Gliding Australia Training Manual

Trainer Guide

Unit 14S

Takeoff Self Launching

Unit 14S - Takeoff Self Launching

AIM

To develop and demonstrate the skills and knowledge required to prepare and then safely fly a self-launch ground roll, separation, initial climb and then transition into the normal climb.

PREREQUISITE UNITS

- GPC Unit 7 - Straight flight, various speeds, trim
- GPC Unit 8 - Sustained turns, all controls
- GPC Unit 10 - Use of ancillary controls

Note to Trainers: Correct control and operation of the aircraft are essential pre-requisite.

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 19 - Crosswind takeoff and landing
- GPC Unit 20 - Launch emergencies

COMPETENCY ELEMENTS AND PERFORMANCE STANDARDS

ELEMENT	PERFORMANCE STANDARDS
1. **Preparation for takeoff.**	• **Describe:** ○ How to calculate the takeoff distance required for the aircraft. • **Demonstrate :** ○ Pre-Take Off checks with options for launch emergencies briefed in accordance with the Aircraft Flight Manual. ○ Nomination of an Abort point on the takeoff run in the event of expected performance not achieved. ○ Aircraft engine checks. ○ Transmission of appropriate radio calls. ○ Confirmation of airspace clearance for launch.
2. **Taxi to launch point.**	• **Describe:** ○ The use of the controls whilst taxiing the aircraft (and how these are affected by the surface wind). • **Demonstrate:** ○ Planning of taxi route allowing for wingtip clearance. ○ Manoeuvring aircraft safely to take off point using appropriate controls for conditions.
3. **Conduct ground run and Separation.**	• **Demonstrate:** ○ Application of independent non-coordinated control inputs. ○ Keeping the aircraft straight on the centre line. ○ Keeping the wings level using aileron. ○ Using elevator to balance the glider on the mainwheel(s) in the correct takeoff attitude. ○ Allowing the aircraft to separate from ground and held in ground effect until the Take Off Safety Speed (TOSS) is established. ○ Pitching the aircraft to the appropriate climb speed (V_X or V_Y).

KEY MESSAGES

- Care must be taken whilst taxiing for takeoff to allow for wind direction and wing tip clearances.
- There are additional recommended radio calls.
- Apply the throttle smoothly over a few seconds - don’t slam it open.
- There are specific effects on takeoff and initial climb from the engine operating.
- An abort point must be preselected in the event of non-performance of the aircraft.
- Plan ahead. Anticipate possible emergency options. You have more control over the flight path than with other launch methods. Think about the safest track, turn heights and directions. Cross wind and local land features will need to be considered. There may be local procedures for flight paths that must be followed if safe to do so.
- Plan the takeoff roll distance for the surface you are on, the crosswind/headwind and the density height for the day (function of temperature, elevation, and humidity). Ensure you have adequate distance for clearance of obstacles as well as emergency plans at any phase of the launch.
- The Pilot in Command is responsible for confirming “airspace clear for launch” and “pilot ready - launch approved”.
- Where there is no wing runner, it is necessary to operate like a powered aircraft and advise local traffic of your intentions as well as being aware of the intentions of the other traffic.
- Place the into-wind wing down in a crosswind to enable earliest pickup of the wing.
- Keep wings level with aileron, aircraft on centerline with rudder, takeoff attitude set with elevator, independently, until the glider is airborne.
- Ensure the glider does not climb out of ground effect until the safe climbing speed (Vy best rate of climb) is reached.

LESSON PLANNING AND CONDUCT

Briefing

Preflight Planning

- Weather. Can you even self launch today? Is it too hot? (hot, high and humid increase density height which negatively impact length of ground run). Is there too much cross wind for the available rudder control at low speed?
- Airfield – elevation affects density height and engine performance. If field elevation is high, is it long enough? What is the surface? Bitumen has the lowest drag on the wheel and therefore best acceleration. Dirt, gravel, short, long and wet grass will all increase takeoff run
- Consult your Flight Manual. Takeoff performance ground run and length to clear a 50’ obstacle is usually specified for various temperatures.
- Fuel sufficient. Drain completed to ensure no water or foreign matter (dirt etc) in fuel. Microbes can grow in fuel/water interface and usually appear as brown, discoloured water

and be introduced with a batch of fuel. Fueling from partially full drums is a possible water source.

- Correct fuel. Most motorgliders prefer premium unleaded but can use AVGas. Consult your FM. Two stroke fuel may require mixing with specified oil.
- DI engine. Vibration of components (especially two stroke) means you should be extra vigilant. Common failures include belts, electrical wiring including to ignition module. If the engine has not run for a while and not properly preserved, carburettors could be gummed up with dried fuel/oil residue. Safe engine test running on ground is recommended.

Glider setup

- Glider setup. Correct (into wind) wing down for wing-drag takeoff or wing runner briefed. Note wing runner may have to wait for engine to warm and then have longer ground run dependent on performance.
- If you operate alone off a different runway to the active glider runway, think about where your car should be parked.
- Pre Take Off Safety Brief and Takeoff plan. Where will you go if the engine fails partially or completely
    - on the runway
    - just airborne
    - below turnback height
    - after turnback height

      (remember the increased sink rate and reduced glide performance with the engine extended)
    - What is the height and direction of your first turn to remain within reach of landable options?

Calculation of Takeoff Distance

- The Aircraft Flight Manual must be consulted to calculate the Takeoff Distance (TOD) required.
- Factors affecting TOD:
    - Headwind.
    - Outside air temperature.
    - Density altitude.
    - Runway surface and slope.
    - Obstructions.
    - Aircraft takeoff weight.

Additional Pre-Takeoff Checks

- Refer to GFA MOSP 2 and Aircraft Flight Manual.

Pre-Boarding and Take-off Checks - Powered Sailplane

From Outside Cockpit	A	**Airframe**: Walk around check for damage and/or defects. Maintenance release checked, including DI validity.
	B	**Ballast**: Powered Sailplane loading is within placard limitations and trim ballast, if required, secure.
	C	**Controls**: Check controls, including airbrakes and flaps appropriate to type, for correct sense and full deflections.
	D	**Dollies**: All dollies and ground handling equipment removed.
	E	**Engine**: Oil quantity checked sufficient for flight, oil cap/stick secure, cooling fluid level checked if required, Propeller checked for condition and serviceability. Run fuel boost pump with the fuel turned on & check for fuel leaks.
	F	**Fuel**: Dipped, quantity sufficient for flight, correct type and octane, oil mix correct if two-stroke, fuel caps on and tight.
From Inside Cockpit	C	**Control Access**: Seat adjustments secure and positioned to allow for comfortable access to all flight controls, panel switches/knobs and the tow release. Rudder pedals adjusted for reach if applicable.
	H	**Harness**: Tight and secure, lap belt low on hips, both pilots.
	A	**Airbrakes**: cycled and set for launch, closed and locked. Flaps: (if fitted) cycled, set as required for take-off.
	O	**Outside**: Airspace and take-off path clear. Wind velocity checked. Sufficient competent ground crew available. **Options**: Evaluate and brief emergency plan, identify aircraft critical speeds.
	T	**Trim**: Check for full movement and Set for launch. **Ballast**: Correct ballast confirmed.
	I	**Instruments**: Altimeter set to QNH, other instruments reading normally, no apparent damage. Radio on and set to correct frequency, other avionics on and set correctly.
	C	**Canopies**: Closed, locked and clean. Side vent adjusted. (under)**Carriage**: Check undercarriage down and locked. **Controls**: Full and free movement available.

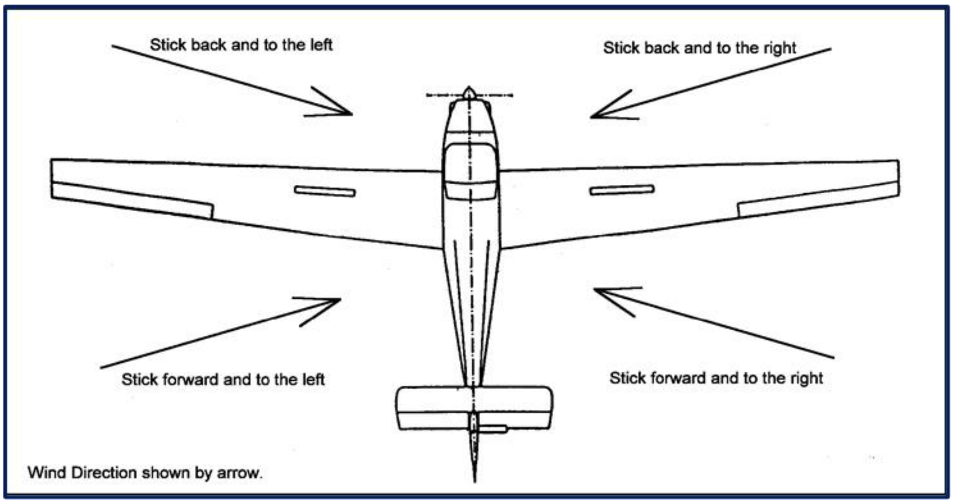
NOTE: The following additional checks should be used unless the Powered Sailplane Aircraft Flight Manual (AFM) specifies otherwise. Engine run up checks are to be completed in accordance with the AFM.

From Inside Cockpit	I	**Ignition**: Magneto check carried out, magneto or magnetos on both.
	F	**Fuel**: On and sufficient, most full tank selected if applicable.
	P	**Propeller**: Set for take-off/ fine position, plus checks required by Aircraft Flight Manual.
	C	**Choke/Carburettor Heat**: Off **Cowl Flaps**: Set if fitted.
	R	**Radio/Transponder**: correct frequency, volume set, call as required/Transponder 1200 Mode C.
	B	**Brakes**: Wheel brakes released, airbrakes locked.

Ground-handling and taxiing techniques

- Glider pilots are not used to taxiing and the exercise must be consciously learned. All pilots will be unaccustomed to the very long wings of powered sailplanes and they will have to think carefully about wing-tip clearances.
- Be aware of the turning radius and stopping distances required for the motor glider.

- In almost all cases, the steerable tailwheel has limited travel and the turning circle is large. Powered sailplanes and tight spots do not mix well. In winds over 10 knots, the control positions for taxiing should be in accordance with the following diagram.



- Arrows denote wind direction. Note that, whenever the stick is forward during taxiing, the wheelbrake(s) must be used with extreme caution. In winds of less than 10 knots, the stick is generally held back.

Additional Recommended Radio Calls to an unpowered sailplane

- Taxiing.
- Before entering a runway for back- tracking or takeoff.

The effect of the engine on directional control on takeoff

- Apply full power with gradual application of the throttle over a few seconds. “Slamming” the throttle open may strain some of the components over time. An immediate effect may cause the engine to “bog” and stutter due to incorrect fuel/air mixture in the carburettor. Smooth application of the throttle is required.
- Most people have heard that powered aircraft sometimes have a tendency to swing to one side on takeoff, powered sailplanes often swing quite badly on takeoff, even those with only 30 or 40 Kw under the cowling. It is often quite a shock to a glider pilot, who is unused to such behaviour.
- As power develops, periodically scan engine instruments to **ensure that expected values are being achieved and prepare to abort the launch if not.**

Propeller torque

- Although torque is a minor factor in forcing a powered sailplane off its takeoff line, it is by far the least important, as it acts in the rolling plane and only really asserts itself in very powerful aircraft, where the torque pushes one mainwheel into the ground and increases the drag on that side. As there are few powered sailplanes with Rolls-Royce Merlin or Wright Cyclone engines, torque effect can be discounted.

Slipstream effect

- The effect of the propeller wash, sometimes called "slipstream effect", is a bit more significant. The air forced back by the propeller has some spiral motion to it, the air striking one side of the rear fuselage and fin more than the other, thus pushing the tail of the aircraft to one side.
- Although noticeable, it is easily corrected by applying a small amount of rudder to compensate.

Asymmetric blade effect

- Another factor causing swing on takeoff is the so-called asymmetric blade effect, also known as propeller factor, or "P" factor. This comes into play if the aircraft is a taildragger, which means that the thrust line is not parallel to the relative airflow while the aircraft is on the ground.
- This causes the down going propeller blade to have a slightly higher angle of attack than the upgoing blade. This in turn displaces the thrust-line slightly to one side of the aircraft's centreline and produces a swing. Once the tail is raised on the takeoff run and the thrust-line is more closely aligned with the aircraft's takeoff path, the effect diminishes. Because nosewheel designs have their thrust-lines more closely aligned with the centreline during the takeoff run, they have little or no tendency to swing.
- Asymmetric blade effect is sufficiently marked in powered sailplanes that it can substantially reduce their takeoff limit in crosswinds, the limiting case being where the crosswind is coming from the direction in which the aircraft is already trying to swing.
- This accounts for why some powered sailplanes have very low crosswind limits in their flight manuals:
    - The Grob G109, for example, is only 11 knots and the RFSB Sperber is even lower at a mere 8 knots, beyond which the pilot runs out of rudder control if the crosswind is from the right.
    - The PIK20E (pop-up engine) is also only 11 knots.
- Even if there is no crosswind, pilots will notice that there is a need to hold on a noticeable amount of rudder during takeoff, just to keep the aircraft straight.
- This effect of the engine on directional control on takeoff is something new for glider pilots to learn, as is the effect on the aircraft's crosswind handling capability.
- Power pilots brought up on tricycle designs, please consider.

After Separation

- Maintain the aircraft in ground effect until it accelerates to the Takeoff Safety Speed (TOSS) then pitch the aircraft to either best angle of climb speed (Vx) or best rate of climb speed (Vy).

The effect of the engine in the initial climb

- Once established in the climb, “P” factor still makes its presence felt, aided and abetted by slipstream effect. The reason for this is that the powered sailplane is still being operated at an angle of attack higher than that for level flight. It must be, or it wouldn't climb. Thus there is still a requirement for the pilot to hold on a certain amount of rudder during the climb, otherwise the slip ball will show that the aircraft is not in balanced flight.

- Many powered sailplanes (e.g. the Stamo-engined Falkes) will be reluctant to climb if there is any slip or skid showing during this phase of the flight, as the drag produced by unbalanced flight is sufficient to largely negate the meagre amount of thrust available.
- Pilots converting to powered sailplanes must become very conscious of their rudder feet and need to get used to referring to the slip/skid ball at frequent intervals during the takeoff and climb, to ensure that the aircraft is in balanced flight and the drag is thus reduced to the minimum.
- While a nose mounted engine is operating any yaw string fitted will be useless, so the slip/skid ball will have to be used.
- Reminder: ball left needs left rudder, ball right needs right rudder, (stamp on the ball), use your feet!

FLIGHT EXERCISES

Specific demonstration and practice required:

- Trainer demonstrates takeoff with the student lightly on the controls.
- Student practise (under supervision).

THREAT AND ERROR MANAGEMENT

Advice to Trainer regarding their responsibility to maintain safe flight:

- Ensure that weight and balance limits are calculated and complied with.
- Ensure that the takeoff distance is calculated especially at a high-density altitude.
- Observe crosswind limitations.
- Be prepared to abort the takeoff if the student fails to compensate for the swing into any crosswind as once a swing is allowed to develop, the aircraft may have insufficient rudder authority to recover, e.g., a Super Ximango with left crosswind.

COMMON PROBLEMS

Problem	**Probable Cause**
• Wings not kept level.	The student may not have identified that one wing is lower, they need to identify this through reference to the horizon ahead and through peripheral vision.
• Insufficient control movement at low speed.	The student may be hesitant to use larger control inputs. Explain that at lower speeds the controls are not as effective and will need greater inputs.
• Failure to adopt the takeoff attitude.	The student cannot identify the correct takeoff attitude or is not judging the attitude of the aircraft correctly. Demonstrate the correct takeoff attitude to the student on the ground. During demonstration of takeoff, note the correct attitude to the student.

• Insufficient rudder to compensate for engine effects.	The student is not recognising the P effects or not applying correct countering control input.
• Failure to keep aircraft in ground effect until TOSS is reached.	The student is allowing the aircraft to rise at lower airspeed. Student needs to counter aircraft tendency to gain height by applying forward stick to keep the aircraft in ground effect until TOSS is reached.

THREAT AND ERROR MANAGEMENT

- Wings not kept level – students may not identify that one wing is lower, they need to identify this through reference to the horizon ahead and through peripheral vision.
- Insufficient control movement at low speed, aileron and rudder.
- Failure to adopt the takeoff attitude results in very fast taxiing with unstable handling.
- Trainer intervention will likely be required in the first attempts.
- Insufficient rudder to compensate for swing on takeoff and initial climb due to engine/propeller effects.
- Failure to keep the aircraft in ground effect until takeoff safety speed (TOSS) is reached.

TRAINING MATERIALS AND REFERENCES

- Powered Sailplane Manual: GFA Ops 0009
- GPC Pilot Guide Unit 14S