

PILOT DECISION MAKING – AN ALTERNATIVE TO JUDGEMENT TRAINING

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INTRODUCTION

In many gliding clubs pilot training is concerned mostly with skills training, and we are generally pretty good at this. Pilots are taught how to handle the glider adequately, and to assess heights and distances, for example how to make good approaches to the runway for a smooth landing. We do this in spite of student pilots being of all ages. People also fit into a huge range of personalities, though we tend to group them into a few categories only. Do we adjust our training for these variations? Do we achieve a good, all-round pilot who is able to handle abnormal situations? Not in all cases. As is widely known, pilot error is blamed for a high percentage of aviation accidents. We can and should address this fact by looking at the training we give, as it is during training that we have the best chance of influencing the future actions of the new pilot. This paper tries to assess the implications of pilot training on accident proneness, and what we as instructors can and should do to train pilots to acquire good decision-making abilities.

Accidents

A serious accident can occur for any number of reasons, and following the accident investigators often

discover a chain of events that preceded the accident. A chain of events that the pilot interrupts means that he or she can breathe a sigh of relief (that the chain was broken) - the pilot then merely had an incident, when nothing was bent. An incident is an accident that nearly happened. If one or more links in the chain of events had not been interrupted, an accident may have happened. By breaking this chain, the pilot took an alternative action that avoided or prevented the accident. How did he or she accomplish this? How can we teach new pilots the techniques to break the chain, and so avoid an accident? This, I believe is the key question.

Rules

Many countries or their gliding organizations have rules that tell us what experience we need to fly a glider, what training we need, and indeed where we may go freely or under what restrictions, and these are often written into national regulations. In addition, in our clubs we see "rules" that are designed in most cases to guide pilots as to when they may do this or that, what sailplanes they may fly and when they may fly them and how much it will cost, and so on. In many cases the rules have been born out of experience or lessons learned following many years of club operations. For example,

in a restrictive valley it would be prudent to limit the conditions under which inexperienced pilots are allowed to fly under turbulent conditions, or are allowed to winch launch with a cross wind. We can all think immediately of examples of restrictive rules. What does this tell us, particularly those of us who are instructors? I think it tells us first and foremost that we are approaching accident prevention from the wrong direction - that is by regulating rather than training.

Pilot Decision-Making

Most of us probably never think about decision-making when driving a car! The consequences of a "wrong" decision about which way to turn at a junction are possibly annoyance at the need to turn round. The consequence is seldom life threatening, whereas in a glider a wrong decision can become critical, particularly when low. For example, a decision to turn towards likely looking lift over rough terrain instead of turning to a smooth landing in a large pasture, can lead to problems. If there is no lift, the pilot will soon have to make a (hurried?) return for a landing in the available field. The glider will now be at a lower height, possibly leading to problems if the pilot is inexperienced. He or she may be unable now to make an uneventful and hence, safe landing.

Typical Training Situation

We do not generally train pilots during ab-initio training with a specific method or technique for decision-making that would cover situations typical of the above. However what has been done recently is development of judgement-training for power pilots.

Judgement Training

The student and instructor work on this system initially together. The student manual asks a series of questions related to how he or she would react to typical flying situations involving the environment, the pilot and/or the aircraft. From the answers the student develops a "personality profile." The profile is discussed with the instructor who then uses his or her manual to develop or set up situations for the student. These are designed to help train the student pilot:

- to recognize the tendency to make a decision based on the pilot's personality, and that this decision often may be inappropriate and therefore unsafe, and
- to make a more balanced and hence safer judgement.

Success was achieved with this program in Canada that used groups of Air Cadets on a power flying course. However, when this judgement training was applied to gliding we found one or two serious shortcomings.

1. Gliding students are generally trained by several instructors, and
2. People often reacted negatively to evaluating their own personality and sharing the information with their instructor!

With many gliding clubs, in which there may be several volunteer instructors and very often a less struc-

tured training environment, this type of "personality-centered" training is difficult to arrange. A student may fly with one instructor this weekend, but might not fly again with the same instructor for several weeks. Continuity of this kind of decision-making training is virtually impossible.

Value of Training in Pilot Decision-Making

It is important to start training the technique very early to ab-initio students. If we delay this training until the pilot has accumulated some flying experience, the pilot will probably have already formed some type of decision-making habits. The habit may be one of making no decisions because the instructor always made them! This is poor training because it will now be difficult to break this "habit" and to develop a new decision-making capability in this instructor's students.

By starting pilot decision-making (PDM) training on the first few flights, a new pilot is given a vital good habit that will remain throughout his or her flying career. If decision-making is seen as part and parcel of flying training, students will learn it and it will become a good habit that, if applied well, will give the pilot the technique to make good and therefore, safe decisions.

THE FOUR-STEP TECHNIQUE FOR MAKING FLYING DECISIONS

The technique is derived from Adaptive Management techniques which are used in making business decisions, and the technique serves our purposes very well. I am indebted to Mike Apps, an international competition pilot from Canada, who first suggested this technique to us.

The first step is to assess or to See the Situation as it exists now.

Next the pilot must evaluate and rate his or her Options.

Based on a predicted outcome the pilot must Act on one option.

This leads to a new situation, so the pilot must Repeat the steps and hence Reassess the developing (new) situation.

Notice that the steps give us an easy to remember acronym - S O A R!

TEACHING THE TECHNIQUE

It is best for all instructors to start early in the flying training with an introduction to the technique and a demonstration to the student pilot of how it is applied.

Starting with the first step, on an early flight, for example on the descent towards the circuit entry area, the instructor can ask the student to assess the situation. Where is the glider relative to the club runway? How far from the club, is the glider in an area of lift or sink, and so on?

The instructor discusses the answers and then suggests some Options for immediate action.

A very important part of the process is to predict the outcome of each option. For example, there are several alternatives: the first is to continue going straight; the

second is to turn left, or to turn right, or to decrease the speed, etc. Why turn left?... there may be a good looking cloud and the pilot predicts lift. If they go straight they might conflict with several other gliders and to the right - blue sky, and a prediction of sink!

Acting on the Best Option

Which option should be chosen? The chosen option must be based on the perceived benefit, and by the objectives for the flight. These could be immediate or longer-term, but in any case safety must take precedence. In fact safety should often veto what might otherwise appear to be an acceptable option.

The question then, is: What is the best option? To decide, the instructor could discuss and consider the goals of the flight, keeping playing it safe foremost in mind.

Having chosen the option that provides the best benefit, the pilots now have to Act.

A word of caution must be included here. When choosing which option to act on, the instructor must teach the student to be more cautious than experienced pilots. Experience is the fool's best teacher, the wise do not need it! (Welsh proverb).

Repeating the Process

The fourth step is a very important part of this process, and it is to Repeat the four steps. In this step the student will be taught to see and assess the developing new situation. During this re-assessment, the student compares the results of the earlier decision to the predictions for that option. This builds up what we call experience. By analyzing and comparing earlier predictions, it becomes easier to make better predictions in the future.

In the above example, if the student had predicted that the turn would take the glider to lift, but all he or she sees is strong sink, (if very low) the pilot must act quickly to evaluate new Options, predict what will happen with each, then choose the best and Act on it! Then Repeat and Reassess again.

You have just read an example of repeating the SOAR steps in a few short lines, although it took a page or so to describe them first.

DISCUSSION

The Situation - The First Step

Besides the important part of seeing the situation from the perspective of where and what the aircraft is doing, you must consider other longer-term factors. These are the:

- Pilot,
- Environment, and
- Aircraft.

First the pilot. Your student may be tired after a rough four-hour flight, so teach him or her during training to make allowances by deliberately saying "I will begin to plan for my landing early. I will allow lots of time to think the situation through, and so on. Understanding ourselves, our limitations as pilots, is a key item that we

neglect too often in our flying and its training. Remind students (and yourself.) that as we get older our reflexes get slower, and our tolerance to heat and altitude, and the lack of food and water also gets lower. We must admit this!

This leads to the second area to see and assess.

The environment is the weather, the wind, its direction (particularly when landing!), the temperature (too hot or cold and we don't function at our best), and the terrain (lots or little to land in, or we may still be at our comfortable home field). All pilots must assess these factors before they can make good decisions. We need to know for example if the wind has increased since takeoff (stronger wind gradient?), to recognize that the selected landing area is tricky because the topography suggests that the ground has a slope to it, or there are trees on the approach. A little extra time to think through and to plan the landing pattern will pay off. Too often we take it for granted that the same old circuit pattern, late decision and same speed will do. Accident statistics show they won't.

The third part of seeing and assessing the current situation is to think about the aircraft itself! We forget that this one has stiff or ineffective airbrakes, or that it is slow to roll compared to our own. We fly different types occasionally, to take a passenger, for example.

Options - The Second Step

It is after a pilot has flown a few flights that he or she starts to gain experience. Using this experience, teach him or her to predict what will happen for each Option they might choose. Each prediction must include an estimate of the benefit of choosing that option. These options are of course strongly geared to the objective for the flight.

The objective, or goal, could be short-term, simply to stay up, or long-term such as trying to maximize the speed around a triangle. Other objectives could be, one of avoiding an out-landing, or of looking good (in front of your peers) or of playing it safe.

As mentioned earlier, the option giving the safest outcome should guide all the pilots' choices.

Acting - The Third Step

Having chosen the option that provides the best benefit, teach the pilot to Act. The students will have been taught the flying skills to do this, however, remind them that if they are low-time pilots, then they must be more cautious than the experienced.

So you Act on the chosen option. This immediately leads to a new situation, and this gets us to the fourth step in this process.

Repeating the Process - The Fourth Step

When we repeat the fourth step we should be looking at the developing new situation. We must compare the results of our decision, to our predictions for that chosen option. This builds up our experience which then makes it easier to make more accurate future predictions.

Instructor Teaching and Contriving Situations

It is fine to write down the four-step technique in an article or manual, and to teach a student to do it. However it will not be used in the air later by a solo pilot, unless it is taught very early, and then practiced through-out training. The first situation that a new student can be shown is the loss of height to a point of having to commit to a landing. In this situation the instructor can choose to try and extend the flight by working some weak lift, or can decide to join the circuit. Merely by showing the student the decision-making process in action, the student is shown its importance to the safety of the flight. As the student gains experience and is beginning to make the decisions, the instructor should prompt the student with questions such as, "what is our current Situation?" and "What are our Options? They can next discuss the student pilots predictions for those options, and (initially) ask or later) wait and see what action is taken. This should be done by all the instructors in a club, at all stages of the training of all student pilots.

A very important part of the training here is for the instructor to contrive situations that will test the student, and will possibly lead the student into making errors.

Typical situations that can be contrived are:

- losing too much height deliberately by circling just before starting the landing pattern,
- agreeing with a decision that will lead the glider away from the club, which the instructor judges will require a non standard, low (but safe) return to the club circuit or to a prearranged off-field landing site,
- suggesting a practice spin at too low a height or when several other gliders are close by,
- practicing field selection and circuit planning for an off-field landing while very close to the club.

In the case of suggesting a low altitude spin practice, the student may begin to "obey" in which case the instructor immediately knows that the SOAR technique of decision-making is not being used! Suggesting that students do something "wrong" should be done with great care, as they should not be given the impression that the instructor would do this! But such a "test" is useful to get an idea of how the student would act when flying solo, for example.

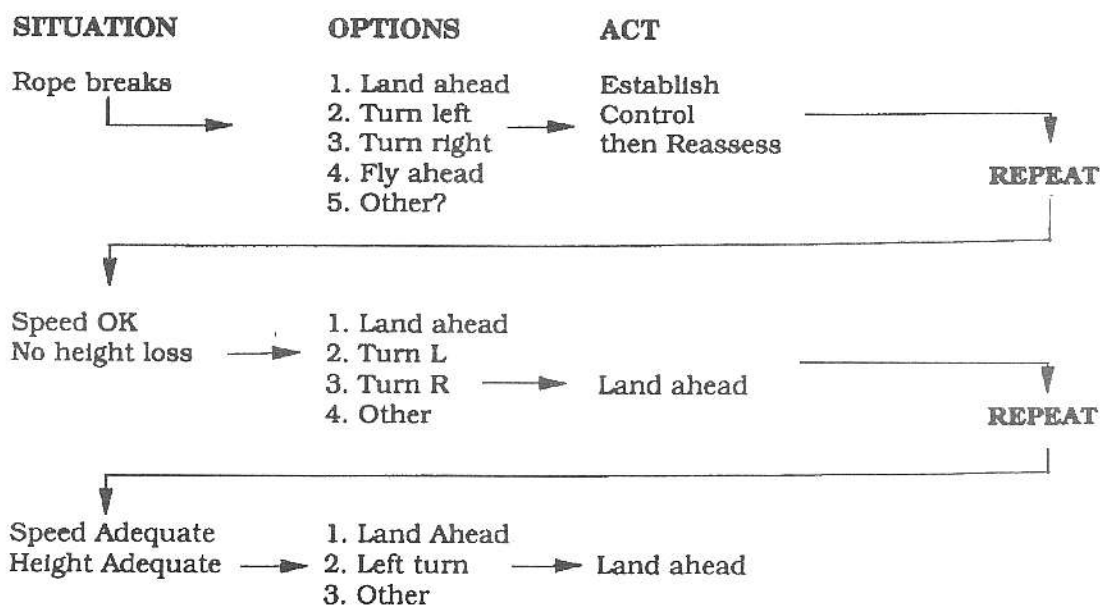
In the last case, we are using the return to the club as a useful time to teach cross-country field selection and circuit planning. By contriving the situation, the student is given a meaningful-exercise while within a safe distance of the club runway. The student will be surprised how much height is taken to look for hazards on the approach, to judge the suitability of landing in the crop, and other features such as the slope, while all the time planning a suitable circuit pattern. Under windy conditions the drift away from the intended landing area is an added problem to contend with, and very realistic situations for an actual out-landing can be simulated.

PILOT DECISION-MAKING TECHNIQUE IN ACTION

The first Situation refers to a low-level rope break: the pilot is on aerotow at about 60 m, with a light wind. There is a field suitable for a landing beyond the runway, and to the left is a stubble field, to the right a tall crop. The pilot is low-time and not too experienced on the glider. The rope breaks... Suddenly the pilot has no more pull...

How does this pilot react? What does he see? What does he do? What should he do? Remember the automatic reactions. So, here we go.

EXAMPLE FOR A ROPE BREAK



S - O - A - R

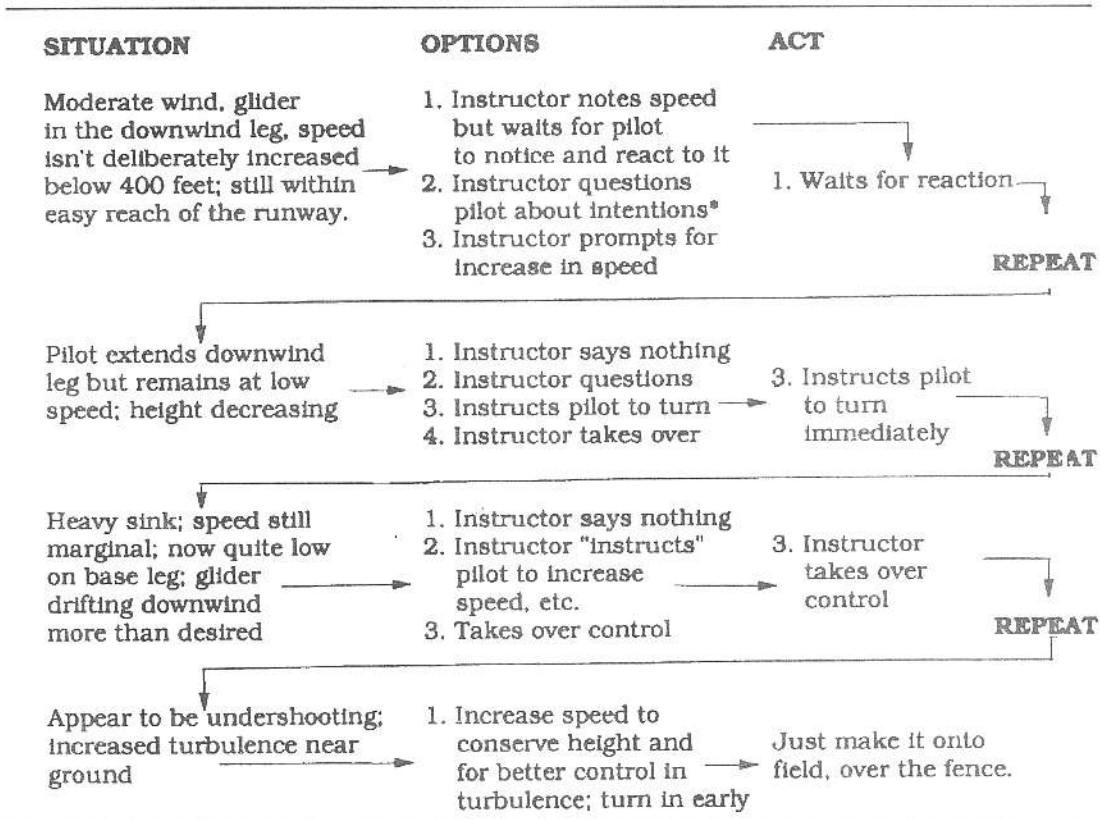
Remember that a rope break can occur in the steep climb through the wind gradient. This requires the automatic reaction to lower the nose to prevent the speed from dropping rapidly after the break. Also under this heading comes a low-level wave-off by the tug, when the speed could be marginal.

Note that the pilot could have turned left towards the stubble field, but in this case, he was a low-time pilot and he considered the left turn more dangerous than going straight ahead onto a good area for a landing. Here we are also operating by the rule for a rope break below 90m, which is to land straight ahead, with only a brief turn into wind if needed.

For a situation where a landing straight ahead is out of the question, the pilot must still react automatically, but his or her responses may be modified now by PDM, that is by using what many people would call good judgement.

EXAMPLE OF AN INSTRUCTOR MONITORING AN APPROACH

The instructor has been monitoring the pilot on a check flight, so is more relaxed than with a pre-solo student. The flight has gone well and good thermal climbs were achieved. They are now in the circuit, the instructor monitoring the pre-landing checks. The speed is a bit low perhaps, but the instructor says nothing, hoping the pilot will notice perhaps...



In this example the instructor clearly left the decision to take over control too late. The good flight with this pilot lulled the instructor into thinking the situation would be recognized by the pilot. The instructor continued to wait for a reaction, rather than to have asked for the pilot's thoughts or plans for the circuit as it was being flown, particularly as the speed and then the height were not ideal. If you look at item 2 in the first block above, (*), this is the decision which would have been the better option for the instructor, bearing in mind that an increase in speed is (usually) required below about 500 feet and prior to making the turn onto base leg. **TO FLY OR NOT TO FLY? THAT IS THE QUESTION**

Another question that occurs occasionally could be whether or not to fly at all. The situation could be that the pilot had a bad week and, though the weather looks great for thermaling locally, today the pilot has a headache. Maybe a hangover too? Not much problem, he

thinks, but let us predict what might happen if he did take of what is likely to happen to the headache? Is he going to be able to concentrate well? Bit of an increasing wind is predicted, and it is strong already. The pilot may be tempted to say he can handle it. OK, so now we will summarize the four steps and see how to use PDM to come to a safe and logical decision.

Situation

Pilot does not feel too sharp (rough week). We mentioned a possible hangover. Weather looks good for thermaling, and it is tempting. Winds are predicted to increase, and are already strong.

Options

There are only two right now; to fly or, to stay on the ground!

The predictions for the flying option are; the pilot will probably be able to climb away and have a flight of an hour or so. The winds will increase, making good pilot-

ing and good planning of the circuit prime requirements for the circuit and landing. The headache will get worse due to the altitude (and when did this pilot last eat?), and concentration will suffer; in fact the pilot will be distracted from "flying the 'plane". Probably he will make a poor circuit and hence a poor landing. With the increasing wind a serious situation could arise.

If this pilot stays on the ground the predictions are that he will gradually get to feel better. He can even do some useful helping around the club and help with the flying operation, and impress on younger pilot that if they don't feel well, it is best to stay on the ground!

Any one or two of the first set of predictions alone (the flying option) would suggest that this pilot should not fly.

An extreme example perhaps, but it was chosen to illustrate that a pilot does not have to be in the air to use

the PDM technique to reach a good and safe decision.

SUMMARY

Before soloing all students, instructors should ensure that the pilots can go through the four-step process without prompting. Occasionally ask students how they are doing; assess whether they are using the technique well, and whether you agree with their decisions.

Don't forget that there are many situations that call for continuous evaluation, in fact there should be very few occasions when a pilot will not be assessing options. Sometimes the process will be fairly relaxed, as when the pilot is very high, but don't forget that practice is essential, as it will be vital to the pilot when the situation calls for rapid decision-making, such as when landing in a strange field. Pilot decision-making, or PDM as we now call it, will be based on the predictions for the options that the pilot is now evaluating.