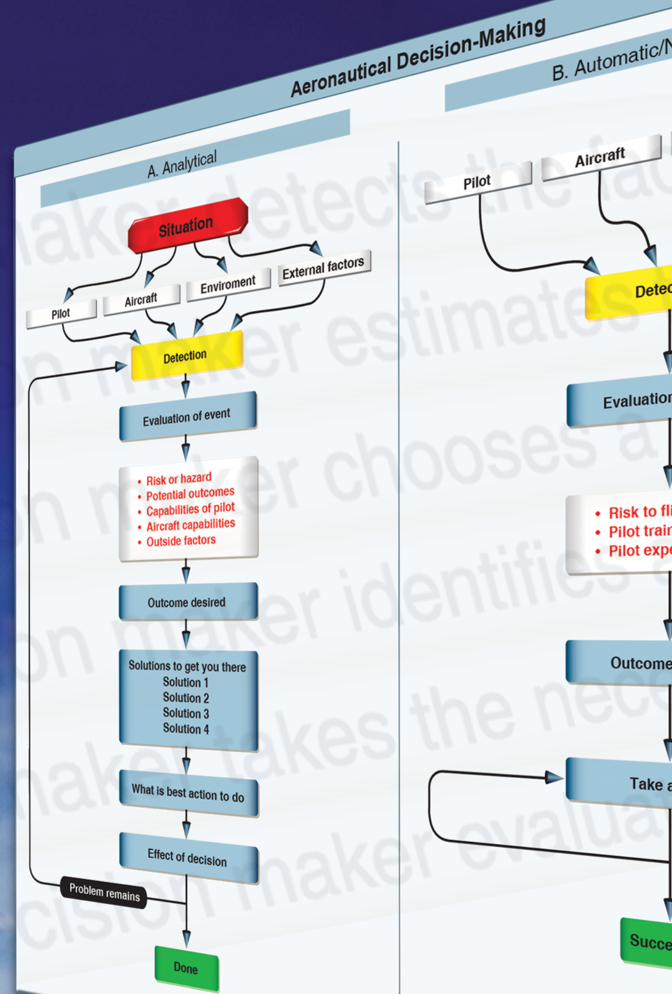
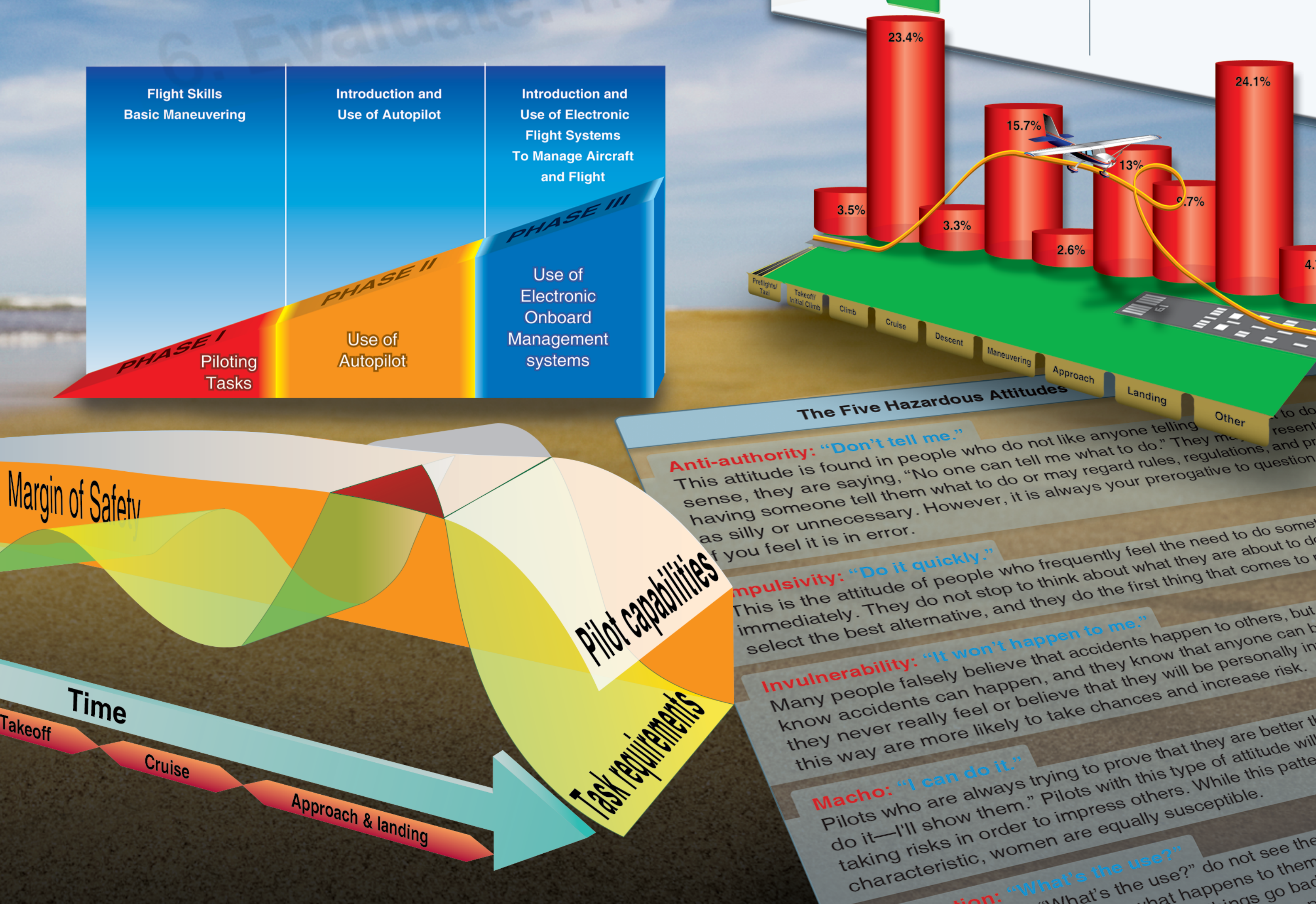
Chapter 2

Aeronautical Decision-Making



Introduction

Aeronautical decision-making (ADM) is decision-making in a unique environment—aviation. It is a systematic approach to the mental process used by pilots to consistently determine the best course of action in response to a given set of circumstances. It is what a pilot intends to do based on the latest information he or she has.



Pilots can perform risk management by using the TEAM checklist:

Pilot

To manage the risk associated with her inexperience and lack of recent flight time, Gayle can:

- **T**ransfer the risk entirely by having another pilot act as PIC.
- **E**liminate the risk by canceling the trip.
- **A**ccept the risk and fly anyway.
- **M**itigate the risk by flying with another pilot.

Gayle chooses to mitigate the major risk by hiring a CFI to accompany her and provide dual cross-country instruction. An added benefit is the opportunity to broaden her flying experience.

Aircraft

To manage risk associated with any doubts about the aircraft's mechanical condition, Gayle can:

- **T**ransfer the risk by using a different airplane.
- **E**liminate the risk by canceling the trip.
- **A**ccept the risk.
- **M**itigate the remaining (residual) risk through review of aircraft performance and careful preflight inspection.

Since she finds no problems with the aircraft's mechanical condition, Gayle chooses to mitigate any remaining risk through careful preflight inspection of the aircraft.

Environment

To manage the risk associated with hazy conditions and mountainous terrain, Gayle can:

- **T**ransfer the risk of VFR in these conditions by asking an instrument-rated pilot to fly the trip under IFR.
- **E**liminate the risk by canceling the trip.
- **A**ccept the risk.
- **M**itigate the risk by careful preflight planning, filing a VFR flight plan, requesting VFR flight following, and using resources such as Flight Watch.

Detailed preflight planning must be a vital part of Gayle's weather risk mitigation strategy. The most direct route would put her over mountains for most of the trip. Because of the thick haze and pockets of IMC over mountains, Gayle might mitigate the risk by modifying the route to fly over valleys. This change will add 30 minutes to her estimated time of arrival (ETA), but the extra time is a small price to pay for avoiding possible IMC over mountains. Because her destination airport is IMC at the time of departure, Gayle needs to establish that VFR conditions exist at other airports within easy driving distance of her original destination. In addition, Gayle should review basic information (e.g., traffic pattern altitude, runway layout, frequencies) for these alternate airports. To further mitigate risk and practice good cockpit resource management, Gayle should file a VFR flight plan, use VFR flight following, and call Flight Watch to get weather updates en route. Finally, basic functions on her handheld GPS should also be practiced.

External pressures

To mitigate the risk of emotional pressure from family expectations that can drive a "get-there" mentality, Gayle can:

- **T**ransfer the risk by having her co-pilot act as PIC and make the continue/divert decision.
- **E**liminate the risk by canceling the trip.
- **A**ccept the risk.
- **M**itigate the risk by managing family expectations and making alternative arrangements in the event of diversion to another airport.

Gayle and her co-pilot choose to address this risk by agreeing that each pilot has a veto on continuing the flight, and that they will divert if either becomes uncomfortable with flight conditions. Because the destination airport is still IMC at the time of departure, Gayle establishes a specific point in the trip—an en route VORTAC located between the destination airport and the two alternates—as the logical place for her "final" continue/divert decision. Rather than give her family a specific ETA that might make Gayle feel pressured to meet the schedule, she manages her family's expectations by advising them that she will call when she arrives.

Figure 2-13. *A real-world example of how the 3P model guides decisions on a cross-country trip using the TEAM checklist.*

alternative airport for every 25–30 nautical mile segment of your route.

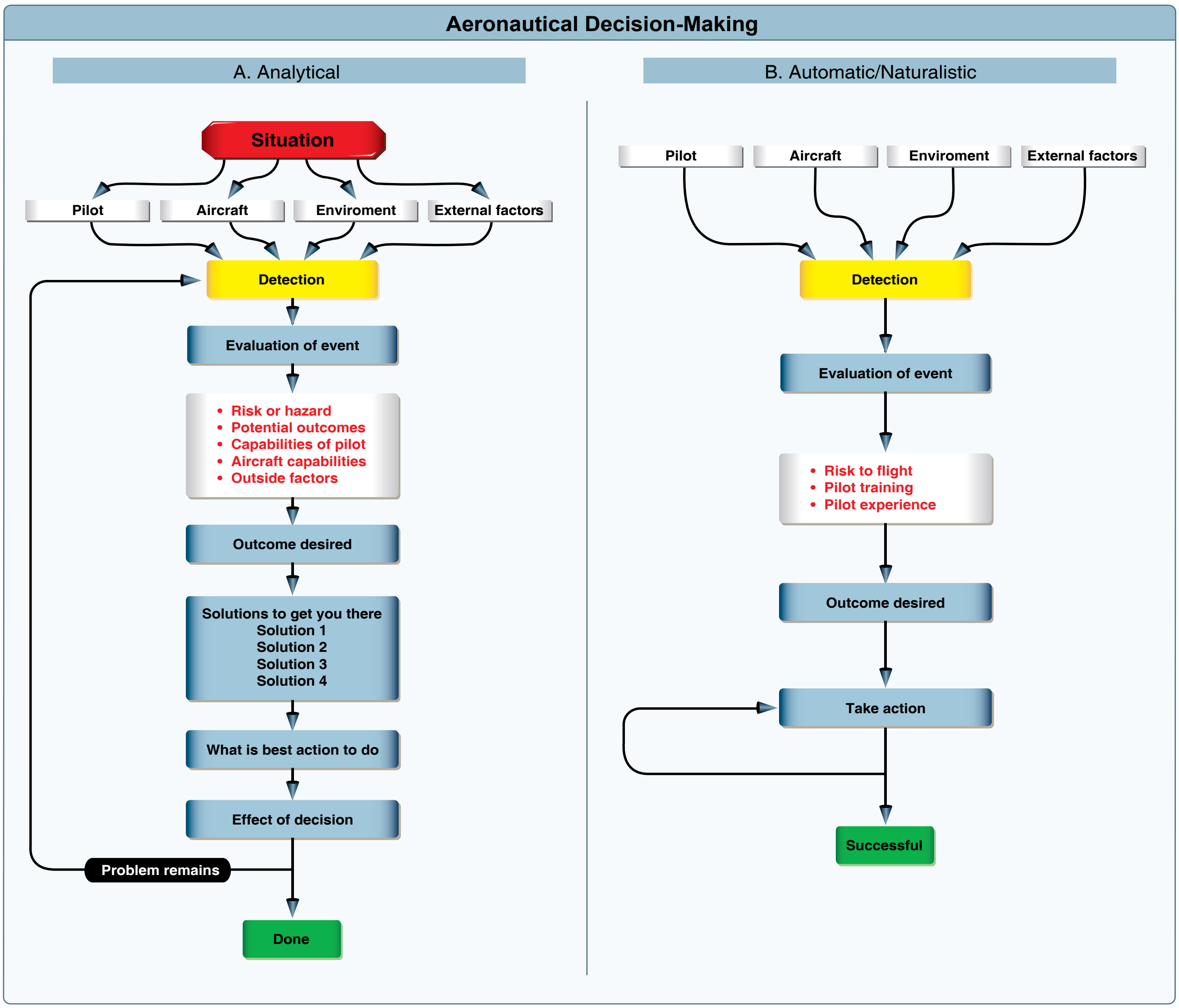
- Preflight your passengers by preparing them for the possibility of delay and diversion, and involve them in your evaluation process.
- Another important tool—overlooked by many pilots—is a good post-flight analysis. When you have safely secured the airplane, take the time to review and analyze the 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.

The DECIDE Model

Using the acronym "DECIDE," the six-step process DECIDE Model is another continuous loop process that provides the pilot with a logical way of making decisions. *[Figure 2-14]* DECIDE means to Detect, Estimate, Choose a course of action, Identify solutions, Do the necessary actions, and Evaluate the effects of the actions.

First, consider a recent accident involving a Piper Apache (PA-23). The aircraft was substantially damaged during impact with terrain at a local airport in Alabama. The certificated airline transport pilot (ATP) received minor injuries and the certificated private pilot was not injured. The private pilot was receiving a checkride from the ATP (who was also a designated examiner) for a commercial pilot certificate with a multi-engine rating. After performing airwork at altitude, they returned to the airport and the private pilot performed a single-engine approach to a full stop landing. He then taxied back for takeoff, performed a short field takeoff, and then joined the traffic pattern to return for another landing. During the approach for the second landing, the ATP simulated a right engine failure by reducing power on the right engine to zero thrust. This caused the aircraft to yaw right.

The procedure to identify the failed engine is a two-step process. First, adjust the power to the maximum controllable level on both engines. Because the left engine is the only engine delivering thrust, the yaw increases to the right, which necessitates application of additional left rudder application.



The DECIDE model

1. Detect. The decision maker detects the fact that change has occurred.

2. Estimate. The decision maker estimates the need to counter or react to the change.

3. Choose. The decision maker chooses a desirable outcome (in terms of success) for the flight.

4 Identify. The decision maker identifies actions which could successfully control the change.

5. Do. The decision maker takes the necessary action.

6. Evaluate. The decision maker evaluates the effect(s) of his/her action countering the change.

Figure 2-14. *The DECIDE model has been recognized worldwide. Its application is illustrated in column A while automatic/naturalistic decision-making is shown in column B.*

The failed engine is the side that requires no rudder pressure, in this case the right engine. Second, having identified the failed right engine, the procedure is to feather the right engine and adjust power to maintain descent angle to a landing.

However, in this case the pilot feathered the left engine because he assumed the engine failure was a left engine failure. During twin-engine training, the left engine out is emphasized more than the right engine because the left engine on most light twins is the critical engine. This is due to multiengine airplanes being subject to P-factor, as are single-engine airplanes. The descending propeller blade of each engine will produce greater thrust than the ascending blade when the airplane is operated under power and at positive angles of attack. The descending propeller blade of the right engine is also a greater distance from the center of gravity, and therefore has a longer moment arm than the descending propeller blade of the left engine. As a result, failure of the left engine will result in the most asymmetrical thrust (adverse yaw) because the right engine will be providing the remaining thrust. Many twins are designed with a counter-rotating right engine. With this design, the degree of asymmetrical thrust is the same with either engine inoperative. Neither engine is more critical than the other.

Since the pilot never executed the first step of identifying which engine failed, he feathered the left engine and set the right engine at zero thrust. This essentially restricted the aircraft to a controlled glide. Upon realizing that he was not going to make the runway, the pilot increased power to both engines causing an enormous yaw to the left (the left propeller was feathered) whereupon the aircraft started to turn left. In desperation, the instructor closed both throttles and the aircraft hit the ground and was substantially damaged.

This case is interesting because it highlights two particular issues. First, taking action without forethought can be just as dangerous as taking no action at all. In this case, the pilot's actions were incorrect; yet, there was sufficient time to take the necessary steps to analyze the simulated emergency. The second and more subtle issue is that decisions made under pressure are sometimes executed based upon limited experience and the actions taken may be incorrect, incomplete, or insufficient to handle the situation.

Detect (the Problem)

Problem detection is the first step in the decision-making process. It begins with recognizing a change occurred or an expected change did not occur. A problem is perceived first by the senses and then it is distinguished through insight and experience. These same abilities, as well as an objective analysis of all available information, are used to determine the nature and severity of the problem. One critical error made during the decision-making process is incorrectly detecting the problem. In the previous example, the change that occurred was a yaw.

Estimate (the Need To React)

In the engine-out example, the aircraft yawed right, the pilot was on final approach, and the problem warranted a prompt solution. In many cases, overreaction and fixation excludes a safe outcome. For example, what if the cabin door of a Mooney suddenly opened in flight while the aircraft climbed through 1,500 feet on a clear sunny day? The sudden opening would be alarming, but the perceived hazard the open door presents is quickly and effectively assessed as minor. In fact, the door's opening would not impact safe flight and can almost be disregarded. Most likely, a pilot would return to the airport to secure the door after landing.

The pilot flying on a clear day faced with this minor problem may rank the open cabin door as a low risk. What about the pilot on an IFR climb out in IMC conditions with light intermittent turbulence in rain who is receiving an amended clearance from ATC? The open cabin door now becomes a higher risk factor. The problem has not changed, but the perception of risk a pilot assigns it changes because of the multitude of ongoing tasks and the environment. Experience, discipline, awareness, and knowledge influences how a pilot ranks a problem.

Choose (a Course of Action)

After the problem has been identified and its impact estimated, the pilot must determine the desirable outcome and choose a course of action. In the case of the multiengine pilot given the simulated failed engine, the desired objective is to safely land the airplane.

Identify (Solutions)

The pilot formulates a plan that will take him or her to the objective. Sometimes, there may be only one course of action available. In the case of the engine failure already at 500 feet or below, the pilot solves the problem by identifying one or more solutions that lead to a successful outcome. It is important for the pilot not to become fixated on the process to the exclusion of making a decision.

Do (the Necessary Actions)

Once pathways to resolution are identified, the pilot selects the most suitable one for the situation. The multiengine pilot given the simulated failed engine must now safely land the aircraft.

Evaluate (the Effect of the Action)

Finally, after implementing a solution, evaluate the decision to see if it was correct. If the action taken does not provide the desired results, the process may have to be repeated.