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COMPETITIVE GLIDING

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Summary

Gliding is a recreational activity and competitive sport in which pilots fly un-powered aircraft known as gliders or sailplanes. Properly, the term gliding refers to descending flight of a heavier-than-air craft, whereas soaring is the correct term to use when the craft gains altitude or speed from rising air. When soaring conditions are good enough, experienced pilots can fly hundreds of kilometres before returning to their home airfields, and occasionally flights over 1,000 kilometres are made. However, if the weather deteriorates, they may need to land elsewhere, but motorglider pilots can avoid this by starting an engine.

Competitive gliding

It may surprise many people, but it is entirely possible for gliders to compete. In fact, like many sports, it evolved through competition. Ever since man first took to the air, intrepid pilots of heavier-than-air machines have been trying to out-do each other. Initially, it was who could fly the furthest (in the early days this was measured in meters), the highest (also measured in meters) and the longest (measured in minutes). However, as gliders got better, speed became important and duration less so: people ended up soaring hills for days, only stopping when they crashed after falling asleep. Not surprisingly, duration as competitive sport has tended to die out. Although there is still distance, speed and height records to be broken, when competitive gliding is discussed, it is usually referring to pilots racing against each other to see who can complete a cross-country task the fastest.

Cross-country flights are now measured in kilometers (many exceeding 500) and speeds are measured kilometers per hour (100 plus is not uncommon). There are also competitive aerobatic competitions, but these tend to be slightly less popular because of the cost involved (gravity, high speed and flying upside-down tends to make the flights very short!).

Cross-country originated as soon as both glider performance and pilot ability became good enough for gliders to fly away from the airfield. In the early days, it often involved seeing who could fly the furthest from home (called 'free-distance). This resulted in some incredibly long retrieves for the poor crew who had to come and get the pilot, and his machine, from some field many miles away from the base airfield. Modern competitions now comprise of closed tasks where everyone races around an aerial route that brings everybody back to base. The weather forecast and the performance of the machines, as well as the experience level of the pilots, dictate the length of the task

How does a glider fly?

Gliders stay airborne by converting potential energy (i.e., height) into kinetic energy (or forward motion). The forward motion of the glider generates airflow over the wings, creating lift. Modern's gliders create lift very efficiently (by some very clever wing design); generally speaking, the longer and thinner the wings, the better. Furthermore, both the design of the wing and the shape of the glider produce very little resistance to airflow and therefore generate very little drag. In fact, the performance of a glider is described by its lift to drag ratio, or L/D, which also indicates its glide angle. Thus, the glide angle is also controlled by the speed of the glider - the faster it goes, the more its glide angle decreases (it produces more drag). Equally, if it flies too slowly, the wing itself starts to create more drag and eventually stops working altogether and the glider stalls. Every glider therefore has an optimum speed range. Something shaped like a bus with very short wings does not glide very well!

Most modern gliders have glide angles of better than 40 to 1, that is, for every 1 unit of distance they descend, they move forward 40 units. Some of the very high performances gliders have better than 60 to 1 glide angles. Moreover, they also achieve this at quite a high speed. For instance, a glider called a Nimbus 4 (which has a 25 + meter wing span), can, from a height of 1 mile, glide well over 60 miles at 60 mph before coming to earth. To put this in context, if such a glider was 2 miles above Bristol (about a third of the height that commercial jets fly at), it could glide into Hyde Park in London. Smaller gliders, such as a Discus, have a 15-metre wing span, but still achieve a 42 to 1 glide angle. In comparison, your average light aircraft (or 'spam can'), can only manage something like 10 to 1 when the engine is switched off. In fact, most planes will glide, but

not very well. The fastest, and perhaps the most famous glider, is the shuttle. Now that is a ride!

How does a glider fly cross-country?

Very simply, by finding air which is going up faster than it is going down! In short, a glider regains the height (and therefore, its potential energy) by flying in up currents that are rising faster than it is falling. This energy comes from the sun and manifests itself in three main ways: as thermals, as slope lift and as a phenomena called wave. The latter two are caused by the wind blowing onto a hill or a mountain. Although glider racing generally uses thermals, slope and wave lift can be also be used. We will concentrate on thermal driven cross-country.

Thermal cross-country

Thermals are basically raising currents warm air (and if they could be visualized, they would like the blobs in a lava lamp). When air near the ground is heated to a higher temperature than its surroundings, it will tend to rise when disturbed. It will continue to rise if the air around it is cooler, as it is less dense. For instance a cornfield, or a town, will tend to generate and trap a lot of warm air in the sunshine. When the warmer air is gently blown towards another feature, such as line of trees, or a lake (which has cooler air over it), it will then separate and rise. Thus to generate the best thermals, you need energy (the sun), a varying landscape to give contrast and colder air above the ground. The best days are often those that have fair weather cumulus; a cumulus cloud is formed by the water in the rising air condensing out as the air cools. However, even on cloudless days (called 'blue days'), there are usually thermals. There are no clouds because the rising air doesn't cool enough to form a cloud (or it contains too little water). The gusts of wind we experience on the ground on warm sunny days are caused by the ascent of thermals - you can often feel the wind suddenly get warmer then colder.

These thermals supply the energy a pilot of a glider needs to go cross-country. On a good day, thermals can be found every 5-15 miles, depending on the terrain and how high they are going. Generally speaking, the higher the better. In the UK, this can be anything from a 1000ft to 10,000ft, depending on the time of year, how much moisture is in the air and how cold the air is. Good soaring days are often preceded by cold nights. Unfortunately, what goes up, must come down. Between the thermals, the air is usually coming down (and is known as 'sink'), so pilots try and minimize the time they spend in the sink and maximize the time they spend in the 'lift'. Thus, to go cross-country, a pilot will circle in the rising air to gain height, and then cruise at a higher speed to the next thermal (and will go especially fast in the sink, thus reducing the time in bad air). The speed at which the pilot goes cross-country depends on many factors.

Racing cross-country

The biggest single deciding factor on how fast a glider can fly around a given task is the strength of the thermals (and thus, the available energy). The stronger the climb, the faster the height is gained and the quicker the pilot can fly to the next thermal (the inter-thermal cruising speed can also be increased to make use of the extra energy). The geographical pattern of the thermals is also extremely important, as this can lead to a type of flying called 'dolphin flying'. Rather than stopping and circling in lift, the pilot more or less flies in a straight line, slowing down in the thermal to regain lost energy from the glide and speeding up in the sink on the other side. If the conditions are right, the glider can gain enough energy from each thermal and maintain its overall height for long distances without circling. Thus, viewed from the side, the glider dives down to gain speed (to get through the sinking air as quickly as possible), and then pulls up sharply in the rising air to maximize the recovery of energy (thus mimicking the motions of a dolphin). Windy days are good for this, as the thermals often line up into 'street's, enabling the pilot to race along an aerial motorway without having to turn.

Another method of going faster, which is often used on good days, is to make the glider heavier by filling it with water (as much as 400lbs in some cases). Although this may sound counter-intuitive, it enables the glider to fly faster for the same L/D ratio (it will come down faster, but it retains the same glide angle at a higher speed). In effect, a heavier glider can pull more energy out of the system and convert it into extra speed. The penalty being that it will not climb so well, but if the conditions are right for delphinine, or the thermals are big and strong, then the benefits of a higher cruising speed greatly outweigh the penalties. So how does one pilot beat another if they are all flying in similar aircraft in the same piece of sky?

Winning

Very simply, the pilot who only flies in the strongest thermals and does not waste time in weak ones, who flies at the optimum speed between the thermals, who follows the straightest course while using the best energy line (i.e., minimizes the time spent in air going down), and when near home, gauges the correct height to make his final glide back to base, will often win the day. But to win the competition, a pilot has to fly consistently over several days. The best pilots are the ones who win by not making mistakes. Quite often, competitions are won or lost by seconds over nine days of flying! Taking one weak thermal, or even a single turn in the wrong place, can lose the competition. It goes without saying that the top pilots have to practice as much as possible (usually in the region of 2-

300 hours a year). Being able to fly the glider perfectly is just the beginning; learning to read the sky, map reading, navigation and tactical decisions are all vital. Being able to do this continuously for several hours, often in hot conditions, is also a must. Peak mental and physical fitness are therefore absolute necessities. Late nights, too much booze and the inability to focus will not make you a top competition pilot!

Not making it to the next thermal, or being shot down by rain, usually means the glider lands in a field. This is not good news when trying to win! Quite often, trying to win the day can lose the competition. The need to 'press-on' to the next super thermal has to be tempered by the fact that most thermals do not exist for very long (5-15 minutes), so the lower the glider gets, the less selective the pilot has to be, or he may end up in a field. Thus, being able to judge the age of a cloud by its looks, or finding a good reliable thermal source on blue days are paramount skills.

Competitions

Like many competitive sports, there are various levels of gliding competitions, ranging from regionals (the lowest) to the Worlds (the pinnacle). In the UK, the competition season starts in May and runs through until early September. Abroad, it just depends on how good the weather is! South Africa, Arizona and Australia are all hot and give many good days. World competitions are generally held in countries that have guaranteed to good weather (not England!).

Most competitions are limited to a maximum of 50 gliders (for safety reasons). Each day (one task) has a maximum score of 1000 points for the winner; this can be devalued if very few gliders get around the task (the idea being that if only a small proportion of gliders get home, then luck probably had a lot to do with it!). The scores are assigned according to the speed relative to the winner.

Regionals

As the name suggests, this is held locally and is generally the first serious competition that budding racing pilots enter. It is normally held over 9 days and is handicapped, i.e., each glider has an assigned handicap rating according to its calculated performance (an old wooden glider may have a handicap of about 80, whereas a modern machine may have one of about 109). To enter the competition, a pilot must have a minimum qualification called a Silver C (to have reached this level, the pilot must have passed written exams, completed a 50 k solo flight, stayed aloft for 5 hours in one go and made a height gain of 1000 meters). The competition is usually run and organized by one of the bigger clubs in the region. Pilots pay an entry fee and can win day prizes. The pilot’s final position in the competition dictates their nationals rating (see below).

Nationals

To enter nationals, a pilot must have first gained nationals rating. This is obtained by doing well in regional contest (usually means finishing in the top 3 or 4). In the UK, there are 5 (6, if you include the juniors) nationals competitions which are split according to glider performance. Starting with the lowest performance they are: the club class (gliders with a handicap of 104 or under, so wingspan is not important); the standards (gliders must not have a wing span of greater than 15 m and must not have operable performance

enhancing flaps); 15 m (as standards, but flaps are allowed); 18 m (wingspan limited to 18 m, but flaps are allowed); open-class (anything goes - wingspans of 27 m are not unheard of). All national competitions are un-handicapped, apart from the club class. The aim of the club class is to encourage high level competition using older and therefore cheaper gliders of differing performances. Club class gliders are also prohibited from carrying extra water (as modern gliders can often carry more and therefore have an unfair advantage).

Europeans and Worlds

To fly in these, you have to become a member of the national team. Pilots who finish in the top two of a nationals competition are normally automatically included. There is usually a team squad who undergo rigorous extra training with a team coach. Pilots who consistently do well can also be voted on to the team by other pilots who are at the top of the ratings. Thus, to get in the team, you have done well in a regional's, and then do very well in a national! The average team squad (who will go to a World competition) will contain 10-15 pilots, with two to three pilots flying in each class (e.g., standards, 15 m and open) and some reserves. The competition itself my run for up to 14 days, with a prior practice week and can be held anywhere in the world. There are also junior world championships (for pilots under 25), as well as women only world championships.

A typical competition day

For the weather forecasters and the task-setters, the day can start very early! Accurate meteorology is vital for good cross-country flight planning. Once the task has been decided, a competition briefing will be held, usually at around 10 o'clock. Prior to this, the pilots will have prepared their gliders and moved them onto the grid ready for launching (the grid order is rotated for fairness).

The briefing

The purpose of the briefing is to brief the pilots on the days task, the weather and any airspace restrictions or areas which they must avoid (e.g., an air show). A proposed first launch time will also be announced.

The launch

As soon as the gliders can safely stay airborne, they are stream launched as fast as possible by being towed up by numerous light aircraft (or 'tugs'). The gliders have to release at 2000 ft, usually in a similar predetermined geographical position. With good organization, the grid can be launched in well under an hour.

The start

Generally speaking, the start line will be opened about 20 minutes after the last glider is launched (although this is dependent on the start height for the day, which is determined by the cloud base). The start zone itself is like a giant invisible semicircle in the sky, with the flat edge arranged perpendicular to the outbound track to the first turning point. It is limited in height and width (e.g., it may have a height of 4000 ft and length of 12 km). Like all things, the launch time (and hence start time) is dictated by the weather. When it becomes favorable for flight and the thermals are going high enough (usually above 2000 ft), then the gliders are launched. Once the start line is opened, it is up to the pilot to decide when to start. Pilots are timed from their last point in the start zone, if they do not put a point inside, then they are penalized.

The start time is critical and many pilots often play a waiting game. Starting a bit later than other competitors may often confer an advantage, both mentally (starting 5 minutes after your main rival and then catching him is very demoralizing for your opponent!), as well as physically (pilots who started earlier often mark the good thermals, so saving the later pilot from wasting his or her time in weaker ones). However, starting too late may also be a mistake, as the weather may deteriorate and the pilot may not get back. Ideally, the pilot should plan to fly the task in the strongest part of the day - usually from about 1 to 4 pm. Once a pilot has started, they have to radio back their start time to the ground control. Pilots are allowed to make more than one start (which is sometimes a good tactic to get other pilots to start before they are ready).

The task

Tasks vary in length and in shape. They can be shaped liked triangles, rectangles, or contain doglegs. Generally speaking, the task-setter aims to make the race last longer than two hours. Three to five hours is usually ideal. For instance, in England, an open-class task may be over 500 km on a good day. The top pilots may well do this in less than five hours. Turning points are usually easily visible ground features, such as a cathedral, or cross-roads. These have to be rounded very accurately. Until the advent of GPS, pilots had to photograph the turning point (from the right position) to prove they had been there. Nowadays, they have to fly within 500 meters (which is recorded using GPS and a logger). Gliders also carry barographs (which continuously record height) to make sure that they have not landed halfway around and taken another launch.

The finish

The final-glide is an art in itself. The pilot has to determine when he or she has enough height to safely glide home without requiring another thermal. If the pilot is too cautious and takes more height than they really need, then they waste valuable time, equally, if they don't take enough, then they risk landing short of the airfield. One important aspect of judging this final glide is the wind; if the pilot encounters a headwind, then they will need more height, while with a tailwind, they will need less height. Furthermore, it can sometimes be advantageous to climb higher in an extra-strong thermal, as this enables them to fly faster and get home quicker. Finally, one of the most exhilarating moments is the finish itself. If the pilot has judged it right, they will cross the finish line low with enough speed to do a spectacular pull up and small circuit before landing (although, ideally, if they have judged their final glide absolutely perfectly, then they will cross the finish line with just enough energy to do a safe landing). However, one of the most graceful sights in the world has to be that of many large gliders finishing one after the other while dumping their water ballast. It is the moment that most competition pilots live for! After several hours of complete concentration, tactical decisions, weather interpretation and not stop flying, the relief and exhilaration of passing the finish line is unequalled. As long as they cross it on the right side of the end marker (often a tower containing the finish marshals). Contests have been lost by pilots finishing the wrong side!

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