Decision-Making Concepts

Are you ready to fly today?

Credit to the American Flyers Program

The Conventional Decision-Making Process

Conventional flight training prescribes the knowledge, experience, and skills necessary to conduct a flight within operational constraints. For the low-time pilot, the instructor attempts to teach good judgment, behavior, and performance through a set of limited, but supervised flight situations. In doing so, the flight instructor not only teaches the necessary aviation knowledge and skills required to execute specific flight maneuvers, but also encourages the student to apply previously learned knowledge and skills to subsequent situations. Since the student cannot be taught how to handle every possible situation they may encounter, the instructor tries to provide a representative range of learning experiences that the prospective pilot can later apply to similar situations. As the neophyte pilot displays competence in training situations, there is an increase in ability to perform safely. In new situations, the pilot's decision will be based upon two considerations: (1) What the pilot had previously learned which may be applicable to the new situation; and (2) what the pilot chooses to consider as relevant information for arriving at a new decision while operating in "unknown territory."

Normally, the need for a decision is triggered by recognition that something has changed, or an expected change did not occur in the five subject areas. The search for a recognition of change, e.g., groundspeed, weather, and fuel, provides the opportunity to evaluate and control the change in order to produce a safe flight outcome.

Failure to search for or recognize change reduces the chance of controlling the change. As time progresses, the alternatives available may decrease, and the option to select the remaining alternatives available may decrease, and the options to select the remaining alternatives may be lost. For example, if a pilot elects to fly into hazardous weather, the alternative to circumnavigate the weather is automatically lost.

In the conventional decision-making process, a change may indicate some action by the pilot is required. A change from normal events; or from expected events; or from desired events should alert the pilot to the action. There sometimes is a difference between what you expect to happen (implying certainty) and what you hope will happen (implying uncertainty). For example, you depart on a flight into marginal weather, hoping that conditions will improve.

The occurrence of change must be detected before a response can be selected. There can be instances when a change may remain undetected for some time. A good example is a pilot who fails to compare actual groundspeed with the planned

groundspeed from the flight log. A change has occurred even though it was not detected until later when the situation became critical and the aircraft was low on fuel.

Selection of the proper response relies on a number of elements that affect every pilot's level of situation awareness. These include a pilot's physical flying skills, knowledge, experience and training.

Experience and Training

Experience is practical knowledge, skill, or practice derived from direct observation of, or participation in, events or in a particular activity. We draw upon our experience every time we fly. In a sense, experience creates a mental file that helps pilots establish how conditions and events are interpreted and how they respond to them. Instructors must provide a representative range of learning experiences that students can later apply to similar situations.

Many of the actions taken while flying are based on experience. Pilots constantly rely on experience to determine the correct action required for a given situation. In this way, experience allows them to solve problems quickly and therefore devote more time to other problems requiring their attention.

Many problems faced by pilots are solved before boarding the aircraft. By constantly reviewing emergency procedures, problems are solved simply by using experience to select the appropriate solution. The procedures associated with an engine failure on takeoff become automatic to the carefully trained pilot.

Experience and training are closely related. Training is more than simply an effort to perfect our systems knowledge and physical flying skills. Training is highly structured and represents the most efficient way to build experience.

However, conventional training programs tend to focus on skills and procedures (how to manipulate controls, performing the specific procedures for operating installed equipment, etc.) with only a minimal emphasis on headwork (how to make rational, systematic decisions based on situational conditions). Unfortunately, headwork, or decision-making ability, is often developed informally by listening to "hangar flying" sessions and many times through narrow escapes (experience). In addition to this informal "training", better instructors and training programs always discuss previous accidents (case studies) so pilots can learn about mistakes of others. But most of this "training" is intended to provide a systematic approach to improved decision making (headwork) and information management skills.

Inadequate skills and procedures or inadequate headwork in conventional decision-making leads to mishaps. Review of accident data reveals that there are several categories of pilot error. These include errors of omission - failing to do something one

should have done; and those of commission - doing something one should not have done; timing errors - doing something too soon or too late; errors involving degrees or response - overreacting or underreacting. It is worth keeping these types of mistakes in mind when examining the decision-making process.

Aeronautical decision-making (ADM) builds upon the foundation of conventional decision making but modifies and enhances the process to decrease the probability of pilot error. ADM provides a structured approach to our reaction to change during a flight. This structured approach addresses all aspects of decision making in the flightdeck and identifies the elements involved in good decision making. These include:

1. Identifying personal attitudes which are hazards to safe flight.
2. Learning behavior modification techniques.
3. Learning how to recognize and cope with stress.
4. Developing risk assessment skills.
5. Considering all resources available in a multi-crew situation.
6. Evaluating the effectiveness of your ADM skills.

As in conventional decision making, such decision-making skills start with recognition of change, assessment of impact/alternatives, decision to act (or not) and response.

Five Risk Elements

Pilots need to have a systematic way of knowing where to look for risk. The Five Subject Areas are also the five elements of risk in flying, which are:

- Pilot — "P"
- Aircraft — "A"
- Environment — "E"
- Operation — "O"
- Situation — "S"

Each of these risk elements applies not only to the flight itself, but also to the "mission" or reason for the flight. For example, some risks such as unexpected precipitation may be encountered during a flight, but other risks such as the desire to reach home on a Sunday night prior to a big day at work are part of the flight before it ever leaves the ground.

When evaluating risk, a developing or potential hazard must first be detected, then the five risk elements must be reviewed. At this point, it would be useful to consider what makes up each risk element in greater detail.

Pilot

A pilot's performance may be affected in many ways during a flight. The "risk raisers", or things that affect pilots by raising the degree of risk, are called "stressors." The three types of pilot stressors are:

Physical stress - Conditions associated with the environment, such as temperature and humidity extremes, noise, vibration and lack of oxygen.

Physiological stress - Pilot physical conditions such as fatigue, lack of physical fitness, sleep loss, missed meals (leading to low blood sugar levels) and illness.

Psychological stress - Social or emotional factors such as a death in the family, a divorce, a sick child, a demotion at work, etc. This type of stress may also be related to mental workload such as analyzing a problem, navigating an aircraft, or making decisions.

Pilots must evaluate their stress level, and their ability to conduct a flight feeling adequately prepared and qualified.

Aircraft

This risk element focuses on the aircraft equipment, its condition and its suitability for the "mission" or intended purpose of the flight. The best time to make this assessment is on the ground during preflight planning.

Part of this assessment is the condition of the aircraft. Do all of the radios work satisfactorily? Does the engine still develop adequate horsepower? Will the fuel endurance enable the flight to reach the intended destination with adequate reserve? These and other questions which relate to the aircraft from part of a pilot's assessment of the aircraft. Although many pilots already make such an assessment during the preflight planning, few recognize it as part of a risk assessment process.

In flight, the assessment needs to be done continuously since conditions, such as winds aloft, change with time even if nothing dramatic appears to be happening. For example, no matter what the flight circumstances, fuel is being burned every instant the engine runs. A safe pilot frequently compares the on-board fuel load with the fuel required to bring the plane to a safe landing at the intended destination or at a diversion airport.

Environment

This risk element is wide reaching and includes situations outside the aircraft which might limit, modify or affect the aircraft, pilot and operational elements. One environmental "risk raiser" which pilots usually consider is weather. Considering the high involvement of weather in fatal general aviation accidents, this definitely deserves attention.

The regulations governing aircraft operations are another less obvious "risk raiser" that should be considered. Pilots must fly safely and legally in compliance with all applicable regulations. Another environmental aspect would be airports which may be used during the flight. Items such as density altitude, runway length, obstacles, landing aids, etc., must be considered before and during the flight.

Operation

The interaction of the pilot, aircraft and environment are influenced by the purpose of each flight operation. The three other risk elements must be evaluated in the context of the desirability of undertaking or continuing the flight as planned, e.g., pressure to arrive by a certain time, an advancing weather front, or fuel being consumed.

The passage of time can also be easily overlooked as a pilot sits in the cockpit totally involved in a problem, wondering how to cope with a worsening situation. If time is short or perceived to be short, impulsive and inappropriate actions may result. Time can complicate an already complex situation. The less time available, the greater the negative effect on the pilot.

Situation

The circumstances regarding a flight, when combined with the previous four risk elements, can increase the probability that an unsafe outcome will result. The combined effects of these risk elements lead into the overall situation which must be continuously evaluated. For example, a pilot feels pressured into keeping an appointment that is already scheduled or return home from a trip after traveling for several days. The weather is marginal and is not improving. After reassessing the first four risk elements, the pilot decides to delay the flight, not allowing the pressure of the situation to lead into an unsafe outcome