# 11c Self-Launch

| SPL Syllabus: Ex 11c: Self-launch | | | |
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## INTRODUCTION

A self-launching sailplane (SLS) is a traditional sailplane, but with an engine or motor which allows it to take off using its own power. This is distinct from a sailplane with an engine for sustaining flight only, where additional training is not required under SFCL. However, a pilot converting from a pure glider to a powered one of any kind should be advised of the safety considerations laid out here, most of which apply to sustainers as well as self-launchers.

Under SFCL a self-launching sailplane may be flown without SLS privileges provided it is launched by aerotow, winch, or bungee. This chapter describes the training for adding self-launch as a launch method.

SFCL.155 specifies that the training for self-launch must include a minimum of five launches in dual flight instruction, and five solo launches in the SLS, under supervision. The dual flight instruction may be conducted in TMGs.

Instructors conducting flying training for self-launch should ideally be qualified and experienced with self-launching themselves. To carry out the dual training element in a TMG they must hold SFCL.315 (a)(4) TMG instructing privileges. Exceptionally, a two-seater SLS may be available, in which case the FI(S) must have completed as PIC at least 30 self-launches as well as meet the associated recency requirements and be familiar with the glider type in question. The solo self-launch flying requirement must be supervised by an FI(S) with a minimum of 30 self-launches as PIC.

Whilst the ‘trainee’ in this case is likely to be an experienced glider pilot, converting to a self-launcher is a significantly different type of flying. This is particularly true if the SLS is an old design with complicated controls, or one that loses a lot of height during engine starts.

## THEORY BRIEFING

There is a great deal of variation between different SLS types, and the flight manual (FM) must always be the principal reference.

Self-launching sailplanes, like powered aircraft, have varied take-off performance. In addition, take-offs may be undertaken from less than perfect sites – short runaways, grass or undulating strips, obstructions in the direction of launch etc. This may make their use subject to additional risks over and above normal gliding operations. It is important that pilots fully understand the limitations in performance and put in place appropriate mitigations.

Care should be taken when operating within mixed operations on an airfield, to avoid conflicting traffic and to avoid picking up a winch cable on take-off.

Various types of powerplant are used in SLS’s;

- Traditional combustion engine within the fuselage and retractable over-wing propeller (many types).
- Jet engine that extends and retracts vertically from the fuselage (e.g. Jet Shark).
- Combustion engine with retractable forward mounted propeller (e.g. Stemme).
- Electric motor with folding nose mounted propeller (e.g. Silent 2 Electro).
- Electric with engine within fuselage and retractable over-wing propeller (e.g. Antares).

**Traditional combustion engine**

Usually, the engine and pylon are housed within the fuselage for when it is in ‘glide mode,’ but the engine is able to extend, start and produce enough thrust to take off and climb.

 

Typically, the engine is a 2-stroke engine that produces around 40-80hp with a 2 bladed propeller.

Another popular engine used in gliders is a Wankel Rotary engine, which produces similar power with a 2 bladed propeller.

**Electric with nose mounted propeller**

These are totally reliant on electrical power, needing large capacity batteries to be able to operate. The electric motor powers a small propeller attached to the nose of the glider. The propeller blades fold neatly up against the fuselage to reduce drag when not in use.

There is very little noticeable pitch change with power changes.

**Electric Pylon**

Much like the traditional combustion powerplant, the engine and propeller are stowed within the fuselage, which can extend, start and produce thrust. This design is completely electric, relying on large batteries.

## CONSIDERATIONS OF OPERATING A SELF-LAUNCHING SAILPLANE

A self-launching sailplane will be considerably heavier than a non-engine version of the same type. The weight increase may be as much as 100kg. This weight increase is the equivalent of carrying permanent water ballast and results in:

- higher stall speed.
- higher approach speed needed.
- longer landing distance.
- longer take off run.
- higher speeds for thermalling/higher radius of turn.

However, sailplane designs vary considerably and some, such as the Silent 2 Electro, are very much lighter than more traditional gliders.

**Centre of Gravity versus Engine Thrust Line**

More consideration of the aircraft's handling is needed with a self-launching sailplane under power.

All self-launching sailplanes produce thrust that acts in relation to the centre of gravity of the sailplane. Those that use a propellor raised out of the fuselage, create forward thrust that acts well above the centre of gravity which generates a significant nose down pitching moment under power. This nose down pitching moment needs to be countered with a marked nose up stick position, most flight manuals also recommending full nose up trim during self-launch. It is important that the stick is held fully back to reduce the risk of the sailplane pitching forward on to its nose during taxiing and the early stages of the ground run. Keeping the stick back on the initial part of the ground run maintains the tailwheel on the ground maximising directional control.

Note: The higher the resistance of the runway surface, the more likely the nose is to pitch down, i.e. taking off on grass will produce more of a tendency to pitch down than taking off on tarmac.

Although the thrust line is much lower for sailplanes that use nose mounted propellers, they are still susceptible to pitching forward at high power settings and risking a prop strike if the pilot is unable to keep the tail on the ground during taxiing and the early part of the take-off run.

## AIR EXERCISE BRIEFINGS

Training to fly self-launchers is unusual because the dual training requirement will most commonly be carried out in a TMG which will have different handling characteristics to the SLS that the trainee will go on to fly and complete their supervised solo flights in. The dual flights should aim to establish principles that will be the same in the trainee's SLS and should focus on engine handling and take off techniques; they are not learning how to fly a TMG. Before the supervised solo launches a comparison of cockpit layout and controls must be made and it will be helpful for the instructor to supervise 'touch drills' with the trainee sitting in the SLS cockpit.

**TEM**

| **Threats:** | **Mitigation:** |
|---|---|
| Engine failure after take-off | Plan ahead with local landing fields; maintain safe airspeed |
| Partial engine failure after take-off | Maintain safe airspeed; treat as engine failure if low |
| Airborne engine start fails | Always be within reach of a landable field; careful TEM in advance |
| **Errors:** | |
| Unsuitable take-off run | Calculate required runway length, including surface and headwind considerations |
| Insufficient airspeed during the initial climb | Monitor airspeed closely |
| Attempting airborne engine start too low | Have a pre-determined minimum height for engine start |
| Failure to control the aircraft with over-wing propeller deployed but not operating | Practise this configuration if the flight manual permits |

**(i) Review of the flight manual for the sailplane used**

Both the instructor and trainee must have read and understood the FM with special attention to:

- CoG and ballast considerations
- Daily Inspection and maintenance requirements
- Fuelling/recharging
- Cockpit and control layout
- Any other specific safety requirements or procedures.

**(ii) Engine extending and retraction procedures**

Modern SLS types may have straightforward mechanisms for deploying the engine. In the case of front mounted electric-powered propellers it is usually just a case of switching on the power unit and turning a knob. However, older types often have complex procedures involving multiple controls in the cockpit that must be operated in a particular sequence.

In all cases, the flight manual is the primary reference. The instructor will not necessarily have flown the glider type themselves, so the trainee will need to be able to demonstrate the procedures with touch drills.

**(iii) Engine starting and safety precautions**

This training can be provided using a TMG because the considerations are the same for all engine starts. The pilot's seating position and view will be different, but the precautions needed with propellers are the same. Before starting the engine, it is **vital** that you make sure no one is near the propeller. Shouting 'CLEAR PROP' and waiting a few seconds is essential. There are blind spots with all gliders. You may not be able to see the person that has their head next to the propeller.

Consider the effect of the prop wash. Are you parked in front of open canopies? Your prop wash may cause issues to others, so check it is clear behind before you start.

**(iv) Pre-take-off checks**

Consult the flight manual and use the manufacturer's checklist where provided. Give consideration to where you undertake checks in relation to active traffic on the airfield.

If a TMG is being used the checklist will be different from the glider's. Nevertheless, the trainee should be shown how to follow it: the principles will be very similar and the habit of following a checklist which is quite different from that in a pure glider must be established.

Similarities to and differences between the specific SLS checklist and a pure glider should be considered. For example, both the TMG and SLS may have a steerable tailwheel, which means checking rudder operation is done while taxiing rather than when stationary. This taxiing check will be completely new to a pure glider pilot.

Positions of switches for fuel, power etc will be different but the principle of setting them appropriately is the same.

It should be pointed out to the trainee that gliders with nose mounted propellers taxiing on rough ground/grass have a significant risk of a prop strike. Therefore, towing the glider behind a vehicle may be safer than taxiing under its own power. If taxiing, they should consider using a wing walker to keep the wings level.

**(v) In-flight engine start checks**

The flight manual for the SLS should be consulted for the procedure.

The basic principles can be demonstrated in a TMG by stopping the engine during flight and then restarting it.

In the SLS consideration must be given to how much height will be lost during engine start in-flight. Some types must be dive started and the speeds used for starting the engine and then changing to a climb profile may be critical. By contrast, starting an electric motor with a forward propeller may result in no height loss at all.

Emphasise that there must always be a safe landing option should the engine fail to start.

**(vi) Noise abatement procedures**

This will probably be an unfamiliar concept to pure glider pilots who are not used to having full control of their climb-out path and have never had to consider the effect of engine noise on inhabited areas below.

Follow noise abatement procedures in place at the operating site. Information about local sensitive areas should be easily available and pilots should be careful to avoid them, particularly during climb out. Electric self-launchers are significantly quieter. Jets are usually extremely noisy.

**(vii) Checks during and after take-off**

These should be performed as per the Flight Manual.

The checks in a TMG will probably be different from the SLS ones but with the same key features:

- Normal checks for other traffic plus required radio calls must be completed.
- It must be established before starting that the runway is long enough, considering the surface and headwind.
- If flaps are fitted, they must be set correctly.
- The throttle must be opened smoothly to full power.
- The pilot must check that full power is achieved and abort the take-off if not.
- An abort point must be selected, where the take-off will be abandoned if the aircraft is not airborne.
- Crosswind limits must be considered and the pilot must self-brief to abort the take-off if a straight ground run cannot be maintained.
- The airspeed to be achieved after take-off and before climbing must be noted.

Differences in procedures between the TMG and SLS should be identified and discussed.

**(viii) Into wind take-off**

Demonstrate the take-off in the TMG (or two-seater SLS) before expecting the trainee to attempt it. The trim should be set as specified in the flight manual. With a pylon-mounted propellor this will be close to or at full nose-up, whereas for a nose-mounted propellor it is likely to be much as for aerotow.

There will be differences in the view, control movements and so on between a TMG and the SLS. The common features should be pointed out.

In the SLS the take-off and initial climb will be similar to that for aerotow – except that the pilot operates the throttle. Deciding where to position the elevators at the beginning of the ground run will be dependent on the thrust line. With a pylon-mounted propellor this will always be fully up. Not only does this counter the nose down pitching moment but with a nose wheel, it lifts the nose wheel off the ground at the earliest opportunity whereas with a tailwheel, it maintains the maximum tailwheel force on the ground allowing better directional control in the early stages of the take-off run. For a nose mounted propellor the stick should remain fully back initially before relaxing the back pressure and allowing the tailwheel to lift slightly.

If the TMG has a tailwheel the take-off attitude should be very similar to that in the SLS: the tail wheel just ‘skipping’ along the ground. If the SLS has a nose mounted propeller, point out the dangers of a prop strike if the tail is allowed to rise much. Particular care must be taken on uneven surfaces.

With a propellor aircraft there are turning tendencies caused by the rotation of the propellor which need to be considered. The first is slipstream effect where the airflow corkscrews back from the propellor and works as a sideways force primarily on the fin of a sailplane. The second is torque effect which tries to roll the aircraft in the opposite direction to the propellor. The third is p factor; when the glider is flying at a positive angle of attack, the downgoing blade is at a greater angle of attack than the upgoing blade, the result of which is more lift from the downgoing blade. All these effects work to make the aircraft turn in the opposite direction to the propellor’s rotation. Therefore, if the propellor rotates to the right as looked at in the direction of flight, the glider will want to turn left.

In an SLS, the launch should be abandoned if the wings cannot be kept level, just as it would be on aerotow. The launch should also be abandoned if the glider cannot be kept straight. Most such gliders have wing wheels, and the take-off run can be started with a wing down instead of using a wing runner. Many pilots prefer this as the wing comes up when they gain aileron control. The condition of the runway surface should be taken into account, and whether the wing is likely to catch on soft or uneven ground or in grass.

Follow the flight manual procedures for use of flaps – again, this is likely to be the same as for aerotow.

Glider pilots who do not fly powered aircraft may be unfamiliar with powered take-off profiles. After the glider leaves the ground, it needs to be held in a suitable attitude while the airspeed increases to the correct climbing speed. This is extremely important in SLS such as the Silent Electro which will lose airspeed rapidly if the attitude is allowed to remain in, or increase above, the slightly nose-up take off attitude.

In the case of self-launchers with a nose mounted propeller the pilot may be keeping the tail on the ground or only just off it during the ground run, and a small but positive adjustment of attitude may be needed immediately after lift-off to achieve a safe attitude during the acceleration phase.

**(ix) Crosswind take-off**

Crosswind considerations must be discussed with the trainee. Crosswind take-offs can be practised in a TMG, paying attention to use of rudder to keep straight and prevent weathercocking, and the need to track along the runway once airborne, by crabbing into wind.

For their early SLS launches, the trainee should not attempt take-off in significant crosswinds (the flight manual may specify limits) and it may be safer to use a wing runner than to start wing down.

If the SLS pilot is to start with the wing down in a crosswind, they must consider which wing should be on the ground. Having the downwind wing down will tend to keep the wing on the ground and prevent or reduce the tendency for weathercocking. Bear in mind that it will take much longer for the wings to level, meaning the wing will be dragging along the ground at a high speed which may lead to an uncontrolled turn and will also have a negative impact on take-off distance.

Having the upwind wing on the ground means that the pilot can usually level the wings very quickly and take-off performance is improved. But there is more of a tendency for weathercocking and the wings may ‘swap’ abruptly early on before aileron authority is achieved, which could result in an uncontrolled turn.

Once again, follow the advice in the FM.

**(x) Power failures and procedures including partial power loss**

Power failures after take-off can be simulated in a TMG exactly as for aerotow failures if the propeller is nose mounted. The trainee should be taught to nominate a minimum height for attempting a turn back to the airfield, and to pick a field ahead if below that height, adopting the appropriate airspeed (as specified in the FM) immediately.

With an over-wing propeller the extra drag of a deployed but stopped engine means that there is probably no safe turn back option below normal circuit height. The situation can be simulated in a TMG by closing the throttle and using airbrakes or spoilers – but only at a safe height! This should fully convince the trainee of the wisdom of not turning. The trainee should also be briefed that a power failure in a sailplane with an over-wing engine will result in a significant nose up pitch (because the trim is close to fully nose up AND the nose down thrust vector has been removed), which must be controlled immediately.

A partial engine failure may still allow a reduced rate of climb or the ability to maintain level flight. Monitoring airspeed is vital. If some rate of climb is still possible, you may be able to achieve sufficient height to glide back to an airfield. However, the possibility of a subsequent total engine failure should be considered, with allowance for the extra drag of the extended engine. When below the pre-determined turn back height for the type, the safest option is to treat the partial failure as a complete failure and pick a field ahead to land in. The partial power of the engine gives a little more time to pick the best landing area.

Partial engine failures can be practised in a TMG. The exercise should involve reducing the power to find the setting at which straight and level flight can be maintained but there is no climb. The trainee can reproduce this exercise, at height, when flying the SLS solo. This will enable them to become accustomed to the feel, noise, and handling of the SLS in a partial power failure. One of the risks of partial power failure is that it may be gradual and therefore not noticed, so the pilot needs to be familiar with the symptoms and able to recognise them.

**(xi) Abandoned take-off**

As when aerotowing, an abort point should be nominated before take-off.

The instructor should demonstrate an aborted take-off in the two-seater and give the trainee practice, briefing that at a certain point the ‘abort take-off’ command will be given, and the trainee should close the throttle and bring the aircraft to a controlled stop, using wheel-brakes as appropriate.

Cutting the power quickly may not be as easy or as intuitive in the SLS as in a TMG. In electrically powered sailplanes with a rotary knob throttle, the pilot should give particular thought to the process for abandoning a take-off, as twisting a knob is less easy than simply pulling a throttle lever backwards.

Pilots should always complete a comprehensive self-brief for the take-off and any eventualities.

**(xii) Maximum performance (short field and obstacle clearance) take-off**

Follow the flight manual procedure. This may include holding the aircraft on the wheel brake as the throttle is opened, to minimise the ground run. The manual should specify the 'best angle of climb' speed, which is lower than the 'best rate of climb' speed normally used.

A short field and obstacle clearance take-off can be demonstrated and practised in a TMG, noting any differences in the airspeeds to be used.

**(xiii) Short field take-off, soft field procedure or techniques and performance calculations**

Follow the FM procedure and performance calculations. This may include selecting neutral or positive flap (if fitted) as soon as aileron control is achieved, to minimise the take-off run and get the airborne at the lowest possible airspeed. In a TMG there is no significant difference between this and the previous exercise.

**(xiv) In-flight retraction of engine and engine cooling**

A demonstration of engine shutdown in flight can be done in a TMG but will be significantly different from the process in the SLS. The SLS flight manual will describe the procedure and touch drills can be done on the ground.

The process can take a significant amount of time, as the propeller is slowed, stopped, and its position adjusted to park it, or allow it to be retracted into the fuselage. For over-wing propellers there is a significant amount of extra drag – and hence height loss – whilst the engine has stopped and before the propeller is retracted. Trainees practising engine shutdown should do it at a comfortable height!

Pilots of self launchers with piston engines must take care to keep temperatures within limits. Appropriate use must be made of cowl flaps and the time spent in both the high power/ low airspeed and low power/ high airspeed regimes should be minimised. The SLS may have an engine management system with software monitoring engine temperatures and power, and the trainee must be familiar with the settings and messages of their installation.

**(xv) Propeller drag**

This item should be covered in discussion with the trainee.

The extra drag of a stopped propeller has already been stressed. A windmilling propeller creates more drag than a stationary one. On sailplanes with a front mounted propeller the drag is very much less than if the propeller is over-wing. The effects can be experienced at a safe height when flying the SLS.

**(xvi) Effects of reduction and increase of power**

There may be significant pitch changes when power is increased or reduced. This will vary depending on how the engine is mounted. To some extent the effect can be demonstrated in a TMG but this is something the trainee should be briefed to try when flying their SLS, at height. Smooth throttle handling is the key.

Prolonged idle running a piston engine using a 2-stroke system may deprive the engine of much of its oil lubrication. Care must be taken when practising handling with the engine a low power settings.

**(xvii) Pitch nose-up tendency in case of engine shutdown (in case of over-wing propeller installation)**

In an over-wing propeller installation, shutting down the engine can create a nose-up pitching tendency because the propeller's thrust is now no longer a downward force, relative to the centre of gravity. However, this will be minimal if the engine is at idle.

**(xviii) Approach with extended retractable engine inoperative (may be simulated by extended airbrakes)**

The flight manual must be consulted because landing with the engine extended may be prohibited – in which case flying a circuit with extended airbrakes is a reasonable simulation; this can also be practised in a TMG. With a stationary pylon-mounted propeller the extra drag will be comparable to flying with full airbrake. The handling and stability of the glider may also be affected. The trainee should be advised to study the flight manual and explore the effects at altitude.

**(xix) Decision process and reasons to terminate the soaring flight and to switch to powered flight**

This item requires thorough discussion with the SLS trainee. There have been many accidents caused by poor decisions about when it is safe to try to start the engine.

For over-wing engines that extend from the fuselage the height loss in airborne starting can be considerable. Consult the flight manual for guidance, and the new SLS pilot must determine their typical height loss by experimentation at altitude. TMG practice may not be especially useful because the process is so dissimilar. On electric systems with front mounted propellers, the height loss is negligible.

The pilot must bear in mind that the engine may not start immediately. This is especially true of piston and jet engines, but electric motors can also fail. An airborne start must never be attempted when a safe landing cannot be made in the event the engine fails to start. It is imperative that the pilot calculates the minimum height at which an engine start can safely be attempted and sticks to that. Below that height they have ruled out using the engine.

When attempting an engine start, the pilot must be in a position where they could land with the engine extended if necessary. The workload in such a situation will be extremely high and the pilot must mentally prepare for the eventuality with TEM beforehand, e.g. '**When** the engine fails to start, I will….' Flying the glider accurately and maintaining safe airspeed are the top priorities. Plan A should be to land in the chosen field, and the engine starting successfully is a happy bonus. Only if there is plenty of height to spare should the pilot check for a reason for non-starting and attempt another start.

 

**(xx) Decision process and reasons for not starting the engine and to end the flight as a non-powered sailplane**

If the pilot's minimum height for engine start has been reached then, if soaring away is not possible, a conventional field landing should be flown. Workload increases significantly when faced with a field landing and to add to that workload by adding a further complex task of starting the engine can lead to a breakdown in a pilot's basic handling skills; this can lead to a loss of control/low-level spin. Accident statistics demonstrate that, in the heat of the moment, pilots may ignore this advice and take significant risks, to avoid the inconvenience of a land-out.

The field landing will obviously be very much simpler when the glider is configured normally, without a stationary engine deployed.

If there is an airfield within gliding range, the pilot of a self-launcher with over-wing engine should bear in mind that a conventional landing followed by a self-launch may be a safer and less stressful exercise than a low engine deployment with the possibility of engine failure. Deciding in advance to choose the landing option would give them more height available to try to soar away.

## MANOEUVRE LESSON & DE-BRIEFING

The minimum number of training flights and supervised solo flights as per SFCL.155 must be achieved including all the items detailed above.

As specified in AMC1 SFCL.155(a)(2), at the end of the training, the candidate should be able to demonstrate:

- a self-launch
- appropriate actions in the event of engine failures
- the decision processes referred to in sections (xix) and (xx) above.

Following satisfactory completion of training, the instructor should sign the pilot's logbook/logbook signature card to indicate that the self-launch method has been added. .

 