Federal Aviation Administration

Aeronautical Decision Making

Introduction

FAA Advisory Circular 60-22 on Aeronautical Decision Making (FAA Advisory Circular 60-22) states that ADM is a systematic approach to the mental process used by all involved in aviation to consistently determine the best course of action for a given set of circumstances.

What does that really mean? From the moment your feet hit the floor in the morning until the key is safely back in your pocket at the end of each flight, you as the pilot (or crew member) have a never-ending series of decisions to make. This process begins long before the master is switched on. The process of good ADM is a continuous flow of information in and actions out. This document describes an effective way to manage this information flow.

Perceive, Process, Perform

Perceive

At any given moment, information affecting the outcome of a flight is all around you. How you manage that flow of information will definitely have an effect on the relative success or failure of each and every flight. First, gather information from all available sources. This is the **perceive** part of the process. You might think of the "information" as situations or facts that require your attention. You will want to perceive situations or facts related to each major element of your flight:

- **P**ilot, passengers, and other people involved.
- **A**ircraft you will be flying.
- en**V**ironment in which you will operate (e.g., airport, airspace, weather).
- **E**xternal pressures likely to influence your decision-making process.

Process

The second part is to **process** the information that you perceived in step one. As you receive information, it is filtered through the five senses: sight, sound, smell, touch, and taste. Not all information makes it through the system. You might not hear correctly, or some of the errors prevalent in human decision making might come into play (more below). In this step, however, the goal is to organize the information, interpret it, and try to match the alternatives with situations from your experience. To analyze in a structured way, process with CARE:

- **C**onsequences of each hazard associated with the PAVE elements.
- **A**lternatives available.
- **R**eality of the situation or hazard.
- **E**xternal pressures that might influence your analysis.

Perform

Now it is time to act, which leads to the third part of the process: **perform**. How you act—perform—will be based on the **perceiving** and **processing** you did in the first two steps. At the most basic level, you perform in one of two ways: action or inaction. As you noticed in the perceive and process steps, there are a lot of external pressures on the human decision-making process. These influences may directly or indirectly affect the action or inaction you choose and also affect how quickly and decisively you perform. In addition, the action or inaction

comes from how accurately you **perceived** and **processed** the inputs up to this point in time. In the **perform** step, you need to do one of the following:

• Mitigate or

• Eliminate the hazard(s) and risk that you perceived and processed.

Evaluate

The relative success or failure of the flight—maybe even the life-or-death moment—may hinge on how well you have **perceived, processed,** and **performed** in the ADM process. There is one more important step in the model: **evaluate.** Constantly consider the outcome of every decision that you make. Question your judgment and your action (or inaction) at every step, and then start the 3-P process all over again. As with a good instrument scan in instrument meteorological conditions (IMC), the ADM process should not stop until your airplane is parked, shut down, and securely tied down.

Human Factors

At least in part, the act of perception relates to physical elements—everything from your eyesight to the condition of the audio system in the rented airplane you are flying. The five senses of sight, sound, smell, touch, and taste are the conduits for 100 percent of the external information going to your brain. These sensory filters are those circumstances that block some or all of that information from making the journey from outside your head to inside your head. Perception (i.e., the act of acquiring information) is also affected by limitations of the human brain:

• Processing in the human brain is limited to about four bits of information per second.

• Working memory capacity is limited to about seven (plus or minus two) chunks, or pieces, of information at a time.

However, our experience, education, and intuition give us the ability to "fill in" gaps in what we really obtained through the five senses. For example, you may not have heard exactly every single word of the ground controller's taxi instructions, but your experience, training, intuition, and expectation help you fill in the missing words. Internal influences, such as motivation, attitude, emotion, distraction, and predisposition (e.g., expectation) also play a role in how your brain compensates for missing information. The problem, of course, is that you might fill in the gaps incorrectly and that, because the fill-in activity is so smooth and automatic, you may not even be aware that it has occurred.

Pilot Error

Going back to the previous example of the taxi instructions: suppose you are in a rented airplane with a scratchy radio and you have several passengers on board who are chatting among themselves. You are tired, but the airport is your home base, and you know the normal procedures like the back of your hand. You therefore know exactly what that taxi clearance from your parking spot to the active runway is likely to be. The bad radios and the noise from your passengers cause you to miss a few words of the ground controller's instructions...but because your brain is expecting a certain sequence, it automatically fills in the missing words. Today, however, the ground controller gave you different instructions, which you "heard" as the normal taxi clearance. The problem is clear, and it escalates at each step of the ADM process: because you perceived incorrectly, you process (evaluate) the taxi clearance and judge it to be "routine," even though it is not. The mistake becomes greater, and possibly more dangerous (e.g., runway incursion), when you perform on the basis of the incorrect information.

The example above begins with a *perceptual* error, in which you simply do not see, hear, or notice a particular piece of information. Human beings are also vulnerable to *procedural* errors, such as when you correctly perceive and mentally process the controller's instruction to change to a new radio frequency, but you enter it incorrectly in the radio itself. Forgetting to lower the landing gear is another example of a procedural error.

Researchers who study human decision-making processes have also identified a third kind of error: the *decisional* error. An example of a decisional error is continuing VFR flight into IMC when you and/or your aircraft are not equipped for this kind of operation. As you might imagine, decisional errors are complicated, because they arise from a large number of other factors. As we saw in the taxi clearance example, errors in how you perceive and process information can lead to decisional errors, which in turn affect your performance. Other factors that play a part in decisional error include—

- **Framing the alternatives.** Any set of alternatives can be articulated, or "framed," in positive or negative terms. Framing in positive terms can support a higher risk decision; for example: *"I know that the weather at my destination is marginal, but I can get there so much faster in the airplane than I can in the car."* Framing in the negative, on the other hand, can help bring a much-needed touch of reality into the ADM process; for example: *"If I find that I cannot land at my destination, I will be stuck at another airport, which would make me late for this appointment."*

- **Judgmental heuristics.** This term simply means that human beings sometimes jump to a conclusion too quickly without considering all available (or all relevant) input.

- **Bias.** There are several types of bias at play in human decision-making processes. One is *confirmation bias*, which is the human tendency to look for information to confirm a decision already made. The taxi clearance example above involves some degree of confirmation bias—a pilot who expects a certain clearance might simply "hear" what he or she expected to hear rather than what was actually said.

- **Expertise, training, experience.** Everyone sees the world in terms of individual life experience and training. Two pilots faced with the same situation will very likely make different decisions, based on how they filter the information and on past experience and training. In the taxi clearance example, a pilot who is new to a particular airport has no experience with local procedures and, thus, has no preconceived ideas about what the clearance "should" be. That pilot's lack of experience with the airport can lead to a very different perception of the situation than that of the pilot whose aircraft is based there.

Risk Management

Note: Some of the information in this section comes from Volume 2, System Safety Course Developer's Guide (http://www.faa.gov/education_research/training/fits/training/flight_instructor/).
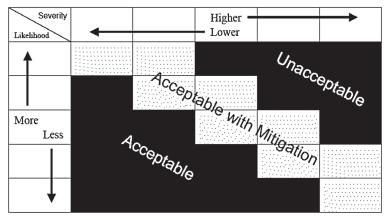
A realistic evaluation of each situation should result in a simple go or no-go decision or, if in flight, a *continue* or *discontinue* decision. There are a few very good tools and rules that can help you make those decisions objectively.

What Is Risk Management?

Risk management is a decision-making process designed to systematically identify hazards, assess the degree of risk, and determine the best course of action. A few definitions:

• A **hazard** is a present condition, event, object, or circumstance that could lead to or contribute to an unplanned or undesired event. For example, a nick in the propeller represents a hazard.

• **Risk** is the future impact of a hazard that is not controlled or eliminated.

The level of risk posed by a given hazard is measured in terms of severity (extent of possible loss) and probability (likelihood that a hazard will cause a loss). Another element in assessing risk is exposure (number of people or resources affected).

Assessment of risk is an important part of good ADM. The hazard described above—a nick in the propeller—poses a risk only if the airplane is flown. If the damaged prop is exposed to the constant vibration of normal engine operation, there is a high risk is that it could fracture and cause catastrophic damage to the engine and/or airframe (not to mention the occupants of the aircraft!).

Principles of Risk Management

As you work through the ADM cycle, especially the "process" step in which you analyze the information you have perceived in preparation for the "perform" step, it might help you to remember the four fundamental principles of risk management.

1. **Accept no unnecessary risk.** Flying is not possible without risk, but unnecessary risk comes without a corresponding return. If you are flying a new airplane for the first time, you might determine that the risk of making that flight in low IFR conditions is unnecessary.

2. **Make risk decisions at the appropriate level.** Risk decisions should be made by the person who can develop and implement risk controls. Remember that you are pilot-in-command, so never let anyone else—not ATC and not your passengers—make risk decisions for you.

3. **Accept risk when benefits outweigh dangers (costs).** In any flying activity, it will be necessary to accept some degree of risk. A day with good weather, for example, is a much better time to fly an unfamiliar airplane for the first time than a day with low IFR conditions.

4. **Integrate risk management into planning at all levels.** Because risk is an unavoidable part of every flight, safety requires the use of appropriate and effective risk management not just in the preflight planning stage, but in all stages of the flight.

Personal Minimums

One of the best tools you can have for ADM and risk management is your own **personal minimums checklist.** To develop a good personal minimums checklist, you need to assess your abilities and capabilities in a non-flying environment, when there is no pressure to make a specific trip. Once developed, a personal minimums checklist will give you a clear and concise reference point for making your go/no-go or continue/discontinue decisions.

In addition to having personal minimums, some pilots also like to use a **preflight risk assessment checklist** to help with the ADM and risk management processes. This kind of form assigns numbers to certain risks and situations, which can make it easier to see when a particular flight involves a higher level of risk.

Another important tool—overlooked by many pilots—is a good **post-flight analysis.** When you have safely secured the airplane, take the time to review and analyze the flight as objectively as you can. Mistakes and judgment errors are inevitable; the most important thing is for you to recognize, analyze, and learn from them before your next flight.

Use the Perceive, Process, Perform, and Evaluate method as a **continuous model** for every aeronautical decision that you make. Although human beings will inevitably make mistakes, anything that you can do to recognize and minimize potential threats to your safety will make you a better pilot.

Resources

You may want to review some of the following documents for more information:

PAVE Personal Minimums Checklist.

Volume 2, System Safety Course Developer's Guide (http://www.faa.gov/education_research/training/fits/training/flight_instructor/).

Personal and Weather Risk Assessment.

FAA Advisory Circular 60-22.

About This Series

The purpose of this series of Federal Aviation Administration (FAA) safety publications is to provide the aviation community with safety information that is informative, handy, and easy to review. Many of the publications in this series summarize material published in various FAA advisory circulars, handbooks, other publications, and audiovisual products developed by the FAA and used by the FAA Safety Team (FAASTeam) for educational purposes.

Some of the ideas and materials in this series were developed by the aviation industry. The FAASTeam acknowledges the support of the aviation industry and its various trade and membership groups in the production of this series.

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