Flight Advisor Corner by Hobie Tomlinson

May 2011 **Human Factors, Part VI**

This month we will continue our series on **Human Factors** by looking at ***Aeronautical Decision-Making (ADM).***

Aeronautical Decision-Making is a systematic approach to the mental process used by experienced pilots to consistently determine the best course of action when faced with any given set of circumstances. It is how a pilot decides what he intends to do while using the best information about his situation which he is able to obtain.

ADM is the cornerstone of risk management because it provides a structured framework which uses established processes to assess what risks are associated with a particular flight. It then uses known actions to reduce those risks to an acceptable level.

Why ADM? Glad you asked! The General Aviation accident rate remains unacceptably high and has been "flat lined" at this level for many years. This has occurred in spite of all the advances in pilot training, aircraft, avionics, and pilot services now available. The plain fact (which remains unchanged in spite of all our technological advances) is that approximately 80 percent of all accidents are caused by human factors ~ i.e. people make errors! The other interesting constant is that almost one-half of all accidents occur during takeoff (23.4 percent) and landing (24.1 percent). In a previous life we called this ***"The critical 10"*** minutes ~ takeoff plus 3 minutes and landing minus 7 minutes.

ADM Reduces Risk. Understanding ADM is to understand how your personal attitudes influence your decision-making and how those attitudes can be modified to enhance your personal safety in the cockpit. It is very important to understand the factors that cause people to make the decisions they make; how the human decision-making process works; and how it can be improved.

Our Focus will be on helping to improve ADM skills in order to mitigate the risk factors associated with flying. The background for the presented material is Advisory Circular (AC) 60-22, Aeronautical Decision Making and FAA-H-8083-2, Risk Management Handbook. This handbook provides the references, definitions, and other pertinent information relating to ADM training in general aviation.

The History of ADM extends back for over 25 years when the importance of good pilot judgment became recognized as critical to accident avoidance and the safe operation of aircraft. Research in this area prompted the FAA to produce training materials directed at improving pilot decision-making and also led to the current FAA regulations requiring that ADM be included in pilot training curriculums. This research and development culminated in 1987 with the publication of six manuals related to the decision-making needs of various categories of rated pilots. These manuals provided materials designed to reduce the number of human factors related accidents. They were validated by independent studies where student pilots who received ADM training made fewer in-flight errors than those who did not receive the training. The differences were significant and ranged up to 50 percent fewer judgment errors!

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Contrary to Popular Belief, good judgment can be taught! Tradition has told us that good judgment was the natural by-product of experience and, as pilots continued to log accident-free hours, a corresponding increase in good judgment would automatically occur. (By the way, this turns out to not always be true.) ADM results in helping to manage risks because when a pilot follows good decision-making processes, the inherent risk in a flight operation is greatly reduced. This ability to make good decisions is based on direct experience, indirect experience, or education. In the multi-crew world of transport flying, pilots usually spend years learning these skills under the mentorship of highly experienced aviators. Because this advantage was unavailable in single-pilot general aviation operations, these skills were developed and codified under the title of ADM, resulting in a defined process which can now be taught to current and future aspiring pilots.

ADM provides a structured, systematic process in analyzing the changes which occur in a flight operation and how these changes may affect the flight's safe outcome. It addresses all aspects of the flight operations decision-making process and identifies the steps involved in situations requiring good decision-making, which will decrease the probability of human error and increase the probability of a safe flight operation.

Good Decision-Making involves the following steps:

- **Identifying** personal attitudes hazardous to safe flight
- **Learning** behavior modification techniques
- **Learning** how to recognize and cope with stress
- **Developing** risk assessment skills
- **Using** all available resources
- **Evaluating** the effectiveness of your ADM skills

While Poor Decision-Making in everyday life will also lead to tragedy, the time frame between action and consequence is usually so greatly expanded that it is not easy to "connect the dots." Due to the facts that the margin for error in aviation is quite narrow and the time frame between action and consequence is exponentially compressed, safety has to be "reverse engineered;" we must start with the desired outcome and back into the decisions which will produce that outcome. That is the essence of ADM, a process by which the future consequences of our actions can be better understood, thus enabling the choosing of those actions whose consequence will be the safe outcome of our flight operation. Because safety is a desired outcome, it behooves all pilots to become familiar with and employ the processes of **A**viation **D**ecision-**M**aking.

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Analytical Decision-Making is the form of decision-making which takes both time and the evaluation of multiple options. It is based on the acronym **DECIDE**, which defines the six steps in the process of logically making good aeronautical decisions. (Acronyms are such a "pilot-thing" that we practically have our own unique language ~ although I understand that we have been completely superseded by the "texting generation.")

DECIDE is decoded as follows:

- **Detect** that a change in the situation has occurred and consider its subtleties as an emerging hazard. The key to decision-making is looking at all changes in a situation as hazards; otherwise, complacency will cause us to continue with the status-quo and no actions will be taken to preclude the developing adverse situation. The companion to complacency (the trap of long time pilots) is ignorance (the trap of new or uninformed pilots). While complacency causes us to ignore the developing hazard, ignorance prevents us from even seeing and/or recognizing it.

- **Estimate** the actions needed to counter and/or react to the change in situation. ***The flight must always proceed with known outcomes!*** The thought process of "I ***Think*** it will be OK" can never be allowed to exist, you must take whatever actions are necessary so that you always will ***Know*** that it will be OK!

- **Choose** a desirable outcome (Safe, *Legal*, and Mission Accomplished ~ ***In That Order!)*** for the flight. Selecting these desirable outcomes requires objectivity and this is where pilots make grave errors. (The protection here is recognizing the importance of Cockpit/Flight Discipline which unfortunately is so lacking in the world of general aviation. This is both because it is not properly taught during training and there is seldom any supervisory authority to enforce it - as is the case in Commercial and Military Aviation.) Instead of selecting a course of action which considers the capabilities of both the aircraft and its pilot, people typically select a course of action which is convenient. Without proper flight discipline and/or external supervision, the choice is usually not only flawed but reinforced by both rationalization and an unrealistic appraisal of the capabilities of both the pilot and his aircraft.

- **Identify** the actions which can be taken to successfully control the changed situation. These actions must always maintain **Safety First**, **Legality Next**, and **lastly** (***and only after*** the first to items are satisfactorily addressed) attempt to complete the flight mission objective.

- **Do** the necessary action steps. Decisions are useless if they are not implemented!

- **Evaluate** the effects of the actions taken. One of the consistent findings in accident investigation is that the pilot has such overconfidence and/or unrealistic expectations in either their ability or the capability of their equipment (especially modern avionics with advanced automation) that they either completely ignore

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or never evaluate information which plainly indicates the high probability of undesirable outcomes to their actions (Red Flags).

FAA-H-8083-2 ~ Risk Management Handbook

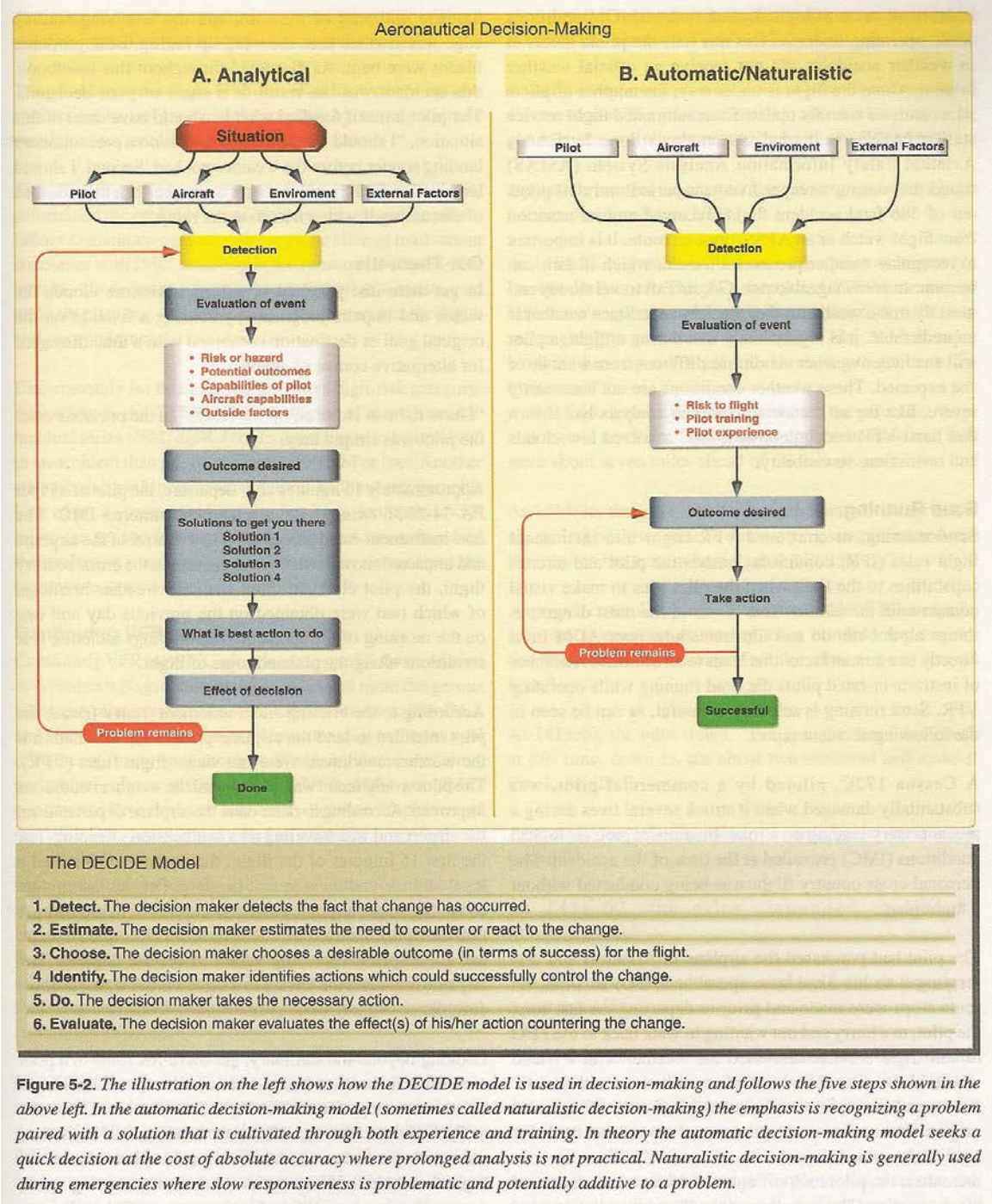

Figure 5-2. *The illustration on the left shows how the DECIDE model is used in decision-making and follows the five steps shown in the above left. In the automatic decision-making model (sometimes called naturalistic decision-making) the emphasis is recognizing a problem paired with a solution that is cultivated through both experience and training. In theory the automatic decision-making model seeks a quick decision at the cost of absolute accuracy where prolonged analysis is not practical. Naturalistic decision-making is generally used during emergencies where slow responsiveness is problematic and potentially additive to a problem.*

<u>Automatic Decision-Making</u> (Naturalistic) is also necessary because emergency situations do not always leave time to use the analytical decision-making model.

(Emergencies often require the Command & Act of automatic decision-making, rather than the Evaluate & Decide of analytical decision-making.) Research into how people make decisions has revealed that when experts are pressed for time while facing a task loaded with uncertainly, they first assess whether or not the situation strikes them as being familiar. Then, rather than comparing the pros and cons of different approaches, they quickly imagine how one of a few possible courses of action will play out. Experts almost always take the first workable option they find and, although it may not be the absolute best of all possible choices, it typically yields remarkably good results.

Gary Kleinn, a famous research psychologist in automatic decision-making, discovered that the laboratory models of decision-making could not describe the decision-making observed under fast, dynamic conditions which were laced with uncertainty. Mr. Kleinn observed that this ability to make automatic decisions holds true for a range of experts from police to firefighters. His discovery has influenced the way our military trains combat officers to make decisions, and it certainly has many aviation applications.

Research indicates that an expert's ability to make automatic decisions hinges on their recognition of patterns and consistencies that clarify options during complex situations. Experts appear to make provisional sense of a situation, without actually reaching a decision, by launching experienced-based actions that in turn trigger creative revisions

This Reflexive Type Decision-Making is anchored in training and experience. It is most often used during emergencies when there is no time to employ analytical decision-making. Automatic Decision-Making improves with training and experience, which is why periodic recurrent training is mandated in both Commercial and Military Aviation. Unfortunately, the recurrent training mandated for light General Aviation aircraft falls woefully short of that which is necessary to develop and maintain these type skills. In some situations, the insurance companies become the enforcers for improved recurrent training, but the real battle is to get the aviators themselves to understand the necessity for this type of ongoing training.

Operational Pitfalls are human-factor accident traps that pilots fall into. The avoidance of these traps is rather simple; however, it requires the disciple and ability to employ good aviation decision-making skills. The specific flight disciple required here is to never allow yourself to be lulled into a position where you do not have an alternate course of action available ~ the infamous **"out."** Some common operational pitfalls which are involved in the majority of light aircraft accidents are as follows:

- **Weather** is the largest, single cause of fatal accidents in light, general aviation and involves both single and twin engine aircraft which encounter instrument meteorological conditions (IMC) while operating under visual flight rules (VFR). Over one-half of the pilots involved in these weather accidents did not even get an official weather briefing. FAA research found that of 586 fatal weather accidents over a five year period, only 19 pilots obtained updated weather from FSS once enroute. It is important to recognize that weather presents a significant hazard to light aircraft which must fly in (rather than above) it. Also, because these same aircraft travel relatively slowly and weather is very dynamic, it is highly likely

that weather conditions may actually be different than those that were expected. Most weather related fatal accidents involve the subtlety of gradually decreasing ceiling and visibilities rather than the "in-your-face" weather of icing and thunderstorms. This "gradualism" of weather deterioration contributes to the following traps.

- **"Get-There Itis" (**More formally known as "Completion Bias") is when we let external pressures override our operational decision-making process. (In the Military this was termed "Target Fixation" after it was discovered that some pilots were concentrating so hard on hitting the target that they did – with the aircraft impacting the target nanoseconds after the bomb!) It is very important that external considerations never be allowed to take precedence over prudent operational decision-making. ***Whenever external considerations begin to impact operational decisions, a big "Red Flag" should be raised!***

- **Scud Running** occurs when the pilot keeps pressing on into deteriorating ceilings and visibilities and is forced to fly lower and lower. This was a trained process in days of yore, which involved intimate local terrain knowledge taught by experienced pilots in 70 mph airplanes without instrumentation. However, it is an extremely dangerous operation with 180 kt airplanes in a world full of high tension wires, multiple antennas, and cell phone towers! *The known outcome of this action is **C**ontrolled **F**light **I**nto **T**errain (CFIT)!*

- **Continuing VFR into IMC** has an 80 percent fatality rate during the ensuing accident. This data validates the fact that this is an extremely dangerous operation with two known outcomes. For instrument rated pilots who, for whatever reason, decide to try proceeding VFR, the outcome is usually the same as scud running ~ CFIT. In the iconic accident that killed Sen. Ted Stevens in Dillingham, AK, the pilot was a highly respected, retired Alaska Airlines Captain. For non-instrument rated pilots the outcome is always the same, spatial disorientation followed by loss of control and ground impact ~ often after inducing structural failure of the aircraft. One of the factors which may predispose pilots to this course of action is total ignorance of the hazards. A few hours of training "under the hood" where peripheral vision can usually see the ground is deceptive. It builds a false confidence in the ability to fly by the flight instruments and it occurs in a very different environment than the real thing. (A dual flight with a CFII in actual IMC is a very worthwhile and educational experience!)

- **Flying Outside the Envelope** involves the pilot *attempting to extract performance that is just not there from either the aircraft or himself*. This can include either attempting a mission profile that is beyond the capability of the aircraft (i.e. excessive weight, range, runway performance, or weather

requirements) and/or the pilot (i.e. inadequate ratings, training, experience or proficiency). A second disturbing trend which has reared its ugly head in recent years is *automation dependency*. This is when the pilot deludes himself into believing that the sophisticated level of automation in modern aircraft will adequately compensate for the pilot's lack of proficiency or ability. This perception that technically advanced aircraft provides the "magic bullet" which compensates for a lack of plot proficiency has led to an unwarranted boldness (the "bullet-proof" syndrome) on the part of many operators of these aircraft. The end result is that the accident statistics for technically advanced aircraft are no better than for the older "steam gauges" models

- **Situational Awareness** is the accurate perception and understanding of all the factors and conditions within the four aviation risk elements that affect safety before, during, and after the flight. These are the *Pilot*, the Aircraft, the *Environment* (weather) and the Operation (mission). The lack (or loss) of situational awareness results in the pilot not fully comprehending his current salutation, the inability to recognize a deteriorating situation (i.e. developing hazards), and a serious misjudgment of the rate of deterioration (i.e. increasing hazard intensity). We can all probably name a pilot who is "an accident looking for a place to happen." If we ever really contemplated why we made that judgment, we would likely come to the conclusion that this particular individual has a very unrealistic appraisal of their skills and ability, often exacerbated by an inflated ego, checkbook, or both. In my experience, weak pilots who have a realistic appraisal of their skills and abilities are seldom the ones who are involved in accidents. If anything, they tend to become over-cautious – if that is even possible.

This looks like a good place to break for his month, next month we will continue with ***Risk Management.*** The thought for this month is a rather famous one which is still very valid.

> "Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terribly unforgiving of any carelessness, incapacity or neglect."
> *— Captain A. G. Lamplugh, British Aviation Insurance Group,*

So until next month, be sure to **Think Right to FliRite!**

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Unfortunate Outcome of Poor Aviation Decision-Making ~ Practice Forced Landing (VT ~ 1983)

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