**Awareness, Accidents and Airmanship (part one of a three part series)**

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In my last article (Mastering Flight November 2004) I described mastery as the path of the most successful flying students. Steady effort combined with carefully chosen challenges leads to steady progress in learning how to fly. Mistakes and frustration - as long as they placed in perspective - lead to greater skill, personal growth and transformation. However, anxiety, big mistakes or scares are often the reason pilots drop out of the sport or worse. In my own attempts at avoiding accidents I have used a classification system to describe accidents. My hope is that greater awareness will encourage more careful pursuit of this great sport.

If consciousness is that confusing time between naps, there is no reason to be confused about preparation for safe flight. Pilots require personal discipline, information and organizational support to do it right. Incremental training and preparation; personal limits; safety margins and attention to safe procedures is how we manage the risks during each flight. All these require the ability to delay gratification. Airmanship and cooperation is the key to avoiding major accidents and remaining in the sport.

**Pilot Error Types**

To err is human but to really screw up requires a computer. That's because humans can avoid or resolve small mistakes spontaneously. Preventable pilot error is the leading cause of all free-flight accidents. A much smaller fraction is due to providence - unforeseen circumstances beyond the immediate control of anyone - like an F-18, mad bull or meteor coming out of nowhere. **Pilot error can be categorized as a lack of proper technique, procedure, and strategy. However, accidents also happen from violations of rules and lack of supervision.** This article describes the first three in detail. These are factors in which we have the most personal responsibility. The last two can be related to the support structure and culture surrounding free-flight.

Pilot error can be simple or complex. One type of error can combine with other types to contribute to the accident. Technique mistakes are simply control input errors and result from lack of training, preparation, the misapplication of personal limits or glider control. Procedural mistakes are those resulting from equipment mis-assembly, operation or use. It arises from the distraction, the breakdown of safety habits, assembly routines. Strategic errors result from ignorance of the principles of safe flight and misapplication of safety margins. It results from lack of instruction, information and development of good flight plans. All these errors can start at the physical, intellectual and emotional levels. This article will describe how these lapses occur.

**Errors of Technique - How the Body Reacts in an Emergency**

Glider control requires recent condition specific training. The internal dialogue, "I can do this" better have real experience behind it. When a threat is recognized or imagined, the brain alerts the body. Normal individuals begin to respond rapidly and exactly, within the limits of their experience and training. How recent (currency) the last performance was affects how efficient the action is. This topic will be covered in the next article For instance, a beginning pilot may learn how to launch, cruise, make small roll adjustments and land in a straight-line away from the hill on a particular day and low spot on the hill. At this point, because of boredom or impatience, the student may be tempted to go higher up the hill. Reliable roll control requires practice at higher degrees of bank and in low, moderate and high wind. The student that takes off from a higher level and finds he/she needs to correct a higher degree of bank (pilot or wind induced) would soon find themselves without the specific experience to react properly. It is likely the pilot would only apply as much correction as they have practiced to that point in their training. Being higher up the hill, the bank has time to develop and the momentum and attitude of the crash would be

more serious. Special skill ratings acknowledge this condition specific requirement in control.

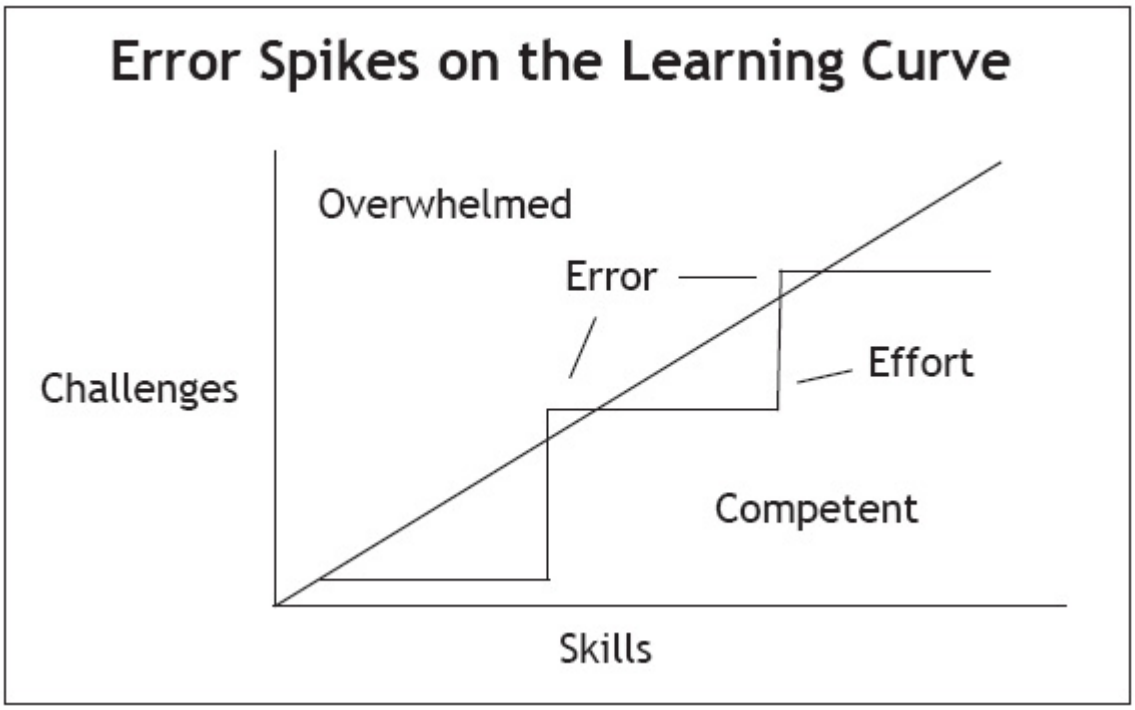
**Neurons Overwhelmed**

The reason why basic control accidents happen is that the reliable associations governing the skill in the brain are overwhelmed by new, unexpected information. The neural web can only process the information of already learned skills – there are no specifically conditioned neurons for the new situation described above. The famous freeze-up or “choke” as the situation deteriorates is a direct result of this phenomenon. That is why we observe the adage of only “one new thing at a time”, including states of mind, specific site conditions, equipment, and required maneuvers. **Many pilots underestimate the need for specific experiences that generalize into other situations.**

Fig 1 Neural Sensory Overload

**When Challenges Exceed Skill (and vice versa)**

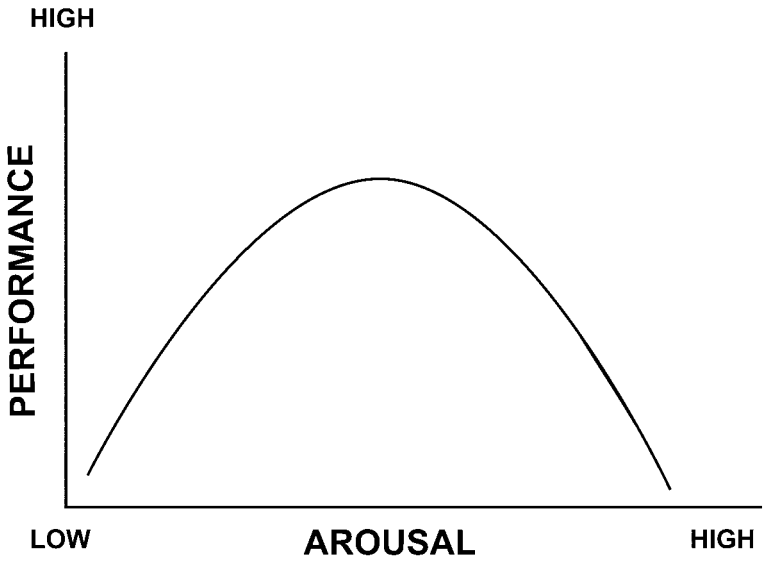
In the article Mastering Flight (November 2004) the learning curve was described as the zone where skills exactly meet challenges. These challenges arise from Mother Nature, the pilot’s goals, or the instructor’s tasks. As effort is exerted, skills are developed within the confines of present challenges. As skills are tested against environmental variability, these skills are honed to perfection - allowing more challenges. These challenges are accepted to a point of increasing error where most pilots will retreat back into the comfort zone to continue the cycle upwards in stair step fashion. Physical proficiencies obviously follow the above rule but emotional and intellectual skills do as well. That is why we teach children manners before starting school and start them with arithmetic before algebra.




Accident-prone pilots continually choose situations where control challenges exceed skills or equipment limitations. The best predictor of reliability in pilots is an accurate self-concept of control skills, recognition of control challenges and the application of personal limits. This is because most accidents are due to technique errors. The extreme situation where challenges are high and skills are low is an obvious area where we are vulnerable. But, surprisingly, situations where skills are high and challenges are low can make us vulnerable as well. We can literally fall asleep at the wheel. We perform best when there is an optimum amount of arousal (challenge) combined with high situational awareness.

**Reaction to Stress**

We react to complex situations by sorting relevant from irrelevant factors. This response tends to break down when we are over-stressed and under-stressed. Situations of extremely high challenges – low skills and high skills – low challenges on (see the learning curve) tend to be places where this discrimination breaks down. We panic in the first case, become complacent in the second. In the first case, choosing mellower conditions or better preparation increases performance. In the second case, finding more challenges or slightly different situations – ironically – makes us safer because we become alert again. However, there comes a point when seeking more challenge again begins to make us unsafe (described in the next article). The middle part of the curve, where performance is highest, we “rise to the occasion” because of adequate preparation and appropriate challenges elicits just enough alertness and ability to discriminate danger from safety. We are able to fluidly weave through traffic to get to the meeting on time.




**Recognizing challenges**

Recognition of flying challenges is tricky and somewhat of an art, especially in marginal conditions. The Robertson Chart of Weather Reliability provides an excellent breakdown of the weather and site factors that may affect a flight. But, practically we use synthesis and experience, rather than analysis, when we make decisions at the site. The sheer number of variables and the fact that free-flight environment is much less structured, consistent and predictable than general aviation makes analysis less practical. As our minds sort out relevant from irrelevant factors, we can point out the particular ones that matter. Furthermore, every flying site or situation has particular pitfalls that require specific insight from local pilots. We choose personal limits on the maximum conditions, pilot rating, specific experience and local site conditions. The next article will delve into how the flying community affects these choices. Recognition provides the opportunity to ask **"Where and when have I experienced this set of conditions?".** The answer to this question provides guidelines for amount of review or preparation needed.

**The Incremental Approach**

Without instruction, a strategy for coping with new challenges would be useful. **An incremental approach to new situations, compensating for or eliminating as many complicating variables as possible is the key to avoiding many accidents.**

For instance the student on the small hill described earlier would be served better by flying at the previous level of skill and elevation in slightly different wind conditions or by being provided exercises that can help hone roll control so that higher degrees of bank are progressively developed.

Another instance of progressive skill development is the choice of glider. Flying an inappropriate glider for ones skill level creates technique error because our gliders are extensions of our bodies. The pilot mismanages the glider's handling characteristics. Pilots rely on whole body control, bar or brake pressure cues and subsequent glider response. If upgrading too quickly all situations become more complex. The glider, like a mismatched shoe, retards the performance of the pilot in all but the most ideal conditions. (And how many times do ideal conditions occur?)

Similarly, learning new maneuvers requires extra altitude, safety margins and approximations to the final form. As a famous instructor has said, "We usually learn

to swim in the shallow end of the pool first". Time and distance from danger, just like driving four car lengths from the car ahead of you, can make all the difference in the outcome of your practice.

**Errors of Procedure**

Not only do minds wander, sometimes they get lost entirely. Accidents occur because of missing bolts, bunched up Mylar, twisted or worn lines, carabineer problems, and configuring during flight etc. etc. We can break down procedural errors into assembly and configuration. You can add political if you fly at a regulated site. Distraction from safety routines and habits can happen at any time to anybody. The devil is truly in the details. Free flight is unforgiving of negligence. Although our gliders are elegantly designed and airworthy compared to other aircraft, we depend on all the features of our simple equipment to operate properly. In essence, when we fly we are test pilots of a newly assembled aircraft. This puts a premium on having meticulous and consistent habits regarding maintenance, set-up and operation.

Configuring our gliders during launch, flight and landing phases must be included in this category. For instance, focusing on the relevant details of the approach and making sure VG or speed-bar is disengaged and getting our legs out of the harness would seem simple. But, target fixation e.g. hitting the spot or wishing for a perfect flare, unusual turbulence, a cow in the field, worry about spectator opinions, or other distracters from the relevant details has caused many mishaps.

Similar to technique and strategic errors, procedural mistakes arise from the three human aptitudes previously discussed. We can be too confused, tired, upset, excited or distracted to focus attention where it is needed. Confusion and forgetfulness are often the result of too much complexity in the situation, lack of specific experience or just a cavalier attitude. Studies have shown that mental fatigue affects working memory. Recent emotional traumas often cause us to dwell on the upset and forget details. Anticipation, excitement, and extreme desire for flight can do the same. Habit interference is often a pitfall as tried and true assembly routines are compromised by something new. For instance, a new harness set-up may stamp out a previous safety procedure detail. In fact, any new thing or distraction can interfere with our safety habits or skills e.g. a stuck VG lanyard, spectator questions, etc. These facts interplay with our disposition for processing information. Checklists taped onto equipment or arm sleeves, mnemonics, non-varying routines, and flying buddy double checks are a proven ways of avoiding these kinds of accidents.

**Errors of Strategy**

Strategic errors are caused by logical mistakes, ignorance of the principles of safe flight and poor in-flight decision-making. A pilot that does a perfect downwind, base, final and flare has perfect technique. But, if he lands on a spectator you could say that strategic judgment is lacking. Situation awareness and technique does not guarantee good decisions and performance. Flight plans are **strategies and actions** that take in account all the possible factors that may affect the flight - including the subjective assessment of fundamental skills needed and margins of safety. Safety margins are application of judgments that provide a cushion of allowable error during maneuvers. They include safe distances from terrain, objects or rotors, weather assessment, landing zone conditions, glide distance judgment and many others. Although flight plans should be followed as closely as possible, they change as conditions change.

Typically, new pilots do not appreciate the amount of learning required in this realm. Strategic errors often compound on one another because the consequences of decisions are delayed. Good accident reports often outline, in agonizing detail, the decisions and "what ifs" that contribute to the incident. Just like technique and procedural errors, strategic errors can happen on physical, emotional and intellectual levels. For instance, driving ten hours to the launch site and planning to fly could be explained on all the levels. Planning the drive and a flight at the end is an

intellectual error. Although the fatigue is the physical problem that actually caused the accident, the absolute need to fly is the emotional contributor.

Another example is scratching (flying near to terrain to soar) without having developed the sense of the margins of safety. Judgments for this include safe speeds, distances from terrain, sink rate and glide distance to the landing zone. Those too eager to soar often find themselves landing in a tree. These are flight plan skills that require instruction, wise mentoring or supervised coaching.

**Some Examples**

The following examples are not meant to replace more traditional interpretations of accidents. However, they may be useful to pilots wanting to develop a refined self-awareness of possible pitfalls. These are explanations to develop a sense of how pilots violate procedure (attention to detail), proper technique (personal limits), and strategy (safety margins). The proper observation of these is the essence of airmanship.

An experienced pilot launched from the dune in an intermediate glider, worked up and flew down the ridge, top landing. Landing may have been hard and glider could have been damaged. Pilot launched again and instead of continuing down the ridge headed straight for the beach seeming to have control problems. The pilot crashed in the rotor behind the ridge near the beach.

Analysis: Procedural error due to equipment negligence and reaction to possible damage to the glider is likely to be the main cause.

Advanced pilot launched into strong winds in an advanced glider, made a pass, and then seemed to start a 360 too close to the hill. With the strong wind, downwind leg is very fast and he was unable to complete the turn. The pilot tried to flare but to little avail.

Analysis: Rating, degree of bank and flare indicates a technique skilled pilot. However, recommended rating limits may have been ignored and lack of specific experience/information in high wind 360’s leads to logical errors, inadequate safety margins and strategic error.

Novice pilot, flying a novice glider, sets-up approach over smallish landing zone in turbulent conditions. Right wing-tip hits tree. One wing stalls, glider spins and dives to ground.

Analysis: As a novice, with solid fundamentals, basic control technique was adequate. However, recommended limits of smooth conditions and large LZ were ignored. Distance to trees was misjudged. Strategic error resulted.

Novice pilot, flying a novice glider, chooses high wind conditions and restricted landing zone (higher tide) on a large dune. Wind induced high bank is not corrected in time and magnitude and pilot flies into the surf.

Analysis: Advanced technique error due to exceeding rating and personal limits.

**Conclusion**

Categorizing accident reports in this way to can help you develop the sense where things may go wrong. They also begin to form a way of classifying accidents that can be used to improve your approach to flying. Strategic mistakes require more careful study or advice on margins of safety. Procedural mistakes require more careful attention to routines, check-lists and maintenance. Technique mistakes require incremental practice, review or preparedness plans and adherence to personal limits. The ability to delay gratification by complete training and preparation is an essential character trait for all these points. This is the beginning of the character

trait called airmanship. The next article will describe some of the ways in which these qualities are often sidelined by the pilot.

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