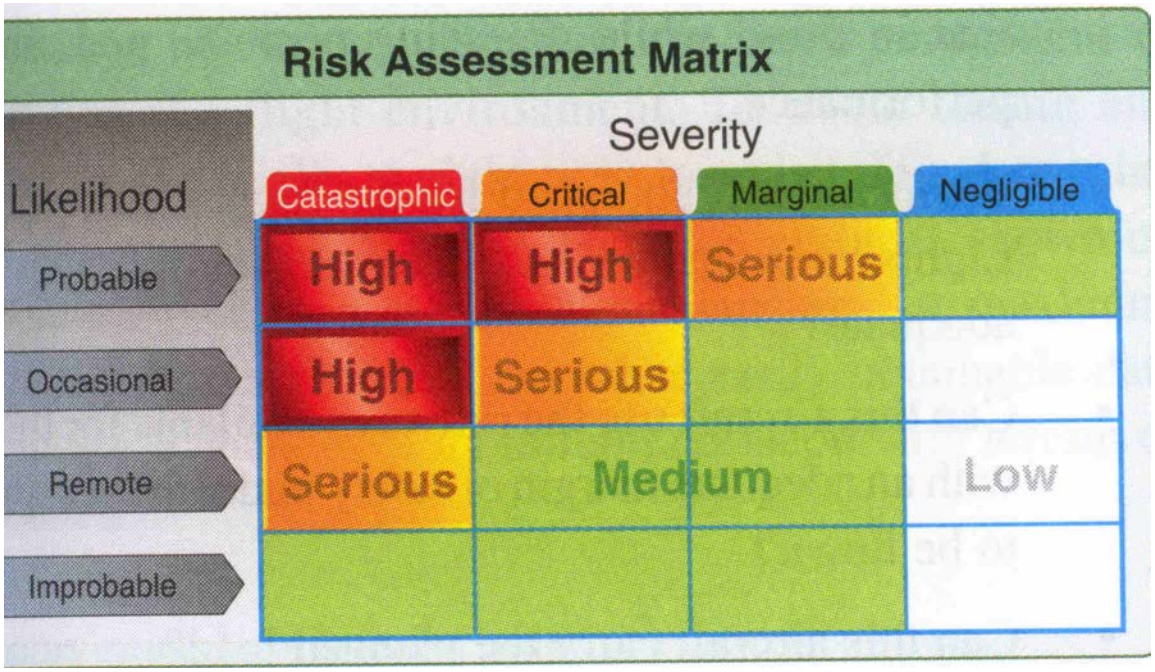
Flight Advisor Corner by Hobie Tomlinson

September 2011 **Human Factors, Part X**

This month we will pick up with ***Risk Management*** and then take one last look at ***Aviation Decision Making*** to wrap up our series on ***Human Factors.*** **Aviation Decision Making (ADM)** is best understood and implemented for most single pilot, light aircraft operations under the framework of **Single-Pilot Resource Management (SRM).**

Quantifying Risk by Using a Risk Matrix is done by assessing the likelihood of an event occurring and the consequence of that event, should it occur.



FAA-H-8083-2 Figure 4-1

"Likelihood" in this context is simply analyzing the existing situation during the preflight process and conservatively estimating the chance that certain hazards (i.e. worsening weather conditions) can occur during your planned flight operation. Very simply put, a *"**Hazard**"* is something that has the very real potential to do any or all of the following:

- *Get you hurt* (i.e. weather causing a major CFIT accident)
- *Damage your aircraft* (i.e. wind causing the loss of directional control during landing)
- *Cause you to Violate FAR's*, personal limits, or Safe Operating Practices (i.e. an enforcement action for entering a Temporary Flight Restrictions – TFR – you missed on preflight)
- *Cause unplanned, extraordinary expense* (i.e. becoming "Weathered-In" for an extended period of time)

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Likelihood Categories are typically defined as follows:

- Probable ~ The event *will occur several times* (i.e. Wind & Turbulence behind a Cold Front)
- Occasional ~ The event *will probably occur sometime* (i.e. Marine Fog enveloping a costal airport)
- Remote ~ The event is *unlikely to occur, but is possible* (i.e. engine failure)
- Improbable ~ The event is *highly unlikely to occur* (i.e. structural failure)

Severity of an Event rates the probable consequences of a hazard actually occurring during the flight. These are as follows:

- Catastrophic ~ Results in *total loss of the aircraft with fatalities* (i.e. low altitude, Night-VMC in mountainous areas or proceeding VFR into IMC conditions)
- Critical ~ Results in *severe injury and/or major damage* (i.e. attempting a takeoff with inadequate runway length available)
- Marginal ~ Results in *Minor injury and/or minor damage* (i.e. loss of directional control during landing on a windy day)
- Negligible ~ Results in *Less than minor injury and/or less than minor damage* (i.e. flat tire during landing rollout)

High or Serious Risks must result in the making of changes to the planned flight operation which will mitigate those risks to a medium/low level (i.e. rescheduling the trip to a better weather day). If it is not possible to make changes to the planned flight operations which mitigate the risks, the flight operation must be cancelled.

Aeronautical Decision-Making (ADM) is the cornerstone of risk management because it provides a structured framework using known processes and recognized pathways which individually and collectively have the effect of identifying hazards that need attention. ADM provides a systematic approach to the mental process which allows pilots to consistently determine the best course of action in response to a given set of circumstances, based upon the latest information that they either have or can obtain.

ADM Skills cannot be overemphasized! Despite all the advances in training and technology, human factors still account for approximately 80 percent of all aircraft accidents with over one-half of all aircraft accidents still occurring both during takeoff (16.4 percent) and landing (40.3 percent).

ADM Helps Reduce Risk because to understand ADM is to understand how personal attitudes can influence decision-making and how those attitudes can be modified to enhance flight safety. It is important to understand the factors which cause people to make the decisions that they make, how the decision-making process works, and what can be done to improve the process.

Contrary to Popular Belief, good judgment can be taught. Tradition holds that good judgment is a natural by-product of experience and that as pilots continue to build flight time, a corresponding increase in good judgment occurs. ADM enhances this process by

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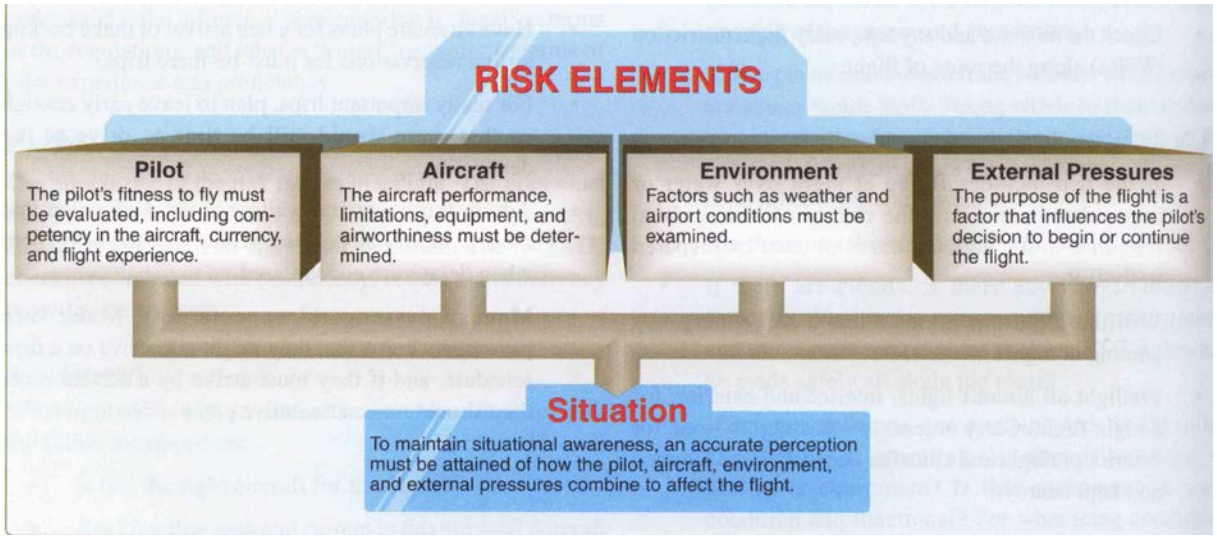
providing a structured, systematic approach to analyzing the changes which occur during a flight and then evaluating how these changes might affect the flight's safe outcome.

Good Decision-Making involves the following steps:

- Identifying any personal attitudes which are detrimental to safe flight
- Learning behavior modification techniques
- Learning to recognize and cope with stress
- Developing proper risk assessment skills
- Using all available resources
- Evaluating the effectiveness of your ADM skills

ADM Results in assisting with the management of inherent risks associated with all flight operations. Pilots who are competent in and make use of good ADM reduce or even eliminate the *High* and *Serious* risks which may be associated with their particular flight. This learned ability to make good decisions is based upon either direct or indirect (i.e. "Hangar Flying") experience as well as continuing aviation education.

While Poor Decision-Making in everyday life can also lead to tragedy; the margins for error in aviation are small and the associated time frames short. The danger is always that in having survived previous unwise choices by "pure luck," the pilot will begin to regard *High and Serious* risk levels as acceptable behavior. The technical term for this is *"Operational Drift"* and it results in the *Normalization of Operational Deviation* (i.e. the acceptance of the unacceptable). It is a modern, technical form of the fabled "*Russian Roulette"* and, like the cases of "Columbia Space Shuttle" and "Deep Water Horizon," inevitably results in disaster!



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Analytical Decision-Making is a type of decision-making which requires the availability of time to evaluate the options available. Its application is *preventive in nature* in that it looks forward to developing situations and reviews the options available to preclude any

these developing situations from reaching a *Serious* or *High* risk condition. Its application uses the basic **DECIDE** model, which is as follows:

- **Detect** that a change in the flight situation has occurred and that a new hazard is developing or an existing known hazard is increasing in intensity (i.e. likelihood of occurrence, consequence of occurrence, or both).

- **Estimate** the actions needed to counter the developing *Hazard* and then *Mitigate* the resultant Risk to an acceptable level (i.e. **Medium** or **Low**).

- **Choose** an acceptable outcome for the flight. (It is important to note here that maintaining an acceptable outcome may involve making undesirable and inconvenient choices!) It is the pilot's insistence on maintaining the desired outcome in spite of the increasing signs of the inadvisability of that course of action that leads to unsolvable situations. An acceptable course of action must take into account a realistic appraisal of both the capabilities of the pilot and the aircraft in order to maintain an acceptable risk level.

- **Identify** the actions necessary to modify the flight operation in order to preserve an acceptable risk level.

- **Do** implement the necessary actions. This is no place for optimism (i.e. "I think it will be OK"), rather a healthy pessimism is warranted. You ***must know*** that the planned flight modifications will result in maintaining an acceptable risk level! (Always remember that *Murphy* was really an optimist!)

- **Evaluate** that your change to the flight operation is achieving the desired results. Continued evaluation of the flight operations status is a critical component in maintaining adequate situational awareness!

Automatic Decision-Making is a reflexive type of decision-making process which is anchored in training and in experience. It is most often employed in times of emergencies during which there is inadequate time available for the analytical decision-making process (i.e. engine failure). This is also called naturalistic or automatic decision-making and it improves with training and experience. The pilot will typically find himself/herself using a combination of decision-making tools that correlate with their individual experience and training. (You do undertake regular proficiency training ~ Right???)

Operational Pitfalls are traps that pilots fall into, even though the avoidance of them is actually quite simple in nature. (*Always have an alternate course of action ~ i.e. Plan B*).

- **Scud Running** is a very dangerous process for two reasons. The first one is that even very familiar geography looks quite different at low altitude with restricted visibility. The second one is that the world has sprouted obstruction towers to the point where it is beginning to look like a porcupines' back. The Technologically

Advanced Aircraft (TAA) with all their modern navigation systems have had the unfortunate effect of emboldening pilots to undertake flights in weather they would never have dreamed of with their older aircraft. *It is wise for one to remember that the current VFR minimums were instituted in the 1940s, in a world inhabited by 70 kt airplanes and minimal obstruction towers*. This tendency is especially prevalent with float planes during the summer season, due to the fact that water landing areas do not typically have instrument approaches available.

- **"Get-There-It is"** occurs when pilots let external pressures make their operational decisions for them. This leads to one of the "*Dirty Dozen"* accident causes called ***"Continuation Bias"*** where the pilot pushes on in spite of the overwhelming evidence that this is a suicidal option. External pressures should be a gigantic ***"Red Flag"*** when they rear their ugly head during any operational decision making process! If you have a "must arrive by" requirement, then a decision must be made while there is still the option of alternate transportation. *Do not go beyond this point unless the situation **is certain** to allow the flight operation without unacceptable risk*!

- **Continuing VFR into IMC** has a known outcome which is spatial disorientation, which results in an uncontrolled collision with the earth! (The alternate is scud-running, which results in controlled collision with the earth - CFIT). *If you intend to fly for travel purposes, get and use an instrument rating! It is the cheapest life insurance there is.*

- **Loss of Situational Awareness (SA)** occurs when the pilot loses an accurate perception (and understanding) of all the factors (and conditions) which exist within the four fundamental risk elements of flight. These are the pilot, the aircraft, the environment, and the mission and their impact upon the flight's safety before, during and after the operation is undertaken. Loss of SA typically occurs when a pilot undertakes a flight operation for which they are either marginally qualified or totally unqualified. The resultant affect is that they can neither recognize their deteriorating circumstances nor adequately assess the rate of deterioration of those circumstances. The remedy for this is to obtain the prerequisite training and maintain adequate proficiency for any future anticipated flight operations.

- **Flying Outside the Envelope** is the lack of adequate knowledge, overestimation of, and/or wanton disregard for the actual performance capabilities of the aircraft, pilot or both. *The laws of physics are not relative and have a total disregard for the pilot's ego, checkbook balance, or existing circumstance. These same laws of physics also have the nasty tendency of exerting themselves at very inopportune times!* By our very nature of being human, we are all "hard wired" to make mistakes and we must all operate with our perception of reality – not the real thing. The closer our perception of reality is to the real thing, the less likely we are to stick our fingers in "the gears of the universe!" *Always leave room for a mistake (i.e. have an "out").*

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Single-Pilot Resource Management (SRM) is a defined process by which pilots can gather information, analyze it, identify potential problems (i.e. Hazards) and make timely decisions in order to maintain an acceptable level of risk during their flight operations.

SRM is a five by five process in which the five elements of SRM (*Plan, Plane, Pilot, Passengers, and Programming)* are continuously applied during the typical five phases of flight (*Preflight, Takeoff, Cruise, Descent, and Landing*).

- **Plan** is the desired mission and requires an analysis of the basic cross-country elements of weather, route, fuel required, adequate facilities, operational hours, and adequate, current publications. This is easily accomplished with one of the many computer flight planning sites currently available – my personal favorite being www.fltplan.com .

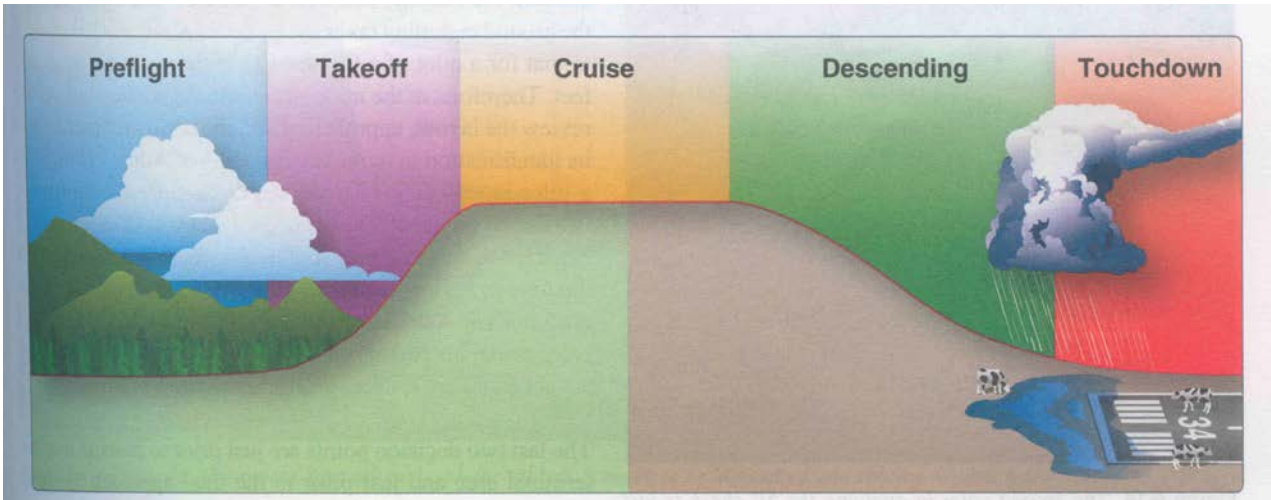

Figure 6-11. *The 5Ps are applied to various modes prior to and during the flight.*

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- **Plane** is the next consideration and includes such issues as airworthy, ADs & inspections up-to-date, all equipment properly functioning, and adequate for the planned mission.

- **Pilot** incudes the classic I'M SAFE Checklist (*Illness, Medication, Stress, Alcohol, Fatigue, and Emotions*) as well as the adequacy of Certificates, Ratings, current Proficiency level, and recentcy of experience for the planned mission.

- **Passengers** are an important consideration in light aircraft operations because they always have direct access to the pilot. This can have both positive and negative implications which should be considered prior to the flight. The three areas that need to be specifically addressed in regard to passengers are as follows: 1) Are they also pilots; 2) If non-pilots, do they understand the higher level of risk in light aircraft vs. the

airlines? and 3) Do the passengers bring external pressures in the form of "must arrive" needs?

- **If Pilots,** an understanding of their relative roles and a clear identification of who is to be PIC is needed.
- **If Non-Pilots** a good preflight briefing is in order.
- **Any "Must Arrive"** needs should be addressed when alternate arrangements are still possible
- **Even Non-Pilots** seated in a front seat can be involved in the flight and help reduce workload by doing such thing as reading checklists, looking for traffic, holding charts and similar such functions.

- **Programming** has become its own task with the advent of Technically Advanced Aircraft and their modern avionics suites. Modern avionics take the tasks that used to be accomplished enroute when workload was relatively low to now heap them onto the relatively chaotic, high workload of preflight and pre-taxi. It is extremely important to make the necessary time to accurately program and verify the information in the automated navigations systems before taxiing is begun. "Heads Down" taxiing is a sure way to get into trouble on busy airports! Pilots must consider their capabilities to make last minute (i.e. approach or departure change) or large changes (i.e. ATC reroute) while manually flying the aircraft. Although these systems can provide greatly enhanced situational awareness, they tend to mesmerize pilots into an overdependence on their automated systems. As the tragic Regional Airline accident in Buffalo, NY demonstrated, automation is not a substitute for poor pilot proficiency or lack of situational awareness. The systems make excellent servants, but terrible masters. *Never do anything with a Glass-Cockpit" aircraft that you would not do with a "Steam-Gauge" one!*

Once Underway, all phases of the flight need to be continuously monitored using the following **3P model** of *Perceive, Process, and Preform:*

- **Perceive** is the step of developing the habit of maintaining adequate situational awareness so that you will be able to perceive developing hazards in all phases of the flight. These are the present events, objects, or developing circumstances which could contribute to an undesired future outcome for the flight.

- **Process** is the second step in which we use previously learned and practiced information to determine whether the perceived hazards constitute an unacceptable risk to the flight (i.e. the future consequence of a hazard which is not mitigated or eliminated by current actions).

- **Perform** is the third and final step in which we take the necessary actions to either mitigate the identified risks to an acceptable level or change our flight operation enough to eliminate them. *In extreme cases, where the risks cannot be mitigated to an acceptable level, this will involve either diverting the flight when enroute or cancelling it before departure.*

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That completes our *Human Factors* Series and next month we will start to take a look at ***AC90-109 – Airman Transition to Experimental or Unfamiliar Airplanes.***

The Thought for this month is as follows: **"Be passionate about what you do and interested in making the people around you better." ~ *Michael Mathieu, CEO of Yume'***

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

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