# A Guide to
# Self-Launching Sailplane Operation


(image by Russ Owens)

## 4th Edition

**By Eric Greenwell**

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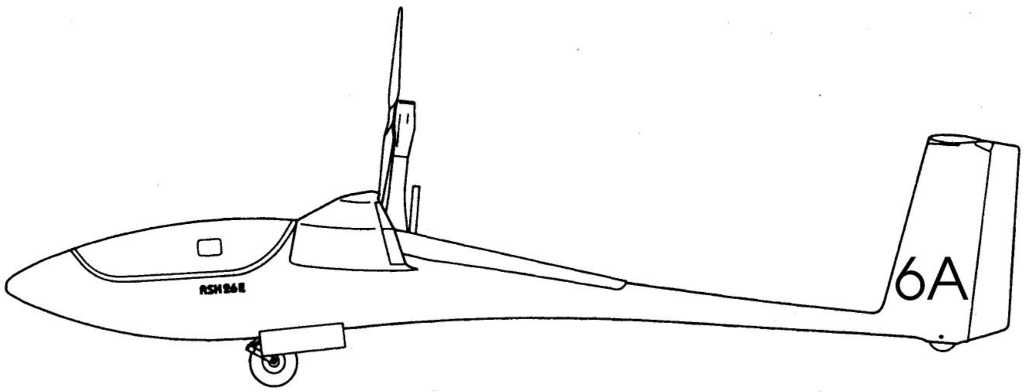


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# 1 Disclaimer

The views expressed in this guide are mine and do not necessarily express the views of the Auxiliary-powered Sailplane Association. While many people contributed to the completion of this guide, any mistakes remaining are solely my responsibility.

Please treat this document as a report of my experiences with self-launching sailplanes. It should not be considered as authoritative recommendations, in part because I have limited experience in powered sailplanes, and most of that in only one type. Because of the large variety of powered sailplanes, soaring areas, weather conditions, and pilot training, it cannot cover every situation, even though several pilots of varying experience have reviewed it. Your aircraft's handbook, gliding instructional texts, previous training, and your common sense must guide you. Since the emphasis is on the differences in operation and thinking made necessary and possible by having a motor, you won't learn everything here that you need to know about flying sailplanes and soaring.

Inevitably, a few US-centric remarks will be present, particularly relating to regulatory requirements. Non-US pilots please ignore these, but in cases where it might lead to real confusion affecting safety, I hope you will contact me so I can change it.

# 2 About this Guide

I wrote the first edition of this guide in 1996 because I couldn't find a comprehensive guide to aid my friends and I when we began flying self-launching sailplanes. The majority of it is aimed at self-launching, high performance sailplanes in general, though much of it also pertains to sustainer equipped sailplanes, and even "touring" motorglider owners can benefit.

Permission is granted for limited quoting and entire copies for personal use, provided credit is given to the author.

I strongly encourage any reader to contact me if they believe there are errors, important omissions, a better or alternative way to do things, or if the clarity and accuracy of the guide can be improved. You may contact me by:

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The Auxiliary-powered Sailplane Association website (motorglider.org) and the Soaring Society of America (ssa.org) websites will always have my contacts.

## 2.1 Acknowledgments

Thanks to Jim Herd for a large number of useful suggestions to improve upon the 3 rd edition, most of which are incorporated into this, the 4$^{th}$ edition.

## 2.2 The author


**Figure 1 The author and his ASH 26 E (before winglets)**

The author has flown sailplanes since 1975, acquiring his three Diamonds in a Ka-6E (the “E” did not mean “engine” back then!). Since then, he’s also owned a Standard Cirrus, Libelle H301, and an ASW 20 C, putting about 3000 hours total on them. Currently he owns an ASH 26 E, which he has flown over 3400 hours. He’s been an SSA member the entire time, and served as the Flight Safety Chairman and as an SSA Director for several years.

# 3 Why Fly a Powered Sailplane?

## 3.1 Powered sailplanes provide opportunities

I've learned some things since getting my powered sailplane in March 1995. One of the most interesting things is how people that aren't powered sailplane pilots have a very limited concept of what a powered sailplane can provide.

Everyone understands what I call "towplane avoidance". The ability to self-launch gives you the freedom to launch when you are ready, avoiding the wait for the towplane and the delay caused by all those other people in front of you. This part everybody envies.

Secondly, everyone easily grasps the idea of "retrieve avoidance", using the motor to avoid landing out. Most people like this idea, though some don't, believing the chance of landing out is is an important part of the sport of soaring.

Indeed, self-launch and self-retrieve are important, but these abilities don't really allow a change in the way you soar, but just allow you to do it more conveniently or more often. After all, a weekend flier at the typical gliderport has little trouble getting a tow, avoiding a landout, or getting a friend or towplane to retrieve them a few times a year.

*"Opportunity"* is the key word.

Not so obvious is that a powered sailplane allows you the opportunity to enhance your soaring. This is what is really important to me. Most glider pilots don't realize how much their self-imposed constraints limit their soaring. The biggest constraint is probably the desire to soar home. Once you realize you no longer have to soar home, your soaring opportunities increase immensely. Here are some examples:

1) I stay hours longer in the great soaring in the mountains, while the unpowered gliders scoot for home before the thermals die on the flat lands.

2) I fly in low cloudbase, marginal, but exhilarating conditions when no one else will bother launching, because the lift is too unpredictable.

3) Sometimes I fly like it's a record attempt, speed ring way up and ruthlessly rejecting all but the very best thermals. Great practice, and the palms still get sweaty!

4) If the soaring is dying between home and me, I keep going towards the still good air knowing I can motor home if I need to.

5) If I miss the wave on the first try, instead of dashing back to the airport to get back in the line for tows, I try another place, and another, until I get it right.

6) I can fly to another place on one day, fly back on the next, and never worry about finding a towplane there or a long retrieve. Great for people that still have to work during the week!

7) Safaris (flying holiday) with or without a ground crew: an expansion of (6), just keep going towards the good soaring, day after day, until it’s time to head back home.

Let me expand on two of these situations from the summer of 1996.

One day in Ionia, Michigan, the cu started early, but only to a two thousand feet AGL base. None of the locals launched when I did, preferring to wait for the bases to rise. The lift was less than a knot, but there seemed to be no sink, and every cloud worked. Gently dolphining from one puffy cumulus to next, I stayed between 1500' and 2000' AGL as I covered about 70 miles in the first two hours. How different from my usual flying! I flew a four-hour, 150 mile cross-country in these odd conditions, and never required the motor. Without it, I would have flown locally, but not gone cross-country. The locals never did fly because the bases didn't rise until too late in the day.

In mid-April, plentiful little cumulus over Hermiston, Oregon, encouraged me to head south from Richland, Washington (my home). The other pilots went north, fearing the Hermiston basin would, as usual, die by mid-afternoon, cutting off their return to Richland. I was certain they were right, but with my ticket home nestled behind the wing, I went past Heppner, and then pushed well into the mountains. The bases rose, the lift increased, streets appeared, and best of all, I was flying in new territory. What a rush! Late in the day, I turned back from well south of Hermiston. The clouds ended before Pendleton, Hermiston was its usual pit, but with slow, careful climbs (and 50:1 glides), I inched my way across Hermiston and the Columbia River. Once again I managed to get home without the motor.

Sometimes I do have to use the motor to get home. Most of the time, I discover there is more lift out there than we realize. Because a retrieve or landout is so inconvenient, most glider pilots play it safe by heading back early, or by not going there in the first place. We take pride in getting back, and don't think of all the soaring we missed. Why else is the first question a powered sailplane pilot is often asked after the flight is "Did you use the motor?", instead of "How was the soaring?".

Years ago, before motorgliders were as common as they are now, some glider pilots, even some powered sailplane pilots, considered it a "failure" if the motor was used after the launch. That perception has changed, and most now realize if it was good soaring, it was good soaring, even if the end of the soaring wasn't the landing. Most of my post-launch motor use is anticipated hours before it happens: I frequently, consciously, make soaring decisions that will almost surely require the motor to return home. Why? So I can do more and better soaring.

Kempton Izuno put it even more strongly:

"When I tell other pilots, including soaring pilots, about the motor, I classify my benefits into three areas, a) towplane avoidance, b) self-retrieval, and c) transportation TO & FROM where the soaring is good. Thus Tonopah, Nevada, is local to me [Kempton lives near San Francisco]. But then you combine a), b) and c), and you have the ability to safari on your own! To me, this COMBINATION is a vast expansion of the soaring horizon. This allows the Texas to Alaska type trips[1], which are simply not possible any other (practical) way. This allows me to realistically consider flying from my home to Tonopah to Montana and back over a week period

[1] Winfried Boos and Hans Fritz, two Germans that shipped their ASH 26 Es to Houston, Texas, then made a round-trip with only the gliders (no crew) to Alaska in a month's time.

WHEN the weather is good. Since I am only dependent on myself, I can go when the weather is going to be best."

### 3.2 Powered sailplanes add responsibilities

The motor that gives the self-launching sailplane its opportunities also exacts additional responsibilities. The towpilot is no longer responsible for the safe operation of the launch vehicle: you, the powered sailplane pilot, are now responsible. Even flying a sustainer-equipped glider still adds much responsibility.

These extras include the:

- Maintenance of the engine and its systems
- Preflight of the engine and extension mechanism
- Fuel and oil addition and checking
- Ground operation (starting and taxiing)
- Entire launch operation
- Converting back to a glider
- Perhaps restarting the motor in flight

The life of a powered sailplane is more difficult due to the extra complexity, weight and vibration. The powered glider should not be treated as casually as the unpowered gliders often are. If you are not an experienced airplane pilot, you will have a lot to learn. Don't rush the learning.

## 4 Preparing Yourself

Selecting and acquiring a self-launching sailplane isn't covered here, but once you have your glider, you need to assure that it and you are ready to fly.

### 4.1 Licensing and insurance requirements

Basically, the FAA requires you to have a glider rating and a self-launch endorsement because these are licensed as gliders. Your power rating doesn't allow you to fly one. The SSA[2] (Soaring Society of America) and ASA[3] (Auxiliary-powered Sailplane Association) web sites can help you find clubs, commercial operators, and instructors that can give you the required training and endorsements.

Sometimes the insurance company's requirements for pilot experience and instruction can exceed the FAA's requirements, so it is important to check with them *before* flying the glider; in

[2] http://www.ssa.org/
[3] http://www.motorglider.org/

fact, it's a good idea to check with them before *buying* the glider, especially if you have limited hours in gliders.

## 4.2 Read the manuals

There is a lot of information packed into a motorglider flight manual that isn't in the manual of an unpowered glider, which is why it's twice as thick. And the maintenance manual is even thicker! You'll need to know this stuff if you want to operate it safely, or even just avoid expensive repairs on the engine. Read them again, until you can remember all the speeds, RPMs, temperatures, and procedures (preflight, starting, stopping, and emergency, to name a few).

## 4.3 Ask questions

You'll probably have some questions, even after you've read your manuals and the rest of this guide. Find a mentor, if you can: someone that's an experienced motorglider pilot in your model of glider (the ideal case), or at least a similar one. In addition, there is a lot of information specific to your glider available on the Web, particularly from the owner's groups. The Appendix has a list of some of these places (13.1 Where to Get More Information).

## 4.4 Develop a flight checklist

Most pilots find it more reliable to work from a checklist at critical parts of the flight. The manufacturer usually provides one, but many of us prefer to develop our own, more succinct list. A number of times when an engine hasn't started in-flight, it was not that the engine failed to start, but that the pilot failed to start the engine. Because they weren't following a list, the stress of the situation caused them to forget something, even something as simple as the ignition switch. Don't join this group of pilots!

Here is an example of one that covers engine starting, takeoff, retraction, in-flight restart, and landing on the different tabbed pages. When it is flipped up (most of the time), the instrument panel is fully visible, and the black covers prevent reflections. Velcro holds it to the cowling. It beats fumbling around to pull one out of the side pocket.


**Figure 2 Checklist and photo by Kempton Izuno**

## *4.5 Have a plan*

You could just drive the glider straight to the airport when you get it, rig it, hop in, and learn “on the job”, but please try a methodical approach for your first flight!

### 4.5.1 Check the weight and balance

I’m willing to trust the factory’s weight and balance on a new glider, but I think it’s essential to get a fresh weight and balance on any used glider I buy before I fly it. Maybe the last one was done incorrectly, maybe the previous owner forgot to remove that ballast he put in it (and didn’t enter it in the log book or correct the placards), and so on.

Before you fly, carefully check the minimum cockpit loading. Because of the motor weight behind the CG, a powered sailplane can have a much higher minimum cockpit loading than a similar unpowered glider. Don’t assume you are OK just because you didn’t need cockpit ballast on any of the other gliders you’ve flown.

### 4.5.2 Practice on the ground

Learn how rig it and do the preflight well, how to fuel it, how to start the engine when it’s cold and when it’s hot, then taxi around an open area of the ramp when it’s not busy. If you plan to taxi to the runway, figure out the best path and check the taxiway for clearances. See Section 5.4 Taxiing for additional remarks before “serious” taxiing. If you don’t have a headset, read 13.3.1 Headsets, because the engine will be much louder when you fly it at full power!

This is a good time to learn how to do a full power test on the ground ("static" test). If you can't achieve the proper static RPM, you might have an engine problem (tuning, fuel pumps, throttle linkage, etc) that should be found before you fly. But beware! Ground run-ups can be dangerous and must be conducted strictly to the book for the make and model.

### 4.5.3 First flight(s)

If you are comfortable doing aerotows, I strongly recommend the first flight, and perhaps more, be made by that method. Give yourself a chance to check the handling of the glider and the functioning of the instruments without the complications and distractions of the motor operation. Then, when confident you and the glider are working well together, tackle the motor operation.

Some pilots first use the engine in flight during one of the aerotow flights, once they are comfortable with the glider (done close to the airport!):

- Extracting the propeller and starting the engine while still several thousand feet up
- Climbing under power another thousand feet or so, then retracting the propeller
- Repeating the sequence another time or two
- Landing with it extended to experience the loss in performance and the masking of the stall buffet by the extended propeller (not on the first landing, of course!)

Once confident the engine can be operated properly, the next flight is a self-launch. Other pilots self-launch the first time they fly, then climb several thousand feet before attempting to retract the engine.

I wouldn't do these initial launches any place where an emergency would be difficult to handle, such as a short, narrow, or busy runway, gusty winds, or high density altitudes. Engine problems, even forgetting to lock the spoilers, can turn an easy launch into a serious problem, and lots of runway makes coping with it easier for the new self-launching pilot. It is helpful to have that mentor standing by with a radio to offer advice during the initial, "get acquainted" non-soaring flights, should the need arise.

# 5 Power Operation

## *5.1 Pre-flight*

This takes me about three times longer than an unpowered glider, four times longer if I must add oil and fuel. I plan for this extra time requirement so I will be able to do it right in an unhurried manner. I review my printed checklist after I've completed the preflight for items I may have missed.

Once I am finished with preflight checks of the glider, I like to look around the airport area to check the wind and traffic activity, then pick the runway I'll use. Next, I'll determine the best way to taxi to it. Sometimes airplanes parked on the ramp mean the usual path isn't clear enough, or the wind direction and strength will affect my choice.

## *5.2 Before launch considerations*

There are a number of things I consider carefully before I even get in the glider. These items overlap with those of the unpowered glider, but need additional consideration:

- Density altitude
- Soft fields
- Runway width
- Power failure

The time to think about these is before you get into the cockpit – remember, the tow pilot won't be doing it for you!

### 5.2.1 Density altitude

Most self-launchers leave the ground quickly and climb rapidly in "standard" conditions (sea level, ~60 deg. F), but in higher, hotter conditions where the density altitude is greater than 5000'-6000', the acceleration will seem lethargic, the ground run substantial, and the climb a bit slow (this is true of all normally aspirated aircraft). The reduction in performance isn't as much for an electric or jet powered glider, but performance is still less and must be considered.

Other factors can become critical under these conditions, factors that may not have seemed as important before, such as wind strength, runway length, slope, surface, obstructions near the end of runway, and thermals and downdrafts. Determine the density altitude, check the handbook to determine the "expected" performance (and don't expect to get performance that good!), and be very cautious in high, hot conditions until you are familiar with the loss of performance and the airport. Fatal accidents have occurred because a high density altitude degraded the glider's performance too much. If the situation appears marginal, TAKE A TOW, or go to another airport.

Unless the runway is exceptionally long, I always start at the end of it. It doesn't take very long to taxi to the end, and the extra length in front of me can keep an emergency from becoming a disaster. Some pilots with gliders that don't taxi well or engines that don't tolerate long idling are tempted to use less than the full length. To maintain the same level of safety requires even more careful planning of takeoff "abort" distances, flight path, and landing options.

### 5.2.2 Soft fields

Compared to pavement, soft fields (dirt, grass, gravel, snow on runway) make it harder to taxi on because the wing tip wheels tend to dig into the surface, the tail wheel doesn't steer as well, and much more power is needed to get moving. In many gliders, this will put the nose into the dirt (at least it's soft). The propeller blast can lift considerable dust and make you very unpopular. The problems are compounded if the field is sloped uphill, even slightly. These are not safety concerns, though, and pushing or towing it to the launch point takes care of the problem.

The major problem is that soft fields, especially wet ones (or even hard ones with puddles) or with tall grass, will significantly extend the ground run, maybe even double it. The pilot must be aware of this, and estimate the effect with the tables in the manual, or by watching what happens to comparable gliders when they launch.

A soft field can provide the unexpected (and unpleasant) opportunity to swerve sharply shortly after the takeoff run begins, simply by placing the downwind wing on the ground when a moderate crosswind exists. From my experience, it happens like this:

- The takeoff starts with the downwind wing tip on the ground.
- As the glider accelerates, the drag of the small tip wheel on the soft ground (or grass) tends to turn the glider away from the wind.
- The pilot compensates with rudder into the wind, holding back-stick to aid the steerable tail wheel's effect.
- Soon the speed is high enough for the ailerons lift the wing tip from the ground.
- Then, without the drag of the tip on the ground, the into-the-wind rudder and steerable tail wheel (firmly held on the ground by the diligent pilot!), plus the normal weathercocking, combine to rapidly turn the glider into the wind!

Opposite rudder, pressing the wing tip back down on the surface, and immediately cutting the throttle may save the day, but it is far better to avoid the situation by placing the upwind wing down, using a wing runner, or taking a tow (the tow rope tension will tend to keep the glider straight). Pilots accustomed to paved runways are especially likely to be caught by this problem, as the situation causes no problem when the tip wheel can roll easily on the pavement.

Pilots whose gliders have tail wheels smaller than the common 8" pneumatic wheel (like an ASH 26 E with the steerable tail wheel), take note: the smaller size allows it to be pressed into the grass and dirt more easily, adding significant drag. For soft field takeoffs, the ASH 26 E flight manual recommends keeping the tail wheel in contact with the ground as long as possible. This method is appropriate for the 8" fixed pneumatic tire, but not the smaller, steerable tail wheel My experience (and confirmed by others) on soft grass airfields suggests the glider will accelerate much more quickly if the small wheel is lifted as soon as possible, then held near the ground while the glider accelerates to flying speed. With a crosswind, getting the tail up early might lead to weathercocking, so the pilot must consider the situation carefully.

### 5.2.3 Runway width

These remarks apply primarily to hard-surfaced runways.

A wing-down takeoff works out much better with the typical self-launcher than with a glider because the wing tip wheels, steerable tail wheel, and lack of towplane wake make it easier to keep the glider going straight down the runway.

When the runway is wider than the wingspan, I always prefer to take off without a wing runner, with the upwind wing on the ground (to allow it to be raised sooner). This way, there is no wing dropping, because the wing can't come up until it's going fast enough to control it. I do this even with water ballast. Even if the wind flips the glider to the other wing tip, there is enough width for it.

When the runway is between about two-thirds span and a wingspan, it may still be desirable to take off wing down. A crosswind from the side with the "up" wing, or enough headwind to let the ailerons keep the wing down, helps quite a bit. The glider must be offset from the runway center, of course. If there is a chance a gust might lift the wing, I don't do an unaided takeoff.

In this same situation, it can be a good idea to taxi or takeoff close to the up-wing side lights, so that if the wind forces this wing down, the runway lights do not hit the wing tip but pass below the inner wing, near the fuselage. This assumes there aren't bushes or other obstacles *beyond* the runway lights, of course!

When the runway is less than half a span, a wing runner is necessary. If there is a chance something off the edge of the runway might catch the wing should it drop, I don't launch. I think it's better to derig and go to a different airport with sufficient width.

### 5.2.4 Power failure

Where will I go if the power fails at 50', 100', 200', and so on? Is the runway long enough to land on it straight ahead, or must I consider using a field off the end? Can I use a taxiway or intersecting runway instead? Of course, all the considerations for a normal glider apply at least as much to a powered sailplane, such as downdrafts and wind.

You should know (or at least select an altitude you can believe in) your "minimum turnaround altitude": the lowest altitude you'd be willing to turn around and land back on the runway with the engine stopped, and propeller extended but not stopped (windmilling[4]). This varies considerably from powered sailplane to powered sailplane. This converts the problem into one similar to an unpowered glider's "rope break" situation, except with a lower initial speed and much more drag. This situation is discussed in more detail in section 12.4 Determining a "Minimum Turn-around Altitude" (MTA).

## *5.3 Starting the engine*

[4] This drag will make the glider lose more altitude during the turn back to the runway than with the propeller stopped.

Be courteous: Even though the propeller is mounted well off the ground, it can still kick up substantial dust and grit behind you, tip gliders from wing to wing, flop control surfaces, and so on, so be sure the area is clear behind you. The engine noise may not please everyone, so I taxi away from people as soon as I can, almost immediately after the motor has started.

I don’t like the engine noise, either, so I put on a headset before starting the motor. It is much easier to hear the radio, especially those airplane pilots with weak audio transmissions and noisy backgrounds. Section 13.3.1 Headsets has some noise figures and headset suggestions.

While it is unlikely anyone would be standing next to the propeller when it starts, it is also difficult to see that area. I always take a good look around, check the mirror carefully, shout “Clear Prop!” loudly out the window, and allow a few seconds to elapse before pressing the starter button. As even the moderate RPM used for starting and warm-up can pull the glider quickly, I hold the brakes strongly.

## *5.4 Taxiing*

If you don’t have a steerable tail wheel, this information might not help you very much, but take a look at 6.3.4 Taxiing without a steerable tail wheel

Unless the runway is exceptionally long, I always start at the end of it. It doesn’t take very long to taxi to the end, and the extra length in front of me can keep an emergency from becoming a disaster.

I plan my route from the assembly area to the launch point before I even get in the glider, avoiding narrow areas (anything less than 70’ wide in my 60’ span glider seems very narrow from the cockpit!) that will take me close to aircraft, people, cars, etc. It is very difficult to judge the wing tip clearance 30’ away while sitting in the cockpit, and I don’t want to hit anything, or even make anyone nervous! I also avoid taxiing where my “up” wing will hit something if the wind flips it down.

If the taxiway isn't wider than my wingspan, I try to taxi so that the upwind wing is always up. This prevents the wind tipping me from one wing tip to the other, which might put the wing into the dirt, lights, signs, or bushes beside the taxiway. Any of these could damage the wing significantly, or turn the glider off the taxiway into an obstacle. Most gliders will taxi well with the upwind wing on the ground in light winds, but there is always the risk a gust could flip over to the other wing tip. This risk is much greater when upwind obstacles such as hangars are present.

Here are some “tricks” for taxiing on hard surfaces that make things easier for me (soft surfaces may require different techniques, but I rarely encounter them):

1. Pulling the rudder pedals one notch closer than normally used in flight, so I can easily obtain full deflection.
2. Setting full back trim to help keep the tail wheel firmly on the ground. Even when taxiing downwind, the airflow from the propeller will usually ensure a good flow across the tail.
3. Setting the flaps “up” (negative setting), reducing the effect of gusts on the wing.
4. Holding the spoilers partially extended (but not enough to activate the wheel brake), also reducing the effect of gusts.
5. I stay alert, ready to brake to an immediate stop if the wing starts to shift from one tip to the other, or I’m not staying on the intended path.
6. Because my glider (like some others with springs driving the tail wheel) tends to turn a bit more tightly towards the “up” wing than the “down” wing, I try to have the wing up on the side of the tightest turn on the taxiway, wind permitting.
7. Applying more power along with some wheel brake when a tight turn is required, or the wind is opposing the turn. The extra airflow on the rudder aids the tail wheel. Pilots must be cautious not to overdo the power and put the glider on its nose.

I kill the motor when approaching people (for example, when approaching a group of gliders and crew waiting at the end of the runway) and coast slowly up to them. I believe this is safer, it is certainly less frightening to them, and the lack of noise and dust are appreciated.

If the wind is strong or the taxiway challenging, it is often safer and easier to put on the tail dolly and push or tow it to the launch point the old-fashioned way; otherwise, I prepare for a wing shift, or to stop somewhere along the way, get out, re-align the glider, get back in, restart, and continue. Another option is to taxi on the runway, if traffic is light enough to permit this. It may be the best option when there is no taxiway, as it's quicker than pushing or towing, so the runway is cleared sooner.

Once I have completed my take-off checklist and the motor has warmed to take-off temperature, I am almost ready to enter the runway. As unpowered glider pilots, we were often accustomed to the towplane taking the runway ahead of us, but now we must remember to check for aircraft taking off, landing, or in the pattern, and make the appropriate radio announcement.

## *5.5 The takeoff*

I always begin the takeoff with a negative flap setting. With full back *trim* (since the stick hand is used on the throttle on my ASH 26 E) and full wheel brake, I check for full static RPM and do an ignition check. With full power still applied, I close and lock the spoilers (the wheel brake is on the spoilers, so this also releases the brake), and begin the takeoff roll. At this point, I move my hand to just behind the spoiler handle where I can detect the spoilers opening, but I’m also ready to close the throttle instantly if a problem arises. Closing the throttle is similar to pulling the tow release, and would let me stop the glider much more quickly than just using the spoilers and wheel brake.

While the above procedure works well for my ASH 26 E, it will not be the best for all models of gliders, because some gliders will tip forward with full power. These gliders must be allowed to accelerate as power is applied. The pilot should not attempt to raise the tail too soon, as a crosswind could cause it to weathervane if the tail wheel loses enough traction. Be sure to understand the flight manual procedures and listen to experienced pilots of your model glider.

Gliders with the wheel brake handle on the stick, instead of actuating with the spoiler handle, will have a different sequence.

I keep the tail wheel on the ground[5] with full back trim and (mostly) full back stick at least until the wings can be leveled, then I let the stick move forward a bit. Shortly after that, I select the climb flap setting (this usually lifts the tail off the ground, if it isn't up already), and then return my hand to its position behind the spoiler handle. From there, the takeoff roll and lift-off are straightforward and easier than an aerotow, with its towplane wake and "formation flying". Because the steerable tail wheel is much more effective than just the rudder at low speeds, smaller, gentler motions on the rudder pedals keep the glider going straight down the runway.

At lift-off speed I ease back on the stick but stay a few feet off the ground until climb speed is reached, then rotate to the climb attitude and maintain climb speed.

As I begin to climb, I purposely drift to one side of the runway (the downwind side in a crosswind) if it is clear. This provides a good view of the runway ahead, and requires only a 180 degree turn into the wind to land downwind, rather than the almost 270 degrees[6] of total turning required if I continue directly over the runway. It still allows an easy, nearly straight ahead landing on the runway if problems occur below my minimum turn-around altitude. It's a situation similar to a "rope-break" during aerotow.

If other runways, taxiways, grass/dirt areas, or fields off the end of the runway are available, I consider adjusting my pattern to use one of them instead of landing back on the take-off runway. As I climb during the launch, I continually evaluate the situation as it changes; that is, "What would I do now?".

If it's an airport new to me, or one I haven't used for a long time, I'll review of the airport layout diagram and ask about potential emergency landing areas before I even rig.

**Flap usage:** The ASH 26E handbook recommends (but doesn't require) starting in a negative flap position, then switching to the climb position. With a wing down on it's tip wheel, starting in the climb position seems to work just as well, as the wing tip is safely on the ground until it can be controlled. It saves fiddling with flaps near take-off speed, and would be easier for someone without much experience in flapped gliders, if the handbook for their glider permits it.

[5] For improved steering, especially in crosswinds.
[6] A 225 degree turn to head back towards the runway, then a 45 degree reversal to align with it.

I prefer to start in a negative flap setting as it is already in that position during the taxi, it provides aileron control a bit more quickly, and it keeps a common procedure for unassisted (wing down) and assisted (wing runner) launching. I always use a negative flap setting for launches with a wing runner, as it reduces the chance the wing will drop early in the launch (a habit more valuable in the ASW 20 C I used to own than my current glider).

## *5.6 Takeoff emergencies*

The previous section is how the launch  is supposed to go, but sometimes it doesn't.

### 5.6.1 If you aren't fast enough, soon enough

- If the engine is not developing full/normal RPM – abort!
- If you have not taken off before your chosen point – abort!

### 5.6.2 If you aren't climbing well…

CHECK YOUR SPOILERS by looking at the wings!

Open spoilers often cause a poor climb or slow takeoff, and closing them will be greatly improve the situation. If they are closed, and plenty of runway is ahead, you may have time for other checks appropriate to your model of glider. I would abort the launch immediately while I still had enough runway, then sort things out later.

There are procedures and hardware devices that can help. See 7.4 "Proper" spoiler usage.

### 5.6.3 The ABC's (and D's) of power loss

This is what I and most other pilots do, but pay attention to your manual as there may be some details that are different and important.

A) Just lifted off:

- Close the throttle (or turn off the ignition)
- Land straight ahead on the runway

B) Climbing but still low:

- Get the nose down *immediately*
- Close the throttle (or turn off the ignition)
- Use spoilers as needed
- Land straight ahead on the runway

C) Higher, but too low to turn around and land in the opposite direction:

- Get the nose down *immediately*

- Close the throttle (or turn off the ignition)
- Use full spoiler to establish a steep descent to land on the runway if possible
- If a safe field that's just off the runway can be reached, use spoilers as needed

D) High enough to turn around:
- Get the nose down *immediately*
- Close the throttle (or turn off the ignition)
- Turn towards the runway with a 35 to 45 degree coordinated bank and adequate airspeed
    - Generally, turn into the wind if you can
    - It works even better if you have drifted off the center line and downwind during the climb
- Land on the runway – it will likely be downwind, so be prepared to stop quickly. At least, with a steerable tail wheel, you won't be likely to lose directional control

E) High enough to go around
- Get the nose down *immediately*
- Close the throttle (or turn off the ignition)
- Turn towards your pre-selected direction with a 35 to 45 degree coordinated bank and adequate airspeed
- Set up to land in the direction you took off
    - You might want a better glide, so …
    - *If you have a spare moment*, stop the prop
    - If you have *two* spare moments, retract it
    - Flying the glider is *much more important* than retracting the propeller
- Land on the runway

That's the basics of my plan if power is lost at a key point. There are some "nuances":
- You have to determine what "low", "higher", and "high enough" mean for you, your glider, and the launch conditions. Talk to other pilots with gliders like yours, but ultimately it's up to you.
- The emphasis on getting the nose down immediately is important, because the power-on climb is "nose-high", and the glider will lose airspeed quickly with a loss of power.
- Quick, decisive action is important: that's why we plan for these events
- Doing the right thing in a few seconds is better than doing it wrong immediately
- It helps to visualize the situations while on the ground (before launching) and imagine responding to them

If you figure out a way to safely practice a takeoff power loss, please, please let me know. We're fortunate that it seems to happen infrequently, but this means we don't get much experience at it, and "learning on the job" is a lousy way to learn in a glider!

## *5.7 The climb*

The airspeed must be monitored for the correct climb speed, as it is tempting to raise the nose, giving the impression of a steeper climb. Besides reducing the climb rate, it increases the risk of a stall, upset from turbulence, or insufficient control during emergencies. With the high thrust line of most self-launching sailplanes, a loss of power means a pitch-up coupled with extra drag, a potential disaster if you are already slow.

I follow the flight path chosen just before the launch, making adjustments if the situation changes.

Once under power, it is tempting to relax and motor off in the desired direction, but one more problem remains: if the engine fails, or if I can't retract the propeller after stopping the engine, will I still be able to glide to a safe landing place? Unlikely as these events would seem, it's happened to four people in our club alone, including myself. With those odds in mind, I ensure that a landing place can be reached even with the propeller extended, until it is safely stowed away.

I use full "climb" power (this varies with the sailplane type) to a safe altitude (at least 400' above pattern altitude), retract the gear, and then almost always continue with full power. Some gliders might require a power reduction for cooling or efficiency reasons – your handbook is your guide.

Why don't I retract the gear sooner? Safety. It is important the gear be down while I am low, should there be an engine failure or other emergency requiring me to land, or in the event of a crash. By waiting to well above pattern altitude before raising it, when I have enough altitude to do the normal pre-landing checks, I am much more likely to remember to extend it. Some pilots leave it down until they stow the propeller, so there is one less thing to forget if the engine develops a problem.

Once above an easy return to the runway (generally, about 400 or 500 feet), I monitor the engine more carefully. In my glider, this means checking the RPM, fuel level, coolant temperatures, and battery voltage. Even though the engine doesn't run very long, it's short-sighted to ignore these checks and potentially miss a developing problem that could cause an engine failure or require some expensive repairs.

Thermals? Oh, right, that's why we're going to all this trouble! Once safely airborne, above pattern altitude (so I don't interfere with other traffic), and still under power, it is worthwhile to remember that I am flying a sailplane: I look for thermals and use them! This is especially worthwhile at high density altitudes where the engine-only climb rate suffers.

Near the top of the powered climb, some pilots do a fuel pump check and an ignition check. This can catch a developing problem that doesn't show up at lower RPMs, before it becomes severe, so it can be repaired before flying the next time.

## *5.8 Becoming a glider*


**Figure 3 Powered to gliding (Schleicher Sailplanes photo)**

This is a critical time because I am concentrating more on the aircraft for about 30 to 45 seconds: stowing the engine, removing the headphones (and getting my hat and sunglasses on straight afterwards!), adjusting the radio and vario audio volumes, and trying to thermal at the same time. These distractions prevent me from looking around as much as I normally do. No one should be close during the process, so I don't motor up to a gaggle or snuggle up to the ridge until I am a glider again!

I usually retract while thermalling, even though this is a little more difficult than when cruising straight. Immediately after closing the throttle and switching off the ignition, I trim the elevator forward, or move the flap lever a notch to a less positive setting, to counteract the nose-up tendency from the loss of power. Remember, turbulence from the raised propeller can hide the some of the usual clues of an impending stall, and your headphones hide the sound cues. Fly to the correct attitude, and monitor your airspeed during this transition.

> Contrary to my ASH 26 E manual recommendation, I always leave the fuel valve open during the entire flight, because I once had an in-flight restart failure when I forgot to turn on the fuel. It's one more thing to forget in a stressful moment.

Closing the fuel valve may be necessary in a glider that pivots the engine to retract it, as this might put the carburetor lower than the fuel level in the tank, causing fuel to leak into the engine compartment, but this isn't the case with the stationary engine of the ASH 26 E. Some gliders use a valve that closes automatically as the engine is retracted.

Now that the engine is retracted, it's just a wonderful high performance glider - fly it and enjoy!

## *5.9 In-flight restart*

I fly my powered sailplane much as I did my unpowered gliders, with a safe landing area always within easy reach. As I sink below about 2000' AGL, I ensure that the fuel valve is open (even though I keep it open while in flight) and review my restart checklist; below 1500' AGL, I turn on the engine control master switch and set the throttle to its normal starting position. At no lower than 1000' AGL, I enter a long downwind (point A) for my selected field, and configure for a landing (extend gear, set flaps, all landing checks). Now I am positioned to complete a safe field landing if the motor doesn't start:

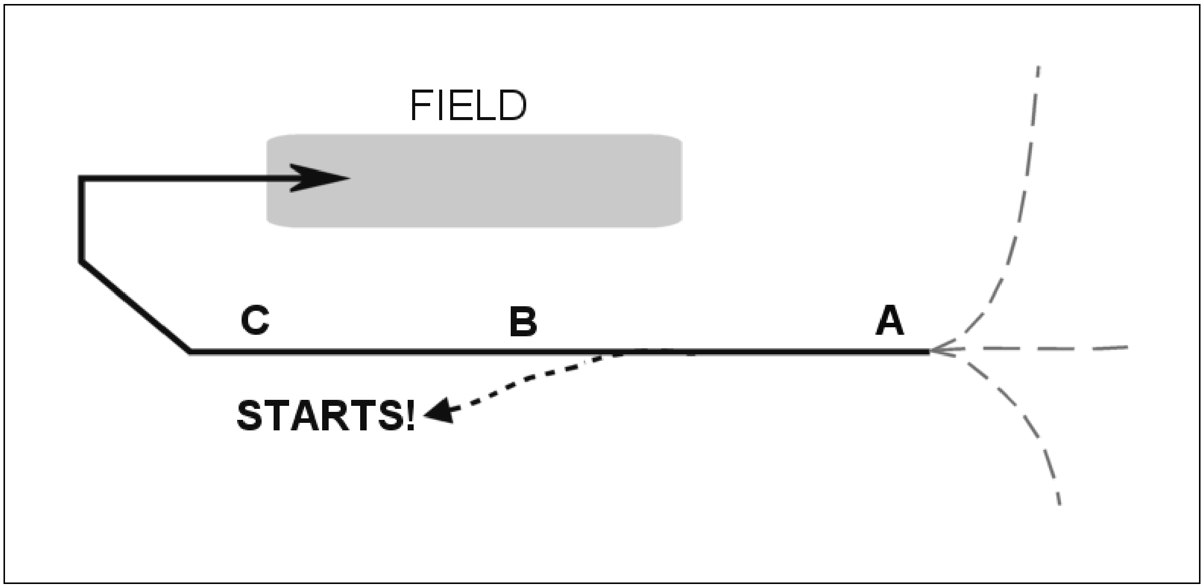


**Figure 4 Field landing pattern (author)**

On downwind, I extract the propeller and attempt to start the engine. If it doesn't start after a couple of attempts, I might retract the propeller at point B if there is enough time and altitude. At point C I abandon any attempts to start or retract the propeller, and then I focus entirely on completing the landing.

If it starts, I apply enough throttle to maintain altitude. While the engine warms at this moderate setting, I retract the gear[7], and then circle my intended landing area, while examining it further and looking for nearby fields that might be more suitable, as a check on my field selection abilities. With the engine still warming, I apply increasing amounts of power to take me to lift, or towards home. Note that not all engines benefit from this short amount of warming, so do as your handbook recommends, and if you need more power, use it! Safety takes priority over a potential increase in engine life.

A new powered sailplane pilot should use altitudes *at least 500' higher* than I've suggested, and make the first few restart attempts over an airport (or practice over the home airport) until experience makes the procedure second nature. Higher AGL altitudes will reduce stress and allow time to deal with difficulties in starting, whether due to pilot error (the most likely reason) or technical problems.

Attempting to re-start the engine too low, and failing, has caused powered sailplane pilots to crash, sometimes with fatal results. Restarting the engine is a critical event in the flight!

[7] Some pilots leave the gear extended until the propeller is retracted – once thing less to worry about if the engine fails.

Jerry Kaufman put it this way: "It's all so easy to get into the mindset of expecting the engine to start and not having any other plan. Or as I put it: plan A is land in that field; plan B is the engine actually works and I motor away."

Just as I did during the launch, I don't motor off immediately in the desired direction, but stay within a *propeller-extended* gliding range of a safe field. All pilots should know how much the extended propeller degrades the glider's "pattern performance", and use higher "restart altitudes" if needed (see section 6.4 Landing with the propeller extended).

There are some good reasons for selecting an even higher restarting altitude than the nominal 1000' I use (or 1500' for the new powered sailplane pilot), if:

- The pilot believes landing with the propeller retracted is desirable[8], more altitude must be allowed to center and stow the propeller after a failed start (very model dependent)
- The pilot wants to attempt a "windmill"[9] start, another few hundred feet will be required (your flight manual will provide recommended values)
- Strong sink (perhaps from wave) is present, causing rapid altitude loss

The altitude required for these situations is best determined while practicing over a familiar airport before experiencing a failed start over an unknown field!

There are some situations when I might choose to start the engine much higher than usual, such as:

- If there is no hope of further soaring, and I am blocked from further progress by a mountain or lack of landing places in that direction, then starting the engine before losing any more height is worthwhile.
- Rapidly approaching bad weather or turbulence near the surface would be reason enough to restart and leave the area as soon as possible.

There is an alternative to the in-flight restart: some pilots, having realized the inherent dangers of in-flight restarts, choose instead to land at an airport, then re-launch from it to continue the soaring or return home. This allows the entire flight (except for the launches) to be flown like a glider, which they are already accustomed to, and it avoids the temptation to attempt starting the engine while too low. They can also work lift somewhat lower, since they do not need extra altitude to start the engine.

## *5.10 Landing*

With the engine retracted, landing a self-launching sailplane is just like an unpowered glider (perhaps one that still has half it's ballast!), except that planning the landing might include the ability to taxi. For example, the most desirable destination (tie-down, fuel, or derigging area) on the airport might not be the closest to the runway. Instead of stopping at the runway turnoff that

[8] For example, if required by the flight manual, to reduce stress on the mast from the engine weight if landing on a rough field, or to reduce the danger to the pilot from the engine if the mast fails in a crash.

[9] Diving at moderate speed so the airflow turns the propeller fast enough to help start the engine.

requires the least pushing to clear the runway, it might be preferable to stop at a turnoff that lets you taxi to your destination. Not all turnoffs or taxiways are wide enough to taxi on, so another turnoff, maybe even one on another runway, might be a better choice. So, I like to arrive at an unfamiliar airport with enough altitude above the pattern to circle and observe the layout.

After touching down, I usually change to a negative flap setting[10]. This is a common procedure for flapped gliders, as it puts the tail wheel more firmly on the ground and improves the aileron control. The steerable tail wheel makes steering much more effective than with the rudder alone, so I use smaller, gentler motions on the rudder pedals. After a few flights with a steerable tail wheel, you will wonder why all gliders don't have them!

There is a downside to this: the better steering encourages you turn off the runway, rather than stopping on it, providing the opportunity to hit a sign, taxiway marker, or other object. Usually, this happens by going around the corner with the wing off the ground, allowing it to hit something at wing height (rather than passing over it with the other tip on the ground), or not keeping the wing level so it comes down and hits something or catches a tip in tall grass. I find the safest way to round a corner is to set a wing tip down while still on the runway, then turning the corner.

Deciding which tip to put down is sometimes a dilemma: should it be the downwind tip (downwind after the turn) to prevent the wind from flipping it to the other tip, or should it be the tip on the outside of the turn, so the force of turning tends to hold it down? If the wind is strong enough to risk flipping the wing, I'll put the downwind tip down, then go around the corner slowly enough that I don't have to worry about the turning force flipping me to the other tip.

And finally, if you are accustomed to a 15-meter or smaller glider, but are now flying an 18-meter glider (ten feet wider than a 15 meter glider!), be more careful in selecting landing fields, and even airports. Bushes close to the runway and landing or taxiway lights are bigger hazards than before; even many runways won't be wide enough to allow your wing tips on the pavement. If the runway is too narrow for my wingspan, I plan my rollout so I can move to (usually) the upwind side of the runway, then gently lower the downwind wing to the surface while I still have good aileron control. The wing tip wheels let the wing tip roll along the ground, and the steerable tail wheel helps keep things straight.

Happily, most of the small airport runways I paced off in the Western USA (my usual flying area) had at least 65' across the runway between the landing lights, but this isn't the case everywhere.

# 6 Advanced Power Techniques

The following expands on the remarks made in the previous section.

[10] Unless I am in the "L" (Landing) flap position, which, on the ASH 26, moves the ailerons to neutral for improved control.

## *6.1 Self-retrieving*

Self-retrieving can be as simple as a few minutes of engine power to get you up from a low point to that lift just out of reach, or hours of motoring in high winds and altitudes. Generally, it's the former, but if you are prepared for the latter, it can make a self-retrieve safer and quicker. The major techniques are the sawtooth mode and continuous motoring.

### 6.1.1 Sawtooth mode

Sawtooth travel, a repeated climb/glide sequence, can be a good way to cover long stretches. I've only used it a few times, but it was easy and effective. I simply climbed high enough to glide easily to an airport along my desired path, shut the motor down, and then glided. Upon arriving over the airport, I began another climb in the direction of the next airport, and so on. In eastern Washington State, where I normally fly, my climbs were to 7000'to 9000' MSL. With airport elevations of 400' to 2000' and low hills, this gave me an easy 30-40 mile glide with an arrival altitude of 1000' to 2000' AGL. The distance between airports can be farther than the glide, because the climbing is done directly towards the airport. For example, a 6000' climb would bring me about 10 nautical miles closer (6000' climb at 5 knots is 12 minutes of climb; at 50 knot climb speed, that's 10 nautical miles less gliding needed).

Wind plays an important part in the equation, because the average calm-wind "sawtooth" speed is about 60-65 knots. At 5-10 knots wind, there seems to be little effect, but going into a 30+ knot wind is a slow, frustrating experience if much distance must be covered. Faced with this situation, I'd consider landing, finding a nice motel near the airport (or just a couch in the pilot's lounge), and waiting until the next day when it might even be possible to soar home. Calling for the trailer (even if it means a lot of pizza and beer must be purchased!) is another option.

### 6.1.2 Continuous motoring

Because most self-launching sailplanes make poor airplanes, with their slow (typically 65-75 knots) cruise and limited fuel (around two hour's worth, unless it has optional fuel tanks), there isn't much temptation to use them that way. Occasionally I will cruise under power to make better headway against the wind while trying to contact wave, or when I'm self-retrieving and the distance back is short, or the cloudbase is too low to make a "sawtooth" mode practical. It's easy to overspeed the engine in cruising flight, so I monitor the RPMs closely until airspeed, altitude, and attitude are steady.

Cruising with the motor can seduce a pilot accustomed only to gliding: suddenly, he has the freedom to go where he points the nose without the usual glider pilot concerns about staying up. He becomes an airplane pilot, but without the training. Will he now succumb to the ever-popular airplane pilot mistake of flying into poor weather? Will he try to push his limited fuel to get home as early as possible, or choose options like landing to refuel, or even a ground retrieve? Does he know how accurate the gauge is when the fuel is low, or how much fuel is used in cruise?

Even with these problems and the steady noise of a motor, cruising can be worthwhile when the headwind is strong. A 75 knot cruise speed will get you home quicker than the "sawtooth mode" (average speed of maybe 60 knots), if you have enough fuel to keep the motor running. It also reduces the number of restarts and the risk of mishandling them, an advantage over the sawtooth mode (but only a small advantage if you do your sawtooth restarts over airports).

### 6.1.3 High altitudes

At areas like Minden, Nevada, I've had to climb much higher while making a self-retrieve, due to the higher airport elevations, greater distance between airports, and the numerous mountain ranges. Of course, the climb rate falls off noticeably at 10,000'-12,000', so the motor must be used longer. Areas like these make a well-tuned engine important, because the power output is already suffering from the high altitude. An engine that runs well near sea level may still run well during a launch from a 5000' elevation airport, but be too rich to run well at 10,000'. This might not be high enough to get you home; conversely, the engine needs to be retuned when taken back to the lower elevations to avoid running too lean and damaging itself. If you have a fuel-injected engine that can automatically adjust to any altitude, smile broadly!

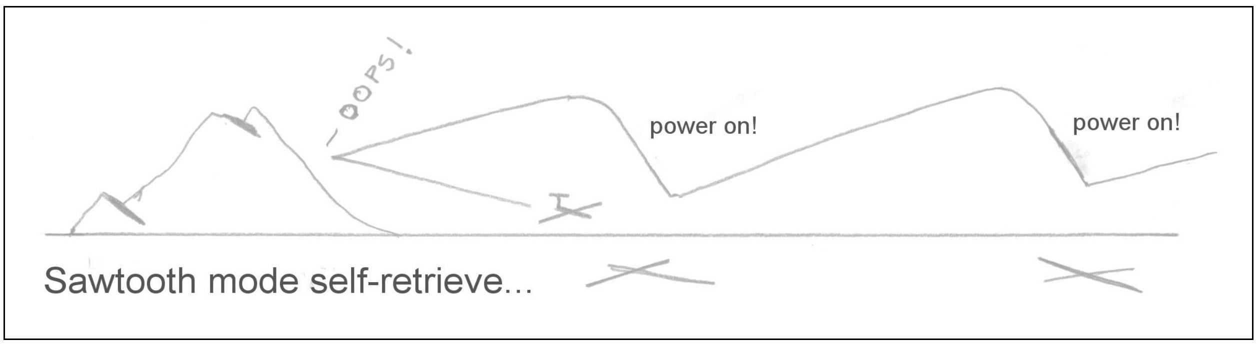


**Figure 5 The perils of high altitudes (author)**

In these areas, it might be impractical to always glide towards an airport, so a *known* safe field (dry lake, private strip, etc) must be substituted to continue. With these issues, some pilots think it's safer and easier to just cruise home, a reasonable strategy if you have enough fuel (optional extra tanks, perhaps) and an engine that runs smoothly during level cruise. The best practice still requires keeping a safe field in reach, even if retrieving from it may be difficult.

### 6.1.4 Refueling

Starting the flight with a full tank will leave the typical self-launcher with plenty of fuel to cover 200 miles or more (even 300+ miles in good conditions) without soaring, but distance, mountains, winds, or prudence might make it necessary to land for refueling. The pilot needs to know which airports have fuel[11] and carry any refueling equipment needed. This might include oil, a refueling pump or a funnel, and a container of some sort if the airport fuel hose won't fit your tank, or if you have to bring fuel to the glider (from an automotive fuel station off the airport, for example).

[11]Databases available for many flight computers can include airport fuel remarks.

### 6.2 Wave flying

Wave flying brings its own problems. Cold soaking of the engine and its starting battery at low temperatures may make it difficult - or impossible - to start without letting it warm first. If I think the engine is too cold, I extend the propeller enough to open the doors once I have descended to warmer air, and let the motor and oil warm up as long as I can. I have an outside air temperature gauge, so I have an idea of the engine temperature.

The details of starting a cold engine will vary from glider to glider, but all of them will start more readily in the air. If I think I'll need the engine to taxi after a wave flight, I'll start it over the airport instead of waiting until I've landed. One option is to warm it up, then shut down, retract, and land normally; the other is to land with the engine running (assuming your flight manual allows this). The latter choice can lead to an 'interesting' problem (see 6.5 Landing with engine running).

As outlined previously (6.1 Self-retrieving), the strong winds typical of wave may make a self-retrieve difficult, impractical, or even impossible, especially in the shortened days of winter. I prepare for this by always being ready to stay over at least a night, with clothing appropriate for the season. Check this list (12.7 ELTs, cell phones, and other emergency gear) of things I always carry, plus the seasonal additions.

### 6.3 Taxiing nuances

On smooth, hard, level surfaces, when the wind is light, taxiing can be very easy. Even so, there are situations when it can go wrong in a hurry.

#### 6.3.1 Using too much power

Most self-launching sailplanes have enough static thrust at full power that they will tip forward onto the nose (even with full back stick), unless the power is quickly reduced. This isn't a problem with the moderate power needed for normal taxiing, but some circumstances require more power:

- Soft ground or thick grass, especially with an upslope
- A rock or depression in the ground
- Going over a raised edge, such as entering a paved runway from the dirt beside it,
- Beginning the takeoff roll

Even moderate power can be enough to cause a problem when taxiing downwind, as the reduced airflow over the elevator reduces its download. Regardless of the reason, if the tail rises, or even becomes too light, the wind can over power the rudder and tail wheel, causing the glider to swing into the wind, or towards the tip on the ground. A forward CG aggravates the problem.

#### 6.3.2 Back taxi

If an airport doesn't have a taxiway wide enough to use, I'll often "back taxi" on the runway to get to the takeoff location. On runways wider than my wingspan, I will sometimes speed up *just enough* to level the wings. That's about 20-25 knots in my ASH 26 E. Some back stick and a negative flap setting ensure I have enough force on the tail wheel for good steering; the negative flap setting also makes it unlikely the glider can lift off if a gust hits it, or I'm going a bit too fast. I also keep the spoilers slightly open.

This gets me to the end much more quickly, so I block the runway as little as possible. I go to idle and slow down well in advance of the end, then gently lower a wing while I still have aileron control. If there isn't enough room to turn around at the end, I'll shut down, get out and turn it around by hand. Annoying, but it still beats pushing it a long way.

Of course, I always check both ends of the runway, the pattern, and the radio for conflicting traffic before entering it to back taxi. Just because I might be at a small airport in an isolated area, I don't assume that I'm all alone, or that approaching aircraft are listening on the radio.

Another reason to back taxi is the wind makes it too difficult to use the taxiway. Maybe it's gusty, and I can't be sure I'll keep be able to keep the glider on a narrow taxiway; perhaps the wind direction means the wind will hit the glider from the opposite side when I turn from the taxiway towards the runway, causing the wing to tip the other way. For those situations, I think it's safer and easier to back taxi, unless there is a lot of traffic using the runway.

### 6.3.3 Taxiing with the canopy open

Taxiing with canopy closed avoids the possibility that wind or bumps will slam it closed (perhaps damaging it) or over-stress the support strut. Because it can also be overwhelmingly hot when closed in the summer months, many pilots have figured out how to safely taxi with it open. These remarks apply to forward opening canopies, as side hinged canopies are generally not as vulnerable:

- Some canopies have a spring strut that is strong enough to hold the canopy fully open in mild winds, and raise it high enough the pilot can still see where he is going. Weaker systems risk hinge failure, which could fail in flight. Check with other owners first.
- Other gliders require the pilot to use a brace to supplement the spring in the fully open position.
- Some pilots keep it open only a few inches with braces under the side or rear of the canopy. This is usually plenty of cooling, and problems from wind and bumps are minimized. There is some possibility the pilot might not remember to close it, as it is close to it's normal position. Avoiding this possibility is very important!

I had a "fun" canopy-open experience in the heat at Austin, Nevada, where I had to taxi about 2000' on the runway to get to the takeoff end. Halfway down, I impatiently began to use a little more speed. Suddenly, I felt my hat brim flip up, causing substantial lift to develop, which pulled at my headphones clamped over the hat. I imagined hat and headphones ripping off my head and being sucked into the propeller, scattering bits of fiberglass, fabric, and noise-canceling circuitry far out into the sagebrush! It was a little wobbly, but I got the throttle shut down while holding everything onto my head, and taxied at a sedate pace after that.

A European pilot told me of canopy covers being sucked out from behind the seat and breaking the propeller. Be cautious when trying something new: there are many ways to find trouble!

### 6.3.4 Taxiing without a steerable tail wheel

Though I've never tried it, it is possible to taxi without a steerable tail wheel. It uses the propeller blast over the rudder to turn, aided by reducing (but not removing) the tail load with power and some forward stick. The wheel brake controls the speed, and a very clever pilot can, in some gliders, actually turn without moving forward. The hazard is a little too much power or forward stick, or even a small gust of wind, can lift the tail. From there it's only a second until the glider is on the nose, then crashes back down on the tail wheel as the panicky pilot cuts the power. So, it seems best to acquire this skill on a grass airfield, or use it only when gentle turns can be made while moving.

### 6.3.5 Aids to taxiing

Taxiing on rough or soft ground may not be practical with the usual small wing tip wheels. Using a larger temporary tip wheel can save the day, though it must be removed before flight. DG Sailplanes makes one that can be folded and stowed in the baggage area after removal.

Some pilots make simple "clamp on" wing tip dolly that is heavy and low. They use it when they need to taxi a long ways in the wind. This one is serviceable, if not elegant (right).

**Figure 6 Removable wing tip  taxi wheel (DG Sailplanes)**

## *6.4 Landing with the propeller extended*

I can think of three reasons for landing with the propeller out (note that not all glider flight manuals may allow this!):

1. I can't, or don't have time to, retract it.
2. I want to start and taxi away from the runway as soon as possible (at a busy airport, say).
3. I want to practice for situations 1 & 2!

So, once I was comfortable with landings, I did some with the propeller extended (I also did a few stalls on the way down to acquaint myself with the behavior – not much change). This accomplished two things: it made me fully aware of the noticeable reduction in performance (compared to normal gliding), and prepared me for the day the motor doesn't start in flight, when I might be unable or unwilling to retract the propeller before landing. It wasn't difficult, but much like flying with the spoilers slightly open.

For an 18 meter glider like the ASH 26 E in *landing* configuration, the glide goes from about 30:1 to about 20:1, but older 15 meter gliders like the PIK 20 E go to about 14:1. I think it's best to become familiar with the degraded performance by practicing with it, rather than be surprised if an in-flight restart fails. I found my normal pattern was conservative enough to absorb the change in performance, but yours may not, especially if you are flying a PIK or other "engine on a stick" model of glider.

There is a risk to flying with the propeller extended: the noise and turbulence from the raised propeller can hide the buffet of an impending stall, so it is even more important than usual to carefully monitor the airspeed during landing. Again, it is better to encounter this during practice instead of during necessity.

## *6.5 Landing with engine running*

A common reason for landing with the engine running is flying into a controlled airfield, where gliding wouldn't let the pilot comply with the air traffic controller's requests. Other reasons are the need to taxi off the runway as soon as possible, or ensure the motor will be available after landing, if a low battery or other problem is suspected.

Some glider flight manuals prohibit this, but others are silent on the issue. Here is a partial quote from the DG Flugzeugbau web site (www.dg-flugzeugbau.de Mar 2004):

> If it's [landing with the engine running] so simple, why is it forbidden?
>
> The reason is that there is no stall warning indicator. Every aircraft begins to shake shortly before the laminar flow breaks away from the wing and turbulence bubbles are shed and begin to hit the elevator. This shaking is so noticeable that no stall warning indicator is needed as in airplanes. Modern laminar flow airfoils release very small turbulence bubbles so that the described effect is not so noticeable. If the motor in a motorglider is running, its vibration covers the shaking associated with the approach of stall. The aircraft has, in effect, no stall warning indication and so landing with a running engine is forbidden by the LBA [German FAA equivalent].

If not prohibited by your manual, and you think it might be useful to you, it might be worth learning to land using the engine. I've done it in a PIK 20 E, and it was easy and not much different than the usual engine-stowed landing.

There is a risk you might not think about at first: an audio gear warning might not be heard. With the motor running, you will likely put on your headphones; those, and the noise of the engine, could easily mask the audio alert of a gear warning system. A very loud alert, an alert that also sounds in the headphones, a warning light, or a tactile warning (I previously used a small spring clamp that I transferred between the gear and spoiler handles) can avoid this problem.

### *6.6 Operating from a tower controlled airport*

A self-launching sailplane makes it possible to operate out of a tower controlled airfield. This might allow you to fly from an airport much closer to your home than a glider airfield, for example. I've done this so little, I'm offering this advice from Tom Seim instead:

> I've operated my DG-400 out of several tower controlled airports without problems. My only glitch was trying to talk to a tower with my canopy open (because of heat) and the engine running. They were having a hard time understanding me. I suggest getting taxi clearance prior to starting the engine if you don't like sitting in a sweltering closed cockpit. If you have problems starting your engine you can always cancel the request. And let them know that you don't necessarily need the whole runway length (this could mean a long taxi which doesn't do 2 cycle engines any good).
>
> If you are going to regularly fly at a particular airport I recommend a visit to the tower to get acquainted. Mostly, these guys love the company and you will have the opportunity to explain the limitations of your glider, in particular the taxi limitations. You should discuss with them landing procedures as some think that unpowered gliders are falling out of the sky and treat it like an emergency landing. I usually enter the pattern high (2000 ft) to give me options. In many respects operating at a controlled airport can be easier than an uncontrolled airport. Once you initially contact them inbound (at least 5 min out, preferably more to allow handling an "unusual to them" aircraft) they are sequencing you to land and you don't have to worry about some other A/C with no radio (or radio on the wrong freq, squelch up, etc.) cutting in front of you. They will ask you to report on downwind at which time they'll give you clearance to land. Be sure to acknowledge EVERY transmission with a read back of their instructions (this is necessary so that they know that you got the instruction correctly). If there is any question about the instruction, ask.
>
> Once I was inbound to Hailey, ID (a controlled airport that serves Sun Valley and is the second busiest in Idaho) with an honest-to-God emergency: I was punching through a squall line and dropping like a rock, and not sure if I was going to make the airport. The tower said something to me, but I was so absorbed with the problems at hand I didn't understand it. Rather take away from flying the glider and have them repeat I simply told them that I was busy and would talk to them in a minute (at which point I would either be on the ground or in the pattern). They patiently waited and I made it thru the squall line. Just remember that you are the pilot and not some remote control actuator; if you have a problem you have to let the tower know. If they are having a bad air day declare an emergency: that will get their attention (but be prepared to visit the tower afterwards and fill out some forms).
>
> I enjoy flying at these places in part because of some of the other power pilots you meet. Once I landed at a controlled airport, put out my engine and requested an immediate departure clearance, which was granted. As I was climbing out another pilot commented on the radio: "That looks like something out of a James Bond movie".

> The moral of the story is that if you haven't heard the permission or clearance you don't have it. Keep repeating the request until you do get it. I have had controllers give me the pertinent airport info but forget to give me the critical "cleared to land" message. I was forced to verify that I had permission to land at a point when I was definitely committed to landing. I have also been left sitting waiting to depart after requesting departure clearance (I think that the controller didn't believe I was self launching even though I identified myself as a motor glider). Another way to clear up any misunderstanding is to repeat back what you understand the instructions to be, i.e., "(call sign) cleared to taxi to (destination)" or "(call sign) cleared to land (airport) runway XX". The controller will definitely correct you at that point if you have it wrong.

Another pilot has this advice:

> “I've been landing in the glider configuration and have had no problems sequencing in with power traffic; the tower has been very helpful when I tell them what I want. I also find it easier to plan the roll out so that I can taxi clear of the active runway without having to fool around with the motor for a powered taxi. It keeps the active open and the tower happy.”

A local pilot operates his PIK 20 E out of our Class D airport, but they request he arrive under power. Another nearby Class D airport allowed the pilot to use his car to tow the glider on the taxiway to the end of the runway (and leave it there!); yet the controllers at one in Idaho would become agitated if even a wing tip went into the taxi area while the pilot was *pushing* the glider. So, do your homework (know how to operate from a towered field, know the NOTAMS, the frequencies, the layout), talk to the controllers, be nice, make friends for soaring, and you can probably work things out to your advantage.

# 7 Glider Operation

While the self-launching sailplane is essentially a glider when the propeller is stowed, there are some issues related to the extra weight and the independence that self-launching provides.

## *7.1 Ground handling*

They are heavier than similar unpowered gliders, though the sustainer types are less so. Retrieving the glider, and especially the fuselage, from a field might require more people, with more beer and pizza afterwards. So, let’s keep our engines in good condition!

### 7.1.1 Trailering

The trailer, with glider, will be noticeably heavier than one for an unpowered glider. You might even need, or want, a larger and more powerful tow vehicle, and you should assure yourself the combination you use is stable and can stop adequately. For example, my ASW 20 C (15 meters) and trailer weighed about 1700 pounds (trailer didn’t need brakes in my state), while my ASH 26

E (18 meters) and trailer with the usual stuff in it weighs about 2500 pounds (trailer needs, and has, brakes).

### 7.1.2 Rigging the glider

The big difference here is fuselage weight, which for an 18 meter self-launching sailplane can add as much as 180 pounds over an unpowered version (engine system, fuel, controls, doors, large battery). This weight and the heavier tail make it harder to remove the fuselage from the trailer. A middle rail on the ramp for the tail wheel and an ramp extension to the ground helps a lot.

I use a tail boom strap to help pull it in and out, so I have good grip on it and don't have to bend over. By going into the trailer and standing besides the tail boom, I can use it to easily lift the tail wheel out of the fiberglass cup in the floor. Trailer manufactures now offer a built-in lever system to do the same thing.

**Figure 7 Tail lifting strap (author)**

It's made from seat belt material, with a loop sewed at each end. The strap goes through one loop to capture the tail boom, and the other is used as a hand grip. I put it in the glider after rigging so I can use it to help move the glider after landing, particularly on dirt strips were it doesn't roll easily.

Other than the fuselage weight, self-launchers rig normally, but to take full advantage of the independence they offer requires a self-rigging dolly. It's not as much fun to fly alone, but why sit around just because no one else can fly? It also makes lifting the root so much easier, that many pilots rig with it to spare their back, even when help is available. It doesn't take much longer, either, but there are some "gotchas" if you aren't familiar with using them. Here are some I've discovered:

- The wind isn't my friend. It can easily tip over the wing and it's dolly if things get a little crosswise to it. I like to point the trailer into the wind, pull the wing out, set it on the dolly, then move the dolly just enough to rotate the wing flat, so it is much less affected by the wind.
- Rough ground can stop a dolly wheel and tip the dolly out from under the wing. Ouch! I pick my spot carefully, watch the wheels intently, and try to get someone to guard the wing tip.
- Even the holes in the ramp pavement for the tie down rings/bars can stop a wheel unexpectedly, so watch where the wheels are going.

I like the hydraulic ramp jack quite a bit, but it must be used with much the same care you would use a hydraulic jack on a car:

- Don't crawl under the glider when it is jacked up with the ramp jack: a leak in the jack or a bumped release lever can put the fuselage down on top of you (about 450 pounds on an 18 meter self-launcher).
- If the fuselage is jacked up without the wings on it, gear down, the fuselage will fall over if the jack is lowered; e.g., by leaking down, the release lever being kicked, or even absently-mindedly doing it yourself. Fuselages have tipped over, breaking the canopy, and ruining the owner's day!

### 7.1.3 Moving the glider

It's the same as any glider when using the tail dolly, or if it has a fixed tail wheel. The engine weight makes if feel like it's full of water, though, and the tail strap really helps for lifting the tail to change direction or put on the tail dolly. The tail dolly isn't really needed on good ground, as long as the glider generally goes forward. The steerable tail wheel lets the glider turn while moving it, much like the tail dolly does.

Note that gliders with steerable tail wheels like to go forward, not backward, as the tail wheel tends to cock to one side or the other going backward. This is fine when I am backing it away from the trailer and want it to turn. Putting the wing down on the outside of the turn makes it easier, as the wheel cocks in the right direction. Going straight back for more than a few feet … well, I just don't try to do that. It is easier to do if a friend or wing dolly holds the wings level.

Going forward is easy, except for the weight. Sometimes I pull on the tail using the tail lifting strap. The steerable wheel makes it easy to go in the desired direction simply by pulling slightly to one side or the other. Other times, on flat, level pavement, I'll push on the rudder and near the center of the elevator, using the rudder move the tail wheel in the direction desired (these parts on my ASH 26 E seem quite stout, but not all gliders will tolerate this). This is especially useful when aligning the glider with the trailer and pushing it up to the ramp for derigging.

Of course, my preferred method of moving the glider is to taxi with the engine!

## *7.2 Launching without using the engine*

There are several reasons why I might choose to launch without using the engine, such as:

- An aerotow (or ground launch) may safer than a self-launch
- Local noise regulations prohibit self-launching
- Contest operations require all contestants to take a tow
- The maximum amount of fuel is desired for a potential self-retrieve

These are all valid reasons, but then I could be flying with an engine that may not have been started in days or weeks. Can I trust it to start reliably, and can I trust myself, since it's also been the same amount of time since I've done a start? The only in-flight restart failure I've had (out of 180+ in-flight attempts) occurred after three days of aerotows and no engine starts, although the engine started immediately on the ground after landing. Fortunately, I'd landed on an airport where I could re-launch, saving myself the embarrassment of a retrieve!

At that point, I decided to always run the engine on the ground before a tow if it's been more than a day or two since I last started it, or at least run it briefly once launched. It's especially worthwhile if I fly where airports are rare or retrieves are difficult.

Like most self-launching sailplane pilots, I rarely aerotow, much preferring to self-launch, so my aerotow skills get rusty. Worse, some of the habits developed for self-launching are different than those for aerotowing. Here's what's given me problems in my glider:

- Forgetting to close the spoiler handle, since I'm not using it to control the glider (taxiing and run-up before launch). I went back to the technique I used on my ASW 20, which was to start the launch with the spoilers open. This was useful in the ASW 20 to prevent it from dropping a wing early in the launch. My ASH 26 E doesn't seem to be prone to drop a wing, but now I have the same habit for both self-launch AND aerotow.
- Without the thrust of the high-mounted propeller, it can take a LOT longer (more speed is needed) to get the tail off the ground. The speed will vary with the model of glider, but it will always be higher than self-launch, especially when using a CG hook. Instead of full back stick to maintain tail wheel control during self-launch, I use full forward stick, and it still takes nearly 40 knots with my ballasted ASH 26 E (it has a particularly heavy tail).
- Since I've rarely used the release handle, and generally not for quite while, I tend to "remember" where it was in an ASW 20 and not where it is in the ASH 26 E. Now I practice pulling the release several times before an aerotow.
- Forgetting to turn right after releasing from tow (USA practice).
- Forgetting to check the towhook, which likely hasn't been used for a long time, and may be dirty or poorly lubricated.

I’ve now made myself an “aerotow” checklist, something I never needed when I was making 50-100 aerotows a year, instead of 4 or 5 (and sometimes none).

I haven’t ground launched in my glider, but I think the cautions would be similar. Talk to a pilot that has done it, and study the relevant section in your flight manual.

## *7.3 Flying without the engine installed*

Why would you even want to do it? Maybe you’ve returned the engine to the factory for an overhaul; maybe you’re waiting for an engine part during the factory’s month-long August vacation; or maybe you want to fly in a contest where weak weather is expected.

Removing the engine and flying without it is generally allowed – check your manual and airworthiness restrictions. I’ve not done it, but I know pilots that have. The most critical action is maintaining a proper CG, because the glider will almost surely be beyond the front limit. I wouldn’t fly it without actually doing a weight & balance before flying it again. In my glider, the two large engine/instrument batteries and some nose weight must be removed, and a new, smaller battery installed in the baggage compartment for the instruments. It is critical that ballast changes be restored when the engine is re-installed, so the CG is in the correct position.

## *7.4 “Proper” spoiler usage*

I encourage everyone to read these comments critically, and decide on a method that you think will work well for you, because self-launching sailplanes are not immune to spoiler induced accidents. Possibly, because of the additional work load of self-launching and without the wing-runners and other helpers around to spot unlocked spoilers, they are even more prone to it.

### 7.4.1 My opinion

These procedures have worked well for me (so far), but that doesn't mean I've experienced every possibility, or that these represent the "best practices" for every situation. It’s more of an issue for gliders that have the wheel brakes actuated by the spoiler handle. Gliders with a brake actuated by a separate lever or heel-actuated brakes can lock their spoilers at any time before the launch, since the wheel brake is independent of them.

*Spoilers during self-launching:*

When I taxi out onto the runway, I use the spoilers/wheel brake to control the operation, as usual. Once in position for takeoff, I open the spoilers fully to give me full wheel braking, ensure full back trim is set, and then fully open the throttle (full throttle is not practical with all self-launching sailplanes because the nose will go down). Once I see full static rpm, I check the ignition circuits for RPM drop (follow the manual for your glider). If the drop is satisfactory, I lock the spoilers and begin the takeoff roll. At this point, I move my hand to just behind the spoiler handle where I can detect the spoilers opening, but I’m ready to close the throttle instantly if a problem arises. Once the wings are level (around 25 knots IAS), I select takeoff flap, then return my hand to its position behind the spoiler handle. Somewhere around 400-500' AGL, I stop monitoring the spoiler handle.

*Spoilers during aerotow:*

“Spoilers open” at the start is also what I use for an aero tow when I have a wing runner (I keep the spoilers moving a bit so the launch crew knows they aren't accidentally open), except I don’t close them immediately, but keep them partially open to about 20 knots. On my ASW 20, this essentially eliminated the tendency to drop the left wing at the start of the takeoff roll. The ASH 26 E isn’t prone to that, but I don’t want to change the habit. The other advantage to starting with the spoilers open is to keep some wheel brake on, so the glider doesn't have any chance to roll over the towrope.

Besides the operational reasons for using spoilers at the start of the takeoff roll, I believe it has an important safety advantage: since I am taking off with my hand on the spoilers, I know they are open, and naturally close them.

*Spoilers under any circumstance:*

If I'm in the glider, the spoilers are either locked, or I am holding the handle. At least for me, it is too risky to let go of the handle without locking the brakes, because then I have an opportunity to forget them. There is a minor exception to this: during the landing roll, I will release the spoiler handle (spoilers still open) to shift from the flap position used for landing to a negative flap setting, then return my hand to the spoiler handle.

### 7.4.2 What else can we do?

There is a simple, low-cost device that might save the unwary the pilot with unlocked spoilers: the Piggott-hook, invented by Derek Piggott. The hook prevents the spoilers from opening, even if they are unlocked. At this writing, it is only available for DG sailplanes (contact DG for information), but ask your glider's manufacturer to be sure. It also serves as a parking brake.

**Figure 8 Piggott-hook example - pin on spoiler handle engages slots in plate**

Some pilots have installed “spoilers unlocked” warning systems. These operate differently than the common “gear up” warning, since they must alert the pilot even when the gear is down for takeoff. DG Sailplanes sells an instrument called the “DSI” that can provide this warning and others. The Cambridge 302 vario will also provide a warning, and there may be other soaring instruments that can do this. Both the DSI and 302 do not alert unless there is at least 20 knots airspeed, eliminating most nuisance alerts while the glider is not flying.

## *7.5 Soaring*

Because self-launching sailplanes are simply sailplanes once the propeller is stowed, there isn’t much to say here that hasn’t been said elsewhere many times. They are sailplanes, fly them and enjoy them!

**Figure 9 This is enjoying it! (the Matterhorn - source unknown)**

There is one detectable difference: the minimum wing loading is higher than an unpowered sailplane, due to the weight of the propulsion system (engine and propeller, fuel, larger battery, etc.). For the 18-meter gliders, this minimum loading is about 8 lbs/sqft (40 kg/m2); for a PIK 20 E (a 15 meter glider), it is about 9 lbs/sqft (45 kg/m2). The airfoils on the modern 18-meter gliders are so good, that this relatively high wing loading is only a disadvantage in the weakest conditions. However, since the motor is available to avoid a land-out (and perhaps get to better conditions) I find I am more willing to fly on weak days than the “unpowered” pilots are willing to, even though they have the lower wing loading!

## *7.6 Contest flying*

Contest flying can be a lot fun, and the pilot can often learn things he never would on his own. A self-launching sailplane makes contest flying more convenient because you are unlikely to need a retrieve. Your crew might appreciate that, or you can even fly without a crew. Unfortunately, there are three potential safety issues if you fly your self-launching sailplane in a contest:

- If you are not allowed to self-launch, then you might be flying with an engine that hasn't run recently (see 7.2 Launching without using the engine)
- You will be tempted to delay starting the engine when you get low, increasing the risk of botching the process and crashing (see 12.2 The Culture of the "Low Save")
- If you do land in a field, the engine weight makes it seem like you still have your ballast, so you must be ready for the higher landing speed and longer roll.

So, the contest flying requires even more discipline than recreational flying, but I've enjoyed it very much, and my wife is happy to see me return every day in time for a beer and dinner before dark!

## *7.7 Badge and record flying*

The self-launching sailplane and a flight recorder (FR) that records engine operation make badge and record flying fun again. Here are a few of the things I do to make things easier (please check the *current* rules carefully, as these comments might be out of date when you read this):

- I seal the FR to the glider so an Official Observer (OO) isn't required at the take off and landing; instead, I can use other, more available witnesses.
- Good lift often starts early, but about 30 miles away. I can declare a point there for my start, and it's easy to reach by climbing directly towards it until within easy gliding range. This only adds about 8 minutes to my usual 2000' climb, since I'm making progress even while climbing.
- Alternatively, I can trailer to an area best suited to my task and fly from there, even if there isn't a towplane at the airport.
- Because my finish is often away from my home airport, I pick a finish altitude at least high enough to do a safe restart, perhaps even find another thermal, so I can easily fly home at the end of the task (this is for tasks with a declared finish).
- Multiple attempts can be made (especially with short tasks) without landing, even if the engine must be restarted, because the FR records the engine operation.

Record rules within countries vary; for the USA, flying for *sailplane* records (as opposed to *motorglider* records) with a powered glider requires that the engine to be unable to start once the task is begun. It can still be used for launching as long as the pilot will be unable to restart it in the air[12], and for self-retrieving after a landing.

[12] There are various model-dependent ways to do this; check with other owners

# 8 Power Emergencies

A self-launching sailplane doesn't have the tow related emergencies a sailplane does; instead, it has its own set of launch emergencies.

## 8.1 In your manual…

The flight manual covers the motor related problems, which typically include things like:

- Fire
- Power loss
- Propeller won't retract
- Loud and increasing noise
- Heavy vibrations under power

Because these happen infrequently in the modern motorglider (and are difficult to practice!), I review the flight manual's Emergency Procedures regularly, then try to visualize what the emergency would seem like and how to react to it. They are also written on the back of my pre-flight checklist.

## 8.2 Power failure

Loss of power during the launch is a relatively rare event, but with potentially fatal results. Here is what Bob Moore, one of the most experienced self-launching sailplane pilots I knew, had to say:

> **Engine Failure:** In the beginning, I vaguely assumed that engine failure-on-take-off would be no more serious than a rope break when launching a conventional sailplane. I also assumed that it was unlikely to ever happen to me. I was very wrong on both counts! Engine failure on take off with an SLS [Self-Launching Sailplane] is serious. There are several reasons it is more serious than a rope break: The motorglider is heavier than a conventional sailplane, more like a competition glider with a full load of water ballast. And, the extended engine and windmilling propeller[13] cause tremendous drag. In the PIK 20 E, the glide ratio drops from a claimed 40 to only 14 - about like a primary glider, or an airplane. There is also fuel on board, which can burn. So, engine failure on takeoff deserves a lot of respect. It certainly gets a pilot's full attention when it happens! How likely is it to happen? I don't know, however I have had this experience five times in my PIK, and twice with the Hummingbird. Two-cycle engines seem inherently less reliable than four-cycle, and most probably don't get the routine maintenance as they deserve."

[excerpted from "So you are getting an SLS? Congratulations, but please fly safely!", by Robert L. Moore, *Towline, May 1998* (used with permission)].

[13] A windmilling propeller has several times the drag of a stopped propeller, because it is producing lift opposite the flight direction, and not just drag like the stopped propeller.

I would add the nose-up attitude (compared to a glider on tow) of the climbing self-launching sailplane obscures the runway ahead , which further complicates the correct decision if power is lost.

The modern motorgliders are more reliable than the 1980's PIK 20 E Bob flew, but this has lead to some complacency in the modern motorglider pilot.

## *8.3 Accidents DO happen!*

Here is a small list of incidents and accidents, all but one of which happened to people I personally knew:

- Pilot forgets to turn on the ignition switch, becomes distracted, crashes (pilot OK, glider badly damaged).
- Bolt breaks on engine mount, allowing the engine to twist and break the propeller, preventing retraction, pilot barely makes it back to airport.
- The engine extension actuator on a two-seater breaks, the propeller mast falls backwards with the propeller crosswise, engine door flies off, propeller breaks, pilots make it back to airport OK.
- The prop brake is mishandled, so pilot can't stop prop to retract it, but is able to restart the engine and return to the field.
- Engine seizes shortly after takeoff, pilot can't center prop to retract it, barely returns to airport (even partially retracting the propeller would have made getting back easier).
- Control hookup access door not secured properly, flies off into the prop and breaks it just as pilot lifts off.
- Landing with engine running, pilot doesn't hear gear warning and lands gear up.
- Pilot can't retract propeller, returns to airport OK, finds breaker open.
- Pilot runs out of fuel during launch, attempts to restart low, fails, and spins in (fatal).
- Engine doesn't start in the pattern, pilot is distracted trying to start it and turns onto base too late to glide in, lands several hundred yards short of airport (pilot OK, gear doors not).
- Spoilers suck open right after takeoff, pilot fails to realize situation, barely returns to airport, lands heavily, damaging gear badly.
- Drive belt breaks just as pilot begins takeoff roll, pilot stops glider without further incident.
- Drive belt slips shortly after takeoff, pilot cuts power to protect engine, fails to lower nose sufficiently to keep airspeed, lands heavily with damage but no injury.
- Smoke pours out from under instrument panel shortly after takeoff, pilot shuts off engine and electrics, lands safely.
- Entire propeller flies off the engine, mercifully misses the airframe, pilot glides back to airport.

Unfortunately, it's not just the people I know that have accidents. All except one of these pilots was a very experienced glider pilot, though not always an experienced *motorglider* pilot at the time of the accident. So please, be cautious, don't get complacent, keep learning, and pass on the things you learn to others.

# 9 Sustainer Operation

Except for the self-launching ability, the sustainer (low power engine) equipped sailplane can do the same things the self-launching sailplane can, so most of this Guide applies to them. There are a few important differences, however.

## 9.1 Limited engine use

Because the sustainer sailplane pilot doesn't self-launch, he tends to use the engine much less than the self-launching sailplane pilot. This has several consequences:

- The pilot has limited practice starting the engine
- The engine may not be ready to start because it was unused for a long time
- The fuel may be "stale" if it's sat around for more than 6 months

I suggest the sustainer pilot use the engine often enough that at least a full tank of fuel is used every 4 months. This could be done by doing a start after towing (perhaps even taking a low tow in anticipation of using the engine, and saving a few dollars!), or by flying a bit more aggressively, so a self-retrieve is occasionally needed. Doing the start after the tow ensures the engine and pilot have recently performed properly, and are ready if a self-retrieve is required during the flight. The pilot might be willing to fly farther or in more difficult conditions with this knowledge, and enjoy his flying more.

## 9.2 Self-retrieve limitations

The lower power of the sustainer engine means a lower "service ceiling". Topping out under power at, say, 8000' MSL isn't a problem in Kansas, but could mean you can't even climb at high elevation places, where the density altitude might already be 10,000' when you launch. These places will often have mountains that block your path, or the safe landing places along your route will be too far apart for the altitude you can achieve. So, you are faced with flying out of reach of safe landing areas, or returning to an airport for a ground or aero retrieve. How much do you trust your engine, even if it seems to be running well, and are you certain you will not encounter some mild sink that overpowers your limited climb ability?

An additional problem, and not just in high elevation areas, is the small fuel supply most sustainers have. It's another reason for not trusting your engine to keep running over poor terrain, even if you think you can trust the fuel gauge.

### *9.3 Temptations*

**Self-launching:** At some point, a sustainer pilot will realize that he *might* be able self-launch, *if* there was some headwind, *and* kind of early in the morning when it's cool, especially if he pushed *all* the way to the end of the runway. And it can work - sometimes! But…with a low climb rate, the glider spends a lot of time close to the ground where it is very susceptible to downdrafts from wind or thermals. A tow would be safer.

**The "low save":** Some sustainer-equipped gliders require diving with the propeller extended to start the engine in air. If it doesn't start, the pilot may need to retract it and complete the pattern into the chosen field. This diving requires extra altitude, so the attempt to start must be several hundred feet higher than the desired pattern entry, and include enough altitude to stow the motor if it doesn't start. Giving up the flight well above pattern altitude (even higher than the same pilot would start a glider that has an electric starter, and much higher than he might give up in an unpowered glider) is quite a dilemma for many motorglider pilots, and requires discipline to make the safe choice.

It might not be essential to retract the motor after a failed start, if the pilot has practiced landing with the engine extended, and has allowed some extra altitude in the pattern to compensate for the additional drag.

# 10 Safaris (Touring) Without Support

The idea of packing your toothbrush in the glider and heading out on a cross-country trip for a week of adventure is appealing, for sure! Taking much more along than a toothbrush is a challenge because the self-launching sailplane baggage "area" is more like a briefcase than a suitcase. Much of what to take depends on the trip (motels or under the wing, one day or one week, airports with services or just airstrips) and where to stash it depends on the specific glider, so the following just hints at what is involved. I suggest you find someone to talk to that is touring in your model of glider.

The glider might need some things you normally carry in the trailer, such as

- Refueling equipment: fuel, oil, fueling pump, fuel container
- Battery charger, basic tools, spares, oxygen
- Tiedowns and canopy cover, cleaning rags for the wing and canopy

You will need some personal things you normally carry in your tow vehicle, such as

- Toiletries, prescription and other medicines, clothing changes
- Cell phone charger, sleeping bag (if motels aren't used)
- In-flight food and water

Where do you store this stuff, in addition to the things you normally carry? Small pilots have an advantage here, as many things that can't be put in the baggage area can be stored behind the seat. After this, it gets tricky, and pilots show a lot of ingenuity to discover places where a few more things can be stored without creating a safety problem – very glider dependent!

Planning to stop at airports close to a town can reduce the amount you need to carry, because things like fuel, tools, food, and beds are available. Or, a group of pilots can arrange for one driver to bring a car full of stuff, and even one trailer that will fit all the gliders, instead of trying to take everything themselves. This is especially worthwhile when going to airstrips far from towns.

If you will be landing at places without electricity, you will need a charger that will operate from the crew car's battery (perhaps by using an inverter to run the charger). If there isn't even a car available, then solar cells on the glider will be needed to keep the sailplane battery charged (see 11.2.1 Solar cells (and other charging methods)) .

Plan well, fly safe, fly far, and enjoy the adventure!

# 11 Maintenance Considerations

A self-launching sailplane requires a lot more maintenance than an unpowered glider. This extra is almost entirely for the motor, it's accessories, and peripherals (fuel tank, starting battery, engine controller, etc). There might be some additional maintenance on other parts of the glider caused by vibration and taxiing. The maintenance should be taken very seriously, because you don't want the motor to fail during the launch, and you want it to start immediately when attempting a restart in the air. Those are the most critical moments for a self-launching sailplane pilot.

I won't attempt to teach engine maintenance, because it varies from model to model, and is best handled with the aircraft's maintenance manual and advice from knowledgeable owners and mechanics. This is an area where model-specific owner groups and websites are very valuable, but here are some general considerations anyway.

## *11.1 Engine storage*

Please respect the storage instructions for your engine and save yourself money and trouble. Several sources tell me poor storage causes numerous avoidable engine problems, including internal corrosion. These happen when the pilot doesn't run the engine often enough, or fails to follow the long term storage procedures.

## *11.2 Charging batteries*

Summary of “best practices”:

- Charge the battery(s) fully after every flight
- Use a “three stage” charger
- Replace the battery(s) every three to four years.
- Install another (or bigger) battery, if possible, for cold weather (winter wave) flying.

The engine battery in a self-launching sailplane is very important, because its failure means you don’t fly, or worse, make a field landing with all it’s risks and inconvenience. It must extend the propeller and start the motor, and might be powering the instruments as well. “Instruments” is no longer just a radio and a vario, but now includes a flight recorder (and perhaps an additional GPS), a flight computer, PCAS or PowerFlarm, and often a transponder, all of which can total 3 or 4 times the current of “the old days”.

Proper charging of the battery is needed to obtain full capacity and prolong the life of the battery. The smaller the charge (amp-hours) that is removed from a battery, and the sooner it is recharged, the longer the battery's life span. Charge it within at least a few days of use and it will be fine. The type of charger recommended by battery manufacturers for the type of lead-acid batteries we typically use (sealed, suspended[14] electrolyte) is a “three stage” charger, which provides:

1. Constant current until the battery voltage rises to the “acceptance voltage” of about 14.4 to 14.7 volts.
2. Constant voltage at the “acceptance voltage” until the current falls to about 10-20% of the amp-hour capacity
3. Constant voltage at the lower “float” or “maintenance” voltage (about 13.6 -13.8 volts)

The optimum charging voltages required vary with the battery temperature. For a typical 12 volt SLA battery:

| Deg. F | Accept | Float |
|---|---|---|
| 110 | 13.6 | 12.7 |
| 90 | 14.0 | 13.1 |
| 70 | 14.4 | 13.5 |
| 50 | 14.8 | 13.9 |
| 30 | 15.2 | 14.3 |

Low cost chargers are usually “taper chargers”, which charge well initially, but the rate tapers off rapidly so a good charge may take days, and they may never produce a full charge . The three stage chargers are much better, but not all are temperature compensating[15], and are usually set for about 70 deg. F. This is fine in the “thermal flying months” when the weather is warm, though it

[14] “gelled” (rare these days) or “AGM – absorbed glass mat” are typical methods of suspending the electrolyte.
[15] Typically, “compensating” chargers adjust the output for the ambient temperature, “compensated” chargers keep the same output despite ambient temperature changes.

is best to avoid overcharging by unplugging the charger within a few hours of entering the "float" stage in temperatures over 90 deg. F. The self-discharge rate is only 6% per month at 90 deg. F - you should fly more often than that, instead of worrying about the charging!

Winter is a difficult time for a battery, as the engine will be harder to start, while the available battery amp-hour capacity and "cranking voltage" are diminished significantly. The situation is not too bad at 32 deg. F (0 deg. C) when you might start your flight, but what about after cold-soaking it during a wave flight? Compared to 70 deg. F, the "instrument amp-hour capacity" is off 40% at 4 deg. F (-20 deg. C), and the "starting amp-hour capacity" is off a huge 60%!

Winter temperatures can also destroy a partially discharged battery by freezing it, so it should be fully charged before putting the glider away for the winter.

A three stage charger with about a 14.7 volt output will work adequately down to about 30 deg. F, but serious cold weather fliers that have to charge really cold batteries should use a charger with a higher output voltage. Temperature *compensating* chargers are available, but must be placed where they are the same temperature as the battery being charged.

I use the BatteryMinder 12248 charger because it has all the desirable features, plus selectable charging rates of 2, 4, and 8 amps, that are a good match for the various batteries I use.

**Figure 10: BatteryMinder 12248 - 120 VAC input, 12 volt DC output**

Even with he best charger and care, the data sheets for batteries suggest it will grow old before it wears out from use. The capacity begins to diminish quickly after three or four years, so why wait any longer when a new battery is only $50 or so?

### 11.2.1 Solar panels and other charging methods

Solar panels for ground use

Because self-launching sailplane batteries are typically difficult to remove, most people charge them in place. There are several ways to do this:

- Move the glider to where you can get an extension cord out to your glider, either in the trailer or at a tie-down
- Place a larger battery with a 12 volt to 12 volt charger next to the glider[16]
- Run the motor longer in flight to allow the generator to charge the battery
- Set a solar panel next to glider
- Install solar panels on the glider itself

A solar panel set next to the glider, or mounted on the trailer (and often removable, so it can be taken to a tied down glider), is a popular method. The panel size depends on how long you fly and how many amps your equipment draws. I suggest the panel output be no less than (flight_duration X amp_draw)/(4 hours) to ensure a full charge for the next day's flying. If you

[16] DG Sailplanes sells a device for this; also, an inverter (12 VDC to 120 VAC unit) can be used with a conventional AC charger.

fly 6 hours and your instruments draw 1.5 amps, that's (6 hrs X 1.5A)/4hrs = 2.25 amp output solar panel required.

These panels and regulators are available from glider equipment suppliers, RV equipment dealers, and other places, and are used with a “three stage (or phase)” charge regulator to avoid overcharging the battery. Panels intended for battery charging usually have a 18 to 20 volt output, and are commonly designated by wattage. For the 2.25 amp example, a 40 watt panel would be just right.

Solar panels for in-flight use

Solar panels mounted on the glider are popular, despite their relatively high cost due to the panel’s flexibility and high efficiency. Not only will it provide a charge when the glider is while it’s in flight, but also tied down on the ground. That's very attractive for unsupported, “crewless” safaris. Because it’s charging continuously, a smaller panel than a “ground based” panel can be used, but 0.5 amps is the smallest likely to be worthwhile. Remember, it's rarely in the optimal position for catching sunbeams as it flies around or sits on the ramp.

These panels are usually mounted on the engine doors with the cleanest installations having the panels inset and flush with the door surface. These are available from the factory when the glider is ordered. Adding them later is more difficult (or more expensive) if you want them inset. Here are two sources for flexible solar panels:

1. www.strobl-solar.de (“Strobl” brand used by Schleicher and others)
2. http://store.sundancesolar.com/ (“Powerfilm” brand – cheap but low efficiency)

DC/DC chargers (12 volts to 12 volts)


A good alternative to directly charging the glider with a solar panel is the DC/DC charger. The R/C modelers use them routinely to charge their model batteries from their car battery while they are at the R/C flying field. I use the Multiplex LN-5014 (right). It's an easy and reliable way charge the glider battery when 120 VAC is not available.

The unit is powered by a 12 volt battery, and provides 14 volts output to charge my glider battery. The output amps can be adjusted from 0.1 amp to 5 amps. It shuts off automatically, displaying the amp-hours it's sent to the battery, a useful indicator for verifying proper charging.

I use it with a 12 volt, 12 or 18 amp-hour battery to power my charger. After a flight, and the glider is tied down, I'll connect the charger to the glider and start charging. By morning, with the glider completely charged, I'll place the charger and it's battery in the trailer, so the battery has all day to charge from the trailer's solar panel before I need it again in the evening.

## *11.3 Tires*

If you taxi very much, you will discover the main tire wears out about 5 times as quickly as a similar unpowered glider that is pushed or towed to the takeoff area. I attribute this to the greater weight (pilot plus engine) and taxiing around with one wing down, which distorts the tire and causes the outer edges to wear more rapidly than the center. The main tire can leave a visible rubber mark on pavement, just from being pushed around! The common tires I previously used lasted about two and half years, or about 120 flights.

Not all tires last the same. The longest lasting tire that I've used is the Kevlar belted Goodyear Flight Custom III. With it's special tube, it costs about two or three times as much as the other tires and tubes, but it's lasted at least three times as long. Besides avoiding many tire changes, it holds air so well, I can go most of a season before adding air!

## *11.4 Testing the motor without rigging*

There are times when it would be useful to run the motor without assembling the glider and tying it down. For example:

- To confirm proper operation after some maintenance, before driving all the way to the airport to fly it
- To run it briefly after a month without use to avoid using the long-term storage procedures

While it is possible to roll the fuselage out onto the trailer ramp and start the motor, this idea has some drawbacks:

- It’s possible for you, or a bystander, to walk into the propeller arc with potentially fatal results, perhaps when attempting to “save” the glider if it starts to move or tip over
- The fuselage will move up the ramp well before full throttle is reached, unless it is restrained
- The fuselage could tip over, particularly with gliders that have high-mounted engines, causing damage and potentially injury from shattered propeller pieces
- A HUGE amount of wind is generated, even at part throttle, and the neighbors won’t like the noise

All the manuals I know about caution against running the engine without the wings attached and the glider restrained. Even so, people do it. I have heard of one DG 400 owner in Europe killed while doing so. Please don't increase that number, and if you think you want to do it, talk to other owners about how to do it safely, and listen carefully.

# 12 Staying Safe

You've got to do the right things, and the right attitude makes it easier.

## 12.1 Are you safer with a motor?

There is a very important paragraph in my flight manual:

> *"The power-plant of a powered sailplane must not be regarded as a life insurance, for instance when crossing unlandable areas. One should always be prepared for the possibility that the power-plant will fail to deliver the hoped-for propulsion. This may not necessarily be due to a technical shortcoming, but might be caused by nervous tension of the pilot (mistakes in carrying out starting procedure)."*

If you think the motor is a safety device, you are sadly mistaken. To be as safe in a powered sailplane as in an unpowered glider, you must treat the motor as a *convenience*. While it will help you avoid some field landings, it adds it own set of potential problems. Without additional knowledge and care, your safety will decrease.

Ironically, I've picked out more potential landing fields and made more low saves per flight hour with my powered sailplane than I ever did with a glider. It's because I fly more aggressively now than I did before, when misjudging the lift or the weather meant the end of the flight, followed by a retrieve.

While I am willing to take risks with the soaring, I don't take risks with the potential landing. My rule is only that a field be easy to land in safely; retrieve convenience is no longer even a small consideration. Since the chances are very small I'll even need the field, I don't mind if the retrieve would take a day or more. Even so, I tend to favor airports for their safety and convenience, unless there is no soaring in that direction.

A logical extension of this philosophy is to select any field that you can land in without injury, even if the glider is likely to be damaged; after all, if the chances are very small you will need it, don't worry, and take advantage of the extra flexibility that it gives you. Well, I do worry. Can I tell the difference between a field that will hurt only the glider and not me? Even if I am unhurt, do I want to be without the glider for the many months it will take to repair it, and pay the higher insurance premiums? Engines *do* fail to start.

## 12.2 The culture of the "Low Save"

After they’ve been in the sport for a while, most glider pilots adopt the culture of the “low save”. That’s the macho belief a “real” glider pilot doesn’t give up soaring until he has to put the wheel down to avoid scraping the fuselage on the dirt. Stories of “getting away” from 600’, 400’, even 200’, are retold by the pundits to the novices, who drive home from the airport fantasizing about hooking a thermal as they turn final, then taking it up to 14,000’ before gliding home to win the day.

A result of this culture, coupled with the very real concerns about landing in a strange field and the inconvenience of the subsequent retrieve, is that many landouts are done poorly. The pilot is simply too low and too tense for a decent pattern and landing by the time he gives up the “save”.

Glider pilots bring this culture with them when they transition to a powered sailplane, with the result the restart of the motor is often attempted too low to have any margin for error. This leads to serious, sometimes fatal, accidents. One of the hardest things an experienced glider pilot must do when flying a self-launching sailplane is to discipline himself to give up the “save” much higher than he did before, so there is time to start the engine, deal with any problems if it doesn’t start on the first attempt, and finally to make a decent pattern and landing if the attempts fail. Almost every pilot underestimates the power of this culture.

I used to worry some about those who recently came to gliding from airplanes because they had little experience in gliders, and probably no experience with landing out. My concern proved unfounded, because these pilots tended get nervous much sooner and were quite willing (eager, even) to start the engine far higher than the experienced glider pilot would. Ironically, their limited glider experience (and consequently small exposure to the “low save” culture) seems to more than compensate for their limited experience with gliders and field landings. In fact, as airplane pilots, they have almost the opposite culture.

## *12.3 How is your memory?*

The flight manual for my ASH 26 E is twice as thick as the one I had for my ASW 20 C. It’s not the paper thickness, but all the additional information required to operate a powered sailplane successfully. The first two seasons, it was worthwhile reviewing all the manuals (flight, maintenance, and motor) about every six months. Now, I review the manuals completely at the beginning of the season, every year.

## *12.4 Determining a “Minimum Turn-around Altitude” (MTA)*

The “Minimum Turn-around Altitude” (MTA) is the minimum altitude at which you would be willing to turn around and return to land on the runway you took off from after releasing from a tow or losing power during a self-launch. For typical situations, 200’ is the generally accepted value for towed glider. For several reasons, this may not be enough for a self-launching sailplane:

1. Airspeed during a powered launch is about 10-15 knots slower than during a towed launch, so there is little extra energy above stall speed.
2. The attitude is nose-up instead of the level as it is during a tow.
3. The extended propeller (and often the engine) adds a lot of extra drag.

The result of these three factors is the speed will drop rapidly if the power fails, so the self-launching pilot must *promptly* lower the nose to regain the proper speed, losing altitude to do so, and will likely lose additional altitude during the turn back to the runway due to the extended propeller. Conversely, the towed pilot can usually complete the turn back without losing any altitude, just by slowing down to landing speed.

The flight manuals don't have this minimum altitude in them, so each pilot must choose a number that is safe for him. Opinions vary widely, even among pilots flying the same model of glider, so I made a measurement of the altitude required for me flying my own glider.

I used my GPS flight recorder set on a 1 second rate to record the maneuver, but you could also do it by using the altimeter (the engine vibration overcomes any "stickiness" in it). I picked a time when the air was relatively calm, then launched to about 2000' AGL. In the "climb" configuration and airspeed (full power, climb flap position selected, gear down, airspeed 52 knots for my ASH 26 E), I cut the power, lowered the nose, and made about a 180 degree turn. The flight trace showed a surprisingly small loss of around 100 feet. A pilot in a DG 400 made the same test and got the same result, so the procedure may not be as difficult as it seems it might be.

Realistically, I must allow more height for some additional turning when the 180 turn doesn't align me with the runway, for poor flying (panic?), and sink! The measurements for the two gliders were done near sea level under good conditions, so the altitude loss would increase at higher elevations. It'd be an interesting experiment to make the measurement at, say, 10,000' density altitude, comparable to flying out of Taos, New Mexico, on a warm day.

## 12.5 Transponders

A self-launching sailplane doesn't have any greater need for a transponder than unpowered gliders, but it can take advantage of them more easily. Their bigger battery can easily power a modern Mode S transponder like the Trig TT21, and the motor gives them the possibility of using Class C airports that typically require a transponder.

Even if you don't operate in airspace requiring one, there are places where one makes a lot of sense, like the Minden (Nevada), area, or the Chicago, Illinois, area. For about the cost of one year's insurance on the glider, you can have one. I think it's cheap insurance.

If you are ordering a new glider, at least have a transponder antenna and cable installed. It's not expensive, and it's easier than adding it later (cheaper, too, usually).

## 12.6 PCAS and PowerFlarm/Flarm

There are two types of collision warning devices available to glider pilots (transponders do not warn the glider pilot of potential collisions). Both require the pilot to determine the proper response to a warning:

- PCAS ("portable collision avoidance system"): This device detects transponders operating within about 5 miles of it, displays the range and relative altitude of the other aircraft, and warns the pilot if it approaches too closely. It doesn't make you "detectable", but at least you can detect aircraft equipped with transponders.
- PowerFlarm (USA) and Flarm (Europe and elsewhere): this device transmits it's GPS position and projected flight path periodically, and uses that information transmitted by other units to determine if the pilot should get a collision warning. Both aircraft have to have a PowerFlarm for the system to work.

The PCAS unit is most desirable if you fly where there are transponder equipped aircraft, which includes many gliders these days; of course, if there are more than "a few" airliners, you should get a transponder, too.

The PowerFlarm/Flarm is most desirable where there are "a lot" of gliders flying with one. It was originally designed for gliders, and works very well for that purpose. The PowerFlarm unit also has the PCAS function (so you don't need to have both units) and also detects ADS-B equipped aircraft (primarily airliners now, but most aircraft by 2020 in the USA).

## *12.7 Mobile phones, ELTs, SPOT/inReach, and other emergency gear*

Sure, the motor is supposed to get you home, but what if it doesn't? Or if you are attempting a long, straight out flight for a badge or record with no intention of returning that day? Then you should be prepared for a night away from home.

Note that the following is just an overview of what is currently available. Each pilot needs to consider what is most effective for the location and kind of flying anticipated.

### 12.7.1 Mobile phones (cellular and satellite)

I carry a cell phone in the cockpit with me whenever I fly, as do most pilots. It provides way of contacting help in an emergency, but the pilot must be conscious to use it, and many places with good soaring don't have good cell phone coverage.

The phone is kept where I can reach it in flight, in a strong. small pack designed to connect to a parachute harness. That keeps it safely secured so it won't dislodge in turbulence, or even a "mild" crash. I want to be able to use it after a crash, even if I can't remove myself from the cockpit, and it will be with me if I have to bail out.

I've heard using a cellular phone from an aircraft in flight is prohibited, but I would not hesitate to make a call if my safety was at stake and I couldn't reach anyone on the radio. Such situations might be:

- When an outlanding in a poor area appears likely, should the engine not start
- A long period without being able to contact my crew, another pilot, or other person by radio
- Radio failure

Despite the apparent prohibition against in-flight use, many pilots report that mobile phones seem to work just fine from the air, and the phone companies have no problem getting the charges to their bill! Be aware that in-flight usability varies widely with the service provider, reception is often uncertain, many areas have poor service, and hills can block the signal when on the ground.

Leaving a cell phone on while flying will likely drain it's battery much faster than when it's on the ground, because it uses higher power transmissions while searching for a good signal. Turn it off to preserve the battery for emergency use on the ground, or carry a spare battery. Some pilots carry a simple, pre-paid phone (and a spare battery) on the Verizon network, as their network has better coverage than the other networks (at least, in the USA).

The satellite phone avoids the reception problems that the cell phones can have, and works very well in a glider cockpit, since it needs open sky to "see" the satellites is uses. This ability to work anywhere in the air (and most places outdoors on the ground) comes at a price: the phones are bulky,  expensive ($500 and up, way up!), and so is the air time (~$1 a minute). But if you really must talk, there is no better solution. There are other, potentially cheaper, satellite-based options if text messages are adequate – see a following section on the inReach and Spidertracks.

I haven't heard of any interference problems, but any transmitting device (such as a mobile phone) should be tested on the ground before you use it in the air, as it may interfere with the engine electronics. Mobile phones in Europe use different frequencies and formats than North America, so even if one phone causes no problems, another one might.

And finally, while a mobile phone can potentially aid a pilot, using it while flying can be a big distraction that leads to an accident. That would be a cruel irony, indeed.

### 12.7.2 ELT (Emergency Locator Transmitter)

Years ago, I installed an ELT in my glider after deciding these facts made an ELT worthwhile:

- I frequently fly when no other gliders are flying, either because it is a weekday, or because I am flying where there are no other glider pilots
- I can fly far beyond radio contact with my crew
- I often fly over mountains, deserts, and other unpopulated and inhospitable terrain
- It's definitely an aid to search and rescue, making their job safer and easier, and likely finding me more quickly
- And finally, my wife said it would give her some peace of mind if I carried one

However...

- ELTs do not have a good record of activation in a crash, though the newest ones are better
- The older, smaller, cheaper 121.5 ELTs are obsolete and no longer monitored by the satellite system, though other aircraft may check on that frequency
- New ELTs are expensive and difficult to install in gliders

Fortunately, there are several other options for gliders, since we are not required to carry ELTs. Continue reading ...

### 12.7.3 Personal Locator Beacons

Some pilots carry "personal locator beacons" (PLB) that are attached to their clothing or parachute harness. Reasons given are the PLB will stay with them if they have to bail out, and that they don't think an ELT will reliably activate in a glider crash. As a consequence, the pilot needs to activate it manually anytime a crash seems possible (clearly, there are some practical difficulties with this idea), such as before a field landing, or before bailing out. They are effective if activated, and don't require any mounting, approvals, or modifying the glider.

### 12.7.4 SPOT, inReach, Spidertracks, APRS

The last few years saw a number of glider flight tracking systems appear, such as SPOT, inReach, APRS, and Spidertracks. They all do the same basic thing: a device carried in the glider reports the glider's GPS position every few minutes to a website where other people can view it. Beyond that, they vary in cost and responsiveness, and some can also send and receive text messages.

The tracking feature makes these devices good, even superior, substitutes for an ELT. With position reported every 10 minutes, even a crash that disables the device still leaves a search and rescue team with a relatively good estimate of your location, and a far smaller area to search than than without that information. Using a shorter interval would reduce that small area dramatically. If the device works after the crash, it will provide your location within a 100' or less, and the units with messaging would let the pilot communicate with the rescue team.

Besides the safety value, spouses, crews, clubs, and contest managers all really appreciate knowing where you are and that you are still flying. It can be a great comfort to them.

NOTE: Don't rely on info here to make a final decision, as this market is changing quickly.

**SPOT**: currently the most popular, the older SPOT devices can send a few preset messages, with "live" tracking at 10 minute intervals. The newest devices offers shorter intervals. It requires a yearly subscription for these services, starting at $100 for basic services, with tracking an additional $50.

**inReach**: a newer entry by Delorme, it can receive messages as well as send them (SPOT can not receive messages). It has other features, including more tracking rate options and subscription choices. The device is more expensive than SPOT, as is the cheapest subscription plan, but it's better suited for glider pilots because of the messaging ability and the altitude, heading, and speed data it sends with the position report.

**Spidertracks:** the most expensive of the group and with a commercial orientation, it has models similar to SPOT (tracking, no receiving messages) and inReach (also does text messages).

**APRS**: "Automatic Packet (or Position) Reporting System" - an amateur radio based system that requires the glider pilot have an amateur radio license (easily obtained, according to APRS users). No subscription is required, but because it's transmissions are to receivers on the ground, it's coverage is may be less than the other systems in certain areas and situations. It require a "ham" license, and more effort to get the device operational, but there are no subscription fees. Search for "APRS tracker" on the Internet, look it up on Wikipedia, or ask an amateur radio operator about it.

### 12.7.5 Additional radios

Handheld aircraft transceivers are small and cheap enough that it may be worth carrying one as a backup in the glider, particularly since even a crash without injury might disable the glider's radio or it's antenna (a broken tail boom, for example). One with a Lithium battery would keep it's charge for many months, perhaps needing a charge only once or twice a season if not used.

A few pilots carry amateur radio (ham) transceivers for the 2 meter band, which can use repeater stations for coverage beyond line-of-sight. If you are already a "ham", this is another option that might work where mobile phones and aircraft radios don't.

### 12.7.6 Emergency landout equipment

Even though the chances of landing in a remote area are, well, remote because I have an engine, I still carry emergency equipment, just as I did when I flew unpowered sailplanes. A 50:1 glider like my ASH 26 E can carry me hundreds of miles in just a few hours, where the weather and elevation can be quite different. In the Spring and Fall, for example, it can be 70 degrees at home, but below freezing at a mountain airstrip.

Here is what I always carry:

- 1 quart non-flight drinking water (2 quarts in desert conditions)
- Space blanket, down jacket (Winter: add mittens and warm hat)
- Signal mirror, whistle, emergency strobe
- First aid kit, sun block, insect repellent, water purification tablets
- Two 20 gallon plastic garbage bags, wire saw, pocket knife, 20' of cord
- Compass, flashlight, extra batteries, paper towels, knapsack
- Fire starter sticks, matches, foil

- Booklet on post-crash survival techniques
- Tie-down ropes (can be used for other things)
- Delorme “inReach SE” satellite communicator with two-way text messaging

The knapsack will let me carry all this stuff (less than six pounds) if I need to leave the glider, and I’ll leave a note (visible from outside the cockpit) describing my condition and where I’m going.

Even though the usual admonition is to “stay with the aircraft” if you are hoping to be rescued, circumstances may make it desirable to leave it and try to get somewhere. While a compass can help, a handheld GPS receiver will make it easier to head in the right direction, or to retrace your steps to the glider, if needed. There are many units, some less than $100 (even less for used ones), which would serve this purpose. Many phones now have this capability, too.

# 13 Appendix

## *13.1 Where to get more information*

Besides the usual printed materials, the Internet has some excellent resources.

### 13.1.1 Related documents

Don't ignore your aircraft’s Flight Manual, Engine Manual, and Maintenance Manual. Review them occasionally.

### 13.1.2 Newsgroups, owner mailing lists, and factory web sites

A good listing of these is on the Auxiliary-powered Sailplane Association’s web site at www.motorglider.org. The “owner mail lists” and dedicated newsgroups are most useful for model-specific information, while the general soaring newsgroups (like rec.aviation.soaring) are better for soaring related questions.

Many of these groups and lists can be searched for particular subjects in past postings. The glider factories monitor some of them, though direct participation is rare. They are a powerful resource with participants from many countries who can often offer a solution or an answer more quickly than the dealer or the factory. You are not alone!

## *13.2 Affording a self-launching sailplane*

*Affording an self-launching sailplane isn’t an “operational” issue, but it’s a very important issue to most pilots contemplating purchasing one, so here’s a slightly tongue-in-cheek plan to save money by owning a self-launching sailplane! Costs are approximate for 2013 – “your mileage may vary”.*

If you already own a glider, then YOU may already be able to afford a self-launching, high performance motorglider! Let me show you how:

The first thing to realize is the motor is about a $30,000-$60,000 premium over a "regular" glider, whether you are buying a used one or a new one. Check the ads for gliders that are available both ways, and you'll see this. Here's an example of what it might cost an active pilot living in Seattle, Washington, and flying out of Ephrata, Washington (about a 170 mile drive)…

Additional costs per year due to the motor:

| | |
|---|---|
| $1500 | interest cost (or interest not earned) on the $30,000 motor purchase at a 5% rate |
| 300 | motor system maintenance - average |
| 100 | annual inspection for the motor |
| 500 | insurance on the motor |
| 120 | fuel and oil for 40 launches |
| $2520 | Total additional costs |

Because it's a self-launching sailplane, there are costs you won't have, which I call …

Avoided costs per year:

| | |
|---|---|
| $1600 | 40 regular tows at $40/tow |
| 270 | 3 aero-retrieves at $90 each |
| 60 | 2 car retrieves plus dinner for crew |
| $1930 | Total avoided costs |

Net cost: $2520 - $1930 = $590

As you already guessed, using a self-launching sailplane exactly as you used your unpowered glider is more costly, though you are spared the aggravation of the line-up for tows and the occasional retrieve.

The chances are you won't fly exactly same way with your self-launching sailplane as you did before it. To get the most value out of a self-launching sailplane, you'll use the extra soaring opportunities it provides:

- Flying from airports that don't have a towplane, or when a towpilot isn't available
- Flying cross-country when you otherwise wouldn't, because the conditions are weak, unpredictable or the lift is beyond an easy tow

So let's include some of this potential as …

More avoided costs:

$525 three weekends flying from near home in the Seattle area, avoiding travel to Ephrata, motel, and food (you don't actually have to fly on a weekend, if you can get afternoons off during the week)

Net cost: $2520 - $1930 – 525 = $65

For an active pilot, the additional cost of the self-launching sailplane may be easily outweighed by the advantages, providing the pilot can afford the extra purchase price. If not, or if the pilot is not so active, a partner can make the costs attractive, while the flexibility of the self-launching sailplane ensures that both pilots get most, and probably all, the flying they want. Each partner is now responsible for only half the costs, and since most of those don't depend on the amount of flying, the cost per partner is almost half that of a single pilot.

One caveat about a motorglider partnership: the motor makes operating the glider more complex; in addition, careless use of the motor can increase your risks, so a partner should be chosen even more carefully than for a unpowered glider, to ensure your partner is capable of operating it safely.

My point is that the self-launching sailplane may not as expensive as you might think, if a good accounting of the avoided costs and the effect of its versatility are fully considered. A similar analysis can be made for sustainer type (e.g., Ventus BT) and "touring" style (e.g., Grob 109, Ximango, Phoenix) motorgliders. For example, someone that flies airplanes and gliders might discover a touring motorglider does both well enough that only one aircraft is required.

The introduction of lower cost powered gliders like the Apis and Silent means that the costs shown above should be smaller, while the avoided costs (like aerotows) remain the same, tipping the balance in favor of the motorglider!

## *13.3 Instruments and gadgets*

Pilots love their gadgets, and the self-launching sailplane gives you an excuse to own a few more.

### 13.3.1 Headsets (Hey! This one is important!)

Hearing protection is important for any gasoline-fueled self-launching sailplane, but particularly for some models: for example, in-cockpit measurements[17] had the ASH 26 E at 103 dB(A), the DG 400 at 110 dB(A), and Nimbus 4M at 117 dB(A). The "permitted exposure times" are, respectively (minutes:seconds): 7:30, 1:30, and 0:20! Just because you might be able to tolerate the engine noise during the typical launch does not mean your hearing is unaffected. Wear hearing protection, or buy a battery powered glider.

[17] "Hearing Damage by Cockpit Noise in Motor Gliders", January 2001, Technical Soaring.

I've always used a headset during the motor operation of my ASH 26 E to protect my hearing and to hear the radio better (there is always some airplane in the pattern with a lousy radio or a "soft talker"), but there are other options to protect your hearing, such as:

- Instead of a headset, get the "headphone" version: it doesn't have the microphone (use the boom mike in the glider), so it's easier to stow and cheaper to buy.
- Just use earplugs. This gives more attenuation than even the best passive headset, but it's likely you won't be able to hear the radio or the vario well enough while using them.
- Use earplugs with a passive headset. This gives you huge noise attenuation while still allowing you to hear the radio. Forget about hearing the vario unless its signal is added to the headset input. Since most units are stereo, the vario signal could come into one earcup and the radio into the other without much wiring difficulty.
- Earplug style headsets, such as the Clarity Aloft Aviation Headset. Small, light, expensive, but easy to stow (or just drape around your neck when not using it), and designed for high noise environments
- Earplug style "headphone" (no microphone), similar to the Clarity Aloft, but not marketed to pilots, these can have good noise reduction specifications at a third or less cost than the Clarity units.

Because new headsets come to market all the time, a review of what's available when you need one might come up with even better choices. And remember, unless you are flying one of the electric powered sailplanes, you do need one!

### 13.3.2 ENL enabled flight recorders

Nowadays, it's hard to outfit a glider without having a flight recorder (or two) in it, as the advanced variometers and flight computers have them built-in; if not, stand-alone units are available from several companies. ENL refers to "engine noise level", indicating the flight recorder will record engine running time.

Flight recordings can make after the flight almost as interesting as the flight itself, by "replaying" them in a flight display and analysis program such as SeeYou, StrePla, or several others. It's particularly entertaining and educational to simultaneously show the flights of several gliders from the same day, as you can see how different choices and techniques affect the speed and distance a pilot can achieve.

If you aren't doing badges, contests, OLC (OnLine Contest) or records, any flight recorder will do, including the recordings made by soaring flight software like SeeYou Mobile, WinPilot, XC Soar, and several others that run on handheld computer (PDA, PNA, smartphones, etc). None of those detect engine operation. They are cheaper than a full featured flight recorder, but you are also missing out on a lot fun by not participating in those events.

## *13.4 Final Remarks*

The goal of this Guide is the safe and effective use of powered sailplanes by their pilots. It's not complete, because we all learn new things every year, so I welcome suggestions for changes to this Guide. Here's the kind of thing I'd like comments on, in order of importance to me:

1. Things that are just plain wrong, especially if it's related to safety.
2. Important safety related omissions.
3. Better choices of ideas and procedures, even if the current ones are acceptable.
4. Confusing language that should be rewritten.
5. Organization and format issues.
6. Pictures, illustrations, cartoons, and drawings that would improve understanding.
7. Useful or interesting subjects that would aid the beginning to intermediate powered sailplane pilot, even though they aren't directly operational subjects.

I encourage readers with comments to contact me by any of these means:

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