Gliding Australia Training Manual

Pilot Guides

Section A

Units: 1-26 (Solo)

Gliding Australia Training Manual

Pilot Guide

Unit 1

Lookout Awareness

WHAT THIS UNIT IS ABOUT

To develop the primacy of effective lookout,

To develop the application of the basic Rules of the Air for collision avoidance.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

This unit should be read in conjunction with GPC Unit 9, Lookout Scan Procedures, which deals with scanning techniques, and you may wish to read on with Unit 4 – Orientation and Stability.

KEY MESSAGES

Lookout

- An effective lookout is the most important element of Airmanship and safety in the air.
- Lookout is our highest priority in avoiding collisions with other gliders and aircraft.
- Throughout training, the highest standards of lookout are insisted on every flight.

Collision Avoidance

- We use lookout in conjunction with listening to the radio to identify other aircraft that might pose a hazard; this technique is called “Alerted See and Avoid”.
- Head must be kept turning and eyes focused mainly outside the cockpit.
- When flying, any sightings of other gliders and aircraft must be reported.
- An aircraft on a collision course with you will appear to be stationary, on a constant relative bearing.

Rules of the Air.

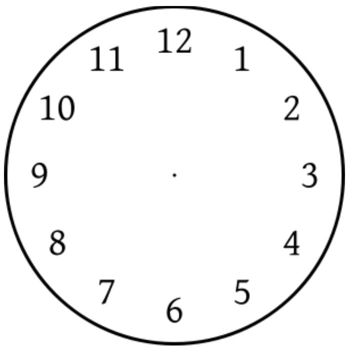
- You must learn and apply the basic Rules of the Air (see more in GPC Unit 23 – this unit will be covered later but the basic rules of the air are listed in that unit)
- Who gives way to whom

PILOT GUIDE FOR THIS UNIT

- Safety is the major priority and collision with other aircraft is by far the biggest risk.
- An effective lookout reduces this risk significantly.
- Situational Awareness is:
  - What has happened recently?
  - What is happening now?
  - Projecting to: What might happen in the future? (Getting ahead of the aircraft.)
  - For example, you see a towplane & glider taking off below you, predict where it will be as you fly towards the circuit. Will you potentially have a conflict?
- Vision is restricted by:

- an individual's eyesight performance,
- dirty canopy,
- poor weather/haze/sun,
- the glider's airframe,
- take actions to improve these deficiencies.

- Look for and identify other aircraft. "Tell me whenever you see something".
- The clock code:



  - 12 o'clock means directly ahead, 3 o'clock means directly to the right, 6 o'clock means directly behind, and 9 o'clock means directly to the left.
  - It is further defined by high or low.
  - (e.g. I see a glider at **10 o'clock, high**)
- Handover/Takeover protocol – don't be lax about this! "You have control" "I have control".

Limitations of vision

Sitting in the front seat of a glider:

- Look ahead (12 o'clock);
- Each wingtip;
- Behind each wingtip (when turning you need to look here);
- Vertically above the glider;
- Look down – how can you see below you?
- Move your head in order to see properly.

FLIGHT EXERCISES FOR THIS UNIT

- Look for specific ground features, in a range of directions – ahead, to each side, behind the wing, below, behind, clouds directly above.
- Make sure you are moving your head accordingly.
- Note by turning the glider you can see places not previously visible (below and behind)
- If other aircraft are flying, try and spot aircraft before your instructor. Point out where they are using the clock code.

- Your instructor may let you come on the controls with them or let you take control.
- On those occasions, the instructor will handover to you and have you confirm taking over and handing over.
- On circuit, take notice of the use of radio, if any traffic tell your instructor what you heard and what you see.
- Identify key features and lookout.
- Relax in the cockpit and try to confidently turn your head and body.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- Ensure positive transference of control. “You have control” “I have control”
- Move your head. Scan by moving your head rather than just shifting their eyes.
- Given that the likeliest threat is along the horizon, that is where you should be focusing your scan.
- This will also improve your speed control and coordination.
- Looking down the wing whilst turning can lead to disorientation and poor speed control.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Explain the priority of lookout to avoid collisions through see and avoid.
- Describe and recognise potential collision risk in flight.
- Describe the use of radio for alerted see-and-avoid.
- Explain Situational Awareness at all times in flight.
- Discuss the risks of excessive focus on instruments and devices.
- Demonstrate limits of vision and how to look in difficult to see airspace. (above, below, behind, when turning).
- Demonstrate the use of the clock code to report other aircraft and identify prominent landmarks.
- Describe the importance of checking airspace before commencing any manoeuvre.
- List the rules of the air applicable to aircraft safe separation; (head to head actions, give way to the right, overtaking on the right, no flying over the top of someone).
- Maintain radio listening watch and provide their interpretation of traffic location and intentions.

RESOURCES & REFERENCES

- Australian Gliding Knowledge pages 240 to 247
- GFA MoSP 2 Operations

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. How do you ensure positive transference of control?
2. Where is 9 O'clock Low?
3. List three things that limit vision.
4. Why is lookout important?
5. What is meant by "Alerted See & Avoid"?
6. What is meant by "Situational Awareness"?

Gliding Australia Training Manual

Pilot Guide

Unit 2

Ground Handling and Signals

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge required to safely handle gliders on the ground and use correct signals.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- Nil

COMPLEMENTARY UNITS

- Theory Course T1 (Ground Handling section) should be completed as part of this GPC Unit.

KEY MESSAGES

- Safety is a shared responsibility. Any person can call and signal Stop!
- When hooking on, check for knots, rope condition, correct weak link.
- Check "Airspace clear for launch" including ahead down runway and launch flight path. (All clear above and behind is insufficient.)
- Haste increases risks of damage or injury.
- Ensure distractions are minimised, to provide better focus on safety and checks. (Sterile environment).

PILOT GUIDE FOR THIS UNIT

Moving the Glider on the Ground

We are constantly moving our gliders from the hangers to the flight line and return. Gliders are built to withstand large forces for flying but they can be easily damaged on the ground through mishandling.

The diagram below shows the areas where we can push and no- go areas.

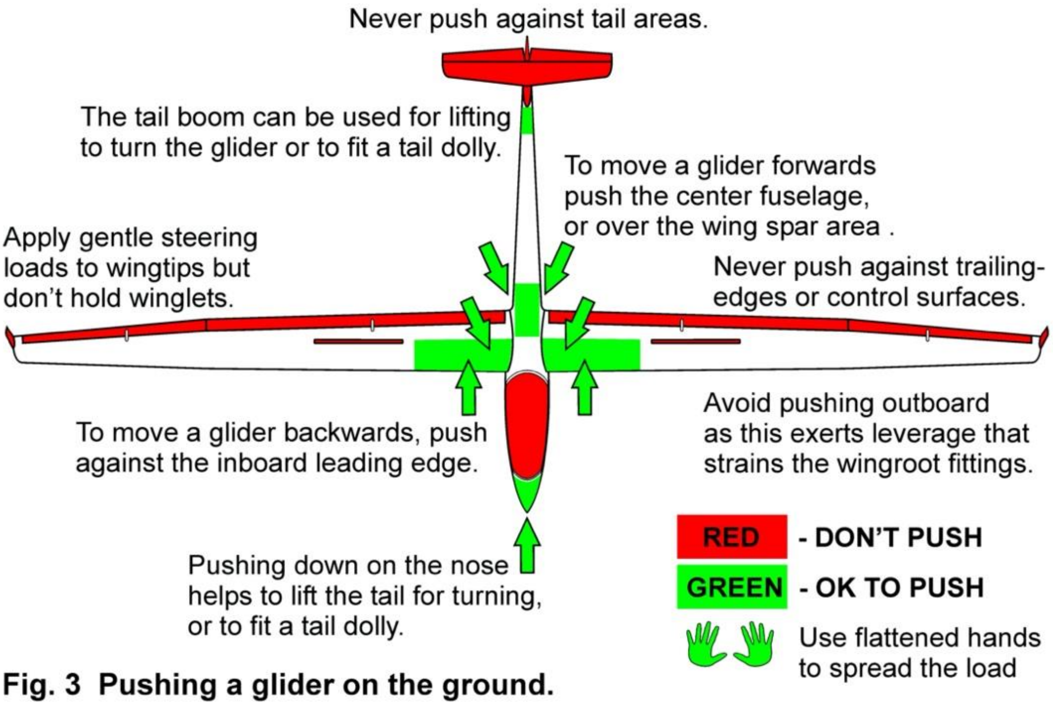


Fig. 3 Pushing a glider on the ground.

- This unit will be covered over several days of operations, in a variety of environmental conditions, with careful introduction and supervision by your instructor and experienced pilots.
- One item to watch out for is the glider's canopy. Canopies are very expensive, fragile and scratch and crack quite easily and a scratched canopy can be difficult to see through and therefore dangerous.
- Never leave the canopy open or unlocked when you are not right near the cockpit. Always close and lock the canopy when you move away from the glider for any reason, especially in a wind. Never lift a canopy by the clear view panel. Lift it by the frame or locking handle.
- When you're moving gliders around the strip, only one person should hold a wingtip. If you have one person on each tip, they may pull against each other and damage the glider. If the wind is very strong, make sure it's the upwind wingtip that you hold onto. If you have to swap to the nose or fuselage, make sure someone else holds the wing before you let go.
- When gliders are moved to the launch point or back to the hangar, it's normal to connect a rope from the aircraft (usually from a cable/rope connection) to a vehicle and tow them.
- The golden rule when towing any glider with a rope is to make sure that the tow rope is longer than two thirds of a wing span. This way, if the glider should decide to turn by itself or overtake the car on a downhill slope, for example, the person on the wing tip can hold back to swing the glider clear and there's no chance of the wing tip hitting the tow vehicle.
- The glider should never be towed faster than a moderate walking pace, so beware when using cars which have an automatic gearbox. Choose the smoothest path to the launch point and always keep a good lookout for obstacles near the wing tips.
- Some gliders are towed nose first with the tow rope attached to the cable release and others are towed tail first either with a rope or a rigid bar off the tail dolly. Tail dollies make manoeuvring on the ground a lot easier, but it's essential to make sure the tail dolly is removed before flight. The dolly should always be removed when you park the glider to make it more difficult for the wind to rotate it.

- Some aircraft ground handling kits have an auxiliary wheel on a special fitting slid over the wing called a “wing walker” so a glider can be towed single handed with the wing walker on the wing and a tail dolly on the tail.
- If a glider is being towed from the tail with a mechanical wing-walker attached to a wing and that wing lifts, stop immediately. It’s possible that the ailerons on the low wing will hit the ground or a thick clump of grass and get damaged. Damage to control surfaces done when ground handling is one of the important items you will check in your walk-around before getting in the glider.
- If a glider is towed with a strong wind from behind, the control surfaces can flap up and down and can get damaged. When towing in a wind, control surfaces should be stabilised by tightening the seat-harness over the joystick and chocking the rudder.
- The rule when parking gliders outside during the day is to make sure the wings can’t develop lift. That means in effect, don’t park it nose into the wind, and make sure the air brakes are out to spoil the airflow over the wings.
- When it’s windy, gliders are normally parked tail into the wind at a slight diagonal with a tyre on the into-wind wing. If the strip has tie down wires, these can be used to secure gliders.
- There may be ropes attached to the tie down wire which you can use. It’s easy to loop a rope over the tail boom of a glider, but securing the wings takes more thought. You can’t loop a rope over ailerons or flaps without putting something like a seat cushion on top of the wing, and passing the rope over the cushion to avoid damaging the control surfaces.
- Alternatively, the cushion is put on the wing and two stakes or screw-its can be driven into the ground, one either side of the wing and a rope stretched between the two stakes. Before you go cross country, make sure the glider has a set of this tie-down equipment stowed somewhere secure.
- Always consider tying down aircraft that are not in use as strong thermals can lift aircraft off the ground and destroy them.

Launching and Ground Signals

- For a launch behind an aircraft tug (aerotow) the diagram below that shows the position of the signaller and wing tip runner. The wing tip runner is there to ensure the glider’s wings remain level at the beginning of the launch as the pilot has limited control of this at low speeds.

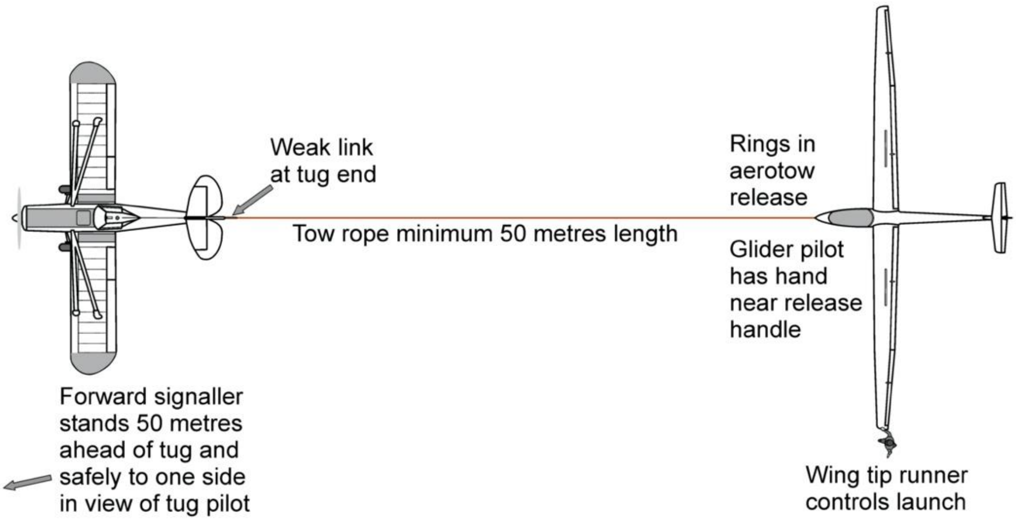


Fig. 2 Aerotow launch

- In a winch launch the winch is at the far end of the runway and the wingtip runner is in a similar position to the aerotow launch.
- When a glider is ready to launch, there must be clear commands between the pilot, via the ground crew, to the operator of the winch, car or aircraft to begin the launch.
- The responsibility is shared between the ground crew, (which for aerotow ideally includes a forward signaller for maximum safety), a wing runner and the pilot.
- The wingtip runner has a responsibility to check that:
- The glider's canopy is closed and locked.
- The airbrakes are closed and locked.
- That the strip is clear and that airspace is clear to launch.
- Because the pilot can only see ahead, the launch crew must check if there is any traffic above and behind the aircraft and it is only the launch crew who can permit the launch to proceed. This is the final safety check before launching and is never omitted. The glider's wing is not lifted until the "Airspace clear to launch" check has been completed.
- When holding a wingtip during the launch, support the wing but do not hold it back. Allow the wingtip to slide through fingers without impediment this will allow the wing to move out of your hand once the aircraft is moving forward faster than the wing runner is moving.
- The tug often moves onto the strip when the canopy is closed and waits for the wing to be lifted and the signal to take up slack. Lowering of a wing always means the launch is on hold or aborted.
- If a pilot is unhappy in any way, or if a launch is delayed for any reason, the glider pilot should pull the release and unhook the tow cable from the glider. It doesn't take long to hook it up again and means that there is no way the aircraft can inadvertently launch.
- There are three launch stages. The stages and commands are the same whichever launch method is in use. The commands to initiate these stages are: Take-up slack, Full power or All Out and Stop!

- These commands may also be given to the tow pilot on the radio.

Take up Slack; the tow rope is slowly taken up by the tug, car or winch operator until there's no slack in the cable.

Full Power or **All Out**; The tug, car or winch operator applies full (or appropriate) power to start the launch.

Stop! Stop! Stop! This signal is the most important of all and should be clearly understood by everyone near a glider being launched. Anyone can give a STOP signal.

- When the STOP signal is given, the person supporting or running the wing must immediately lower it to the ground and hold both hands above their head.

- The lowered wing alerts the pilot who may not be otherwise aware anything is wrong and it's normally seen by the tug pilot as well.
- When the pilot is aware of the wing being lowered and sees the crew with their hands in the air, the pilot should immediately release the cable.
- Nobody should ever be afraid of shouting Stop if it looks like something is not right.
- No-one will mind if there was no problem. The launch can easily be restarted and it is far more important that nobody gets hurt.
- Your instructor will show you the "take up slack" the "All out or full power" and the Stop signal.

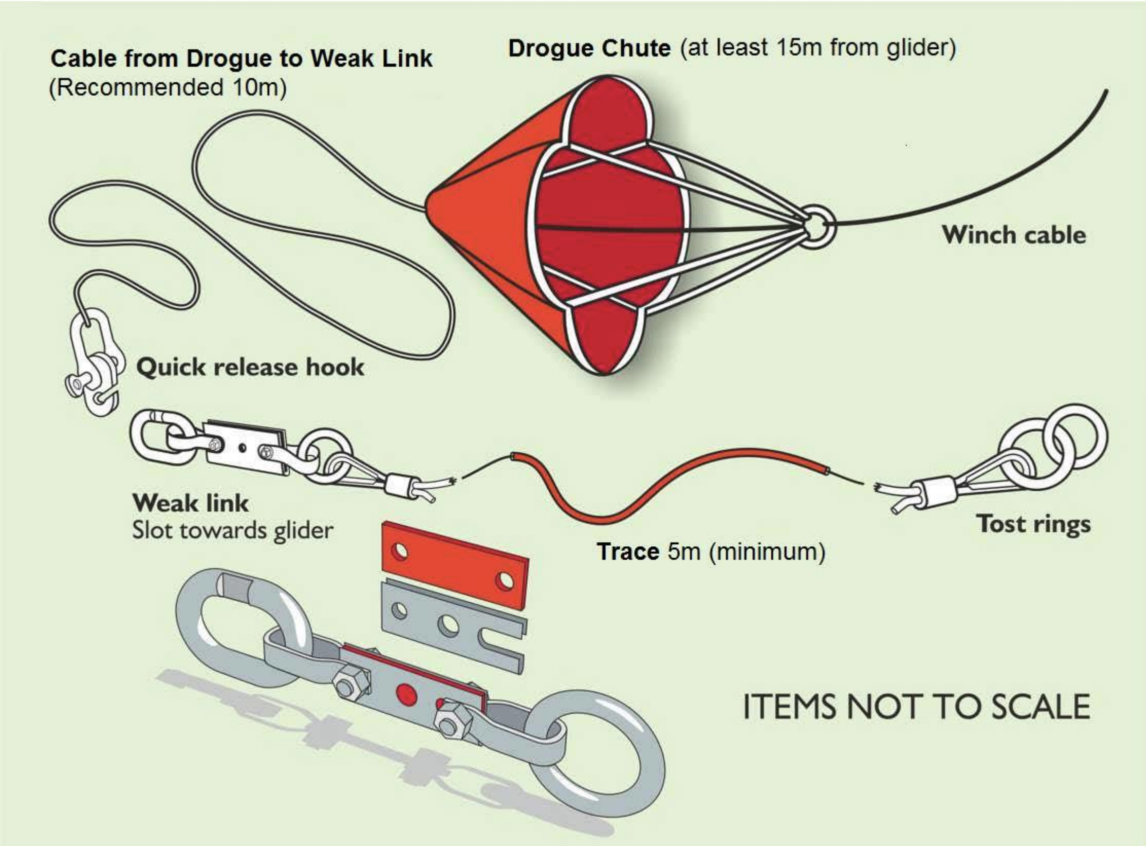
Launching

Winch Launching

At the end of the length of wire which is drawn out from the winch, there are certain items of equipment which play a part in the safe launching of the glider. A typical make-up of a cable- end is as follows -

1. **The cable itself.** Although traditionally known as "cable", the material commonly used (and recommended by the GFA) is "Range 2 spring steel wire" of either 2.8 mm or 3.15 mm diameter. This is the wire used to make bedsprings and is readily available from spring manufacturers in 300 kg rolls. Exceptionally, wire rope of 3 mm or 4mm diameter may be used, but only where fairly soft grass surfaces are available for launching, as wire rope is both expensive and susceptible to failure by abrasion and ingress of dust.
2. **Drogue parachute**. Usually about 1.5 metres in diameter, the drogue is used to stabilise the wire after release and keep it under some tension. Some clubs using stranded cable instead of the more usual solid wire do not use a drogue. However, such clubs are in the minority.
3. **Weak link.** This vital piece of equipment is fitted to protect the structure of the glider from damage due to overspeeding of the launch or the pilot trying to climb too steeply. The correct weak link must never be omitted.
4. **Release rings.** This is a linked pair of rings of standard "Tost" design. The smaller ring is inserted into the winch-release hook of all gliders. Two rings are used, rather than just one, in order to ensure that the force exerted on the glider towhook is a straight pull, no matter what the angle is on the cable itself.
5. **Trace.** This length of rope or stranded wire acts as a shock absorber for the launch and serves as a spacer to keep the drogue at a suitable distance from the glider. The minimum length for a trace is 5 metres.

- A cable is never to be attached to a glider unless the pilot specifically requests it. The appropriate ring is inserted into the glider's towhook, the "belly" hook being used for winch launching, the pilot opening the hook to facilitate this. The hook's ability to release under some tension is required to be checked before the first flight of each day.
- Belly-hooks are required to have an automatic over-ride or "back-release" mechanism fitted. This protects the glider in the event of failure to release when the pilot pulls the yellow handle. It does so by sensing the downward force on the hook and opening a back-releasing "cage" when an angle of just over 75 degrees to the horizontal is achieved. It is checked before the first flight of each day, by pulling VERTICALLY downwards under considerable tension.
- Checking a back-release by pulling the cable back towards the tail of the glider is really not searching enough and such mechanisms should not be checked in this way. However, vertical pulls are not always possible on gliders with minimal ground-clearance. All you can do in this case is get the pull as vertical as you can.
- As an absolute last resort, most winches are equipped with a means of cutting a cable, should it fail to release from the glider for any reason. With the reliability of modern tow-hooks and present-day maintenance practices, such action has not proved necessary for many years.



Auto-towing

- For auto (motor-car) towing, everything is the same as for winch-launching, except that some autotow operators use polypropylene or polyethylene rope instead of wire. Parafil rope is another, although expensive, alternative method for autotowing. Such ropes may be used without a drogue or a swivel, although the rest of the equipment will still be necessary.
- As a precaution against the unlikely case of release failure in the glider or loss of control of the vehicle by the driver, the tow-car is required to have a means of releasing the cable.

Aerotowing

- The attachment to the glider is the same in principle as for winch and auto-towing.
- Most gliders these days have a nose-mounted hook specifically for aerotowing. This hook should always be used in preference to the belly hook.
- The weak link on an aerotow rope is normally fitted at the tug end. This protects the glider against overstress on tow and also protects the tug in the event of the rope getting fouled in a tree or power line on the landing approach.
- In this method of launching, the distance between the glider and the towing aircraft is not great and in most cases the pilots of both aircraft can see each other. In spite of this we will ensure that we give clear signals to the tug-pilot so as to avoid confusion and keep the operation completely safe.
- As stated previously, all launch signals (apart from "Stop") originate from the pilot and no signals can be given unless the pilot has authorised them. So, we will assume the pilot has

checked that all is clear for take-off and authority has been given to the wingtip holder to give the "take up slack" signal. The wingtip holder waves one arm to and fro in an underarm motion and keeps doing it while the slack is being taken up.

- This signal is relayed to another signaller standing forward and to one side of the tug aircraft. This signaller, who is easily visible from the cockpit of the tug, repeats the take up slack signal and the tug moves slowly forward to tighten the rope.
- When the rope is tight the wingtip signaller gives the "all out" signal, which is an over arm wave.
- This signal is also relayed to the tug pilot by the forward signaller and tug pilot applies power to the engine to continue the take-off.
- The forward signaller may be omitted when using tugs with good all-round visibility and all involved in the launch are satisfied that safety is not being compromised. If the launch needs to be stopped for any reason, the wingtip holder shouts "Stop", puts the wingtip down on the ground and raises both arms above the head.
- When the pilot hears the word "Stop" being shouted, immediately pull the release knob to release the rope. Meanwhile the forward signaller repeats the stop signal by raising both arms above the head and the tug pilot stops the take-off. It is obvious that the pilot needs the left hand to be near the release knob during the take-off, so hand signals from the cockpit should not be used, as they are a major distraction.

FLIGHT EXERCISES FOR THIS UNIT

There is no flight exercise for this unit. Your instructor will show you the launch operation and explain the actions of the launch crew.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- Initially learning the names for various components of the glider and equipment.
- Remembering the checks and processes for launching the aircraft.

HOW DO YOU DEMONSTRATE COMPETENCE?

You demonstrate competence in this unit by being able to:

- Safely move the glider on the ground and it tie it down
- Explain and demonstrate the standard ground signals
- Correctly perform the wing-runner and launch crew duties to launch a glider without guidance.

RESOURCES & REFERENCES

Australian Gliding Knowledge. Pages 83 to 99.

Theory Briefing: Ground Handling & Signals in Theory Lesson 1

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Who can stop a glider launching sequence when something is not right?
2. When manoeuvring a glider on the ground can you push on the tail?
3. What is the minimum length of rope attached to a car when towing the glider?
4. What are the three standard ground handling signals?
5. How should a wing-runner hold the aircraft’s wingtip when performing a launch?

Gliding Australia Training Manual

Pilot Guide

Unit 3

Pre-Flight Preparation

WHAT THIS UNIT IS ABOUT

To

- Develop, obtain and interpret required pre-flight information; and
- perform the outside and cockpit pre take-off checks.
- apply standard checks reliably and thoroughly, by rote or by reference to a checklist, without undue delay.

A basic understanding of the parachute is also required if these are used.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- Nil

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- Nil

KEY MESSAGES

- Become familiar with Pre-flight briefing material.
- A sterile environment is required when checks are conducted. If interrupted start again.
- Follow approved checklists and call all checks out loud.

PILOT GUIDE FOR THIS UNIT

Pre- Flight information

- Your trainer will indicate to you that it is vitally important to obtain the weather and aeronautical information before flying to determine which runway to use and ensure that the weather and other conditions are suitable for your type of operation.
- The weather and other information can be obtained through NAIPS which is a government aviation site providing up to date information for pilots. You will also be shown other sites such as “Windy” weather” and on the GFA site a weather prediction purely for gliders indicating how high and far you could possibly fly on that hday.
- You will be shown your local airfield layout, training areas, airspace boundaries, circuit directions and safe landing areas in case of launch failures.

Aircraft documentation and Cockpit Safety

You will be shown in a parked glider the following information. You will be expected to access this information as you perform a pre-flight inspection of your glider.

Airworthiness Documentation

- All gliders are certified as airworthy with the issue of a Certificate of Airworthiness (C of A). There is a requirement to conduct an annual inspection by authorised people. When deemed airworthy from the inspection, a Maintenance Release is issued, which is carried in the cockpit of the glider (see below).

The Maintenance Release

- This document certifies that the glider is being maintained in accordance with GFA requirements. It also validates the C of A or Permit to fly of the glider. It is issued by a GFA- qualified inspector and is renewed on completion of the relevant inspection. If a Maintenance Release is present in the glider and is within its validity period, the glider is legal to fly. Check this before flight.

MAINTENANCE RELEASE PART 1	Aircraft Type		Registration Marks VH -
In accordance with the GFA Manual of Standard Procedures this Maintenance Release is issued following the completion of an inspection certified on the GFA Form 2 dated			........../......../..........
Issued by: (Organisation)		Valid from First light on	........../......../..........
Signed by: (Person)	1109 G:	Valid until Last light on	........../......../..........

RETURN TO SERVICE – FLIGHT REPORT

Before return to general service an experienced pilot must conduct a check flight and sign below that the flight characteristics are normal. Check for general handling, trim, abnormal buffering within the flight envelope.

LOW SPEED ☐ Stalls, Spins, Trim, Abnormal wing drop etc.

HIGH SPEED ☐ Handling, Trim etc, Up to VNE

Pilot's signature: .... Date: ..../........./..........

MAINTENANCE

This Maintenance Release is issued subject to the following conditions:

1. A Daily Inspection as detailed in the GFA Manual of Standard Procedures shall be performed on the aircraft each day before flight *and following any re-rigging occurring at any time.*
2. Maintenance required during the validity period of this Maintenance Release shall be performed.

- Although it may be legal to fly, the glider is not necessarily airworthy to fly. For example, it may have suffered a heavy landing on its last flight the previous day and there may be damage present which, for some reason, the last pilot did not report and did not enter into the Major Defects section of the Maintenance Release.
- It is therefore a requirement for a glider to receive a Daily Inspection by a qualified person before it is allowed to fly on any given day.
- Each pilot flying the glider must check that the Daily Inspection has been carried out, before carrying out his own walk-round inspection prior to flight.

The Daily Inspection Record (GFA Form 1)

- This is used to certify that a glider has received a Daily Inspection from a suitably qualified person. Check that the correct date appears alongside the Inspector's signature. If the correct date does not appear there, do not fly the glider - make some enquiries.
- The Maintenance Release and the Daily Inspection Record are contained in the same common booklet, which is kept in the glider at all times. It is a very important document and forms the link between the inspector who looks after the airworthiness of the glider and the pilot who flies it.

DAILY INSPECTION RECORD **GFA FORM 1**

A signature and authorisation number on this form certifies, in accordance with the GFA Manual of Standard Procedures that at the start of a day's flying and after each rigging a Daily Inspection has been performed and the glider is considered fit for flight. INDEPENDENT CONTROL CHECK, Two consecutive independent signatures are required after controls have been disconnected and reconnected.

Signature and Authorisation Number	Date and Time	Signature and Authorisation Number	Date and Time	Signature and Authorisation Number	Date and Time
1		8		15	
2		9		16	
3		10		17	
4		11		18	
5		12		19	
6		13		20	
7		14		21	

The daily inspection is carried out before the first flight of the day. On each subsequent flight, the pilot must carry out a pre-flight inspection/check. See Pre-Boarding checks on Page 3.f

Glider Limitation Placards

- A typical glider speed and manoeuvres limitations placard appears below: -

Rolladen Schneider LS4a *neo* Sn.4312 VH-HDI

Limiting Speeds			Limiting Weights	W&B 12/06/2020
Max Smooth Air	VNE	151 kts	Min Solo Pilot	80 kg
Max Dive Brakes	VD	146 kts	Max Solo Pilot	110 kg
Max Landing Gear	VLO	146 kts	Max Fuselage Load	123 kg
Max Rough Air	VRA	103 kts	Max Take off Dry	370 kg
Max Manoeuvring	VA	103 kts	Max Take off Wet *neo*	505 kg
Max Aerotow	VT	103 kts	Max Water Ballast	160 kg
Max Winch	VW	76 kts	Max Weak Link	600 kg
Acrobatic Flying	Not Permitted		Airframe Empty Weight	260 kg

The permitted aerobatic manoeuvres will also be displayed, either on the same placard or on a separate one alongside. The maximum (and possibly the minimum) weak link strength will be displayed, internally on the placard and externally next to the release hook(s).

Weight and Balance

As well as observing placarded speed and manoeuvre limitations, a glider also has to be operated within strict limitations of weight and balance. A pilot must be thoroughly familiar with these limitations on each glider he flies.

The following basic definitions are relevant: -

Empty weight - the glider's empty weight, equipped to fly, without pilot, parachute or removable ballast.

Gross weight -the maximum flying weight.

Maximum pilot weight - the heaviest pilot with parachute that can be accommodated without exceeding gross weight or moving the CG out of limits

Minimum pilot weight - the lightest pilot with parachute that can be accommodated without fitting removable ballast

Removable ballast - Lead or steel blocks or cushions which can be fitted and secured in order to bring a pilot up to the minimum pilot weight.

CG range - the range of movement of the centre of gravity, presented to the pilot in terms of a maximum and minimum pilot weight. In the case of two-seaters, a sliding scale is often used in order to take into account the varying weights in each cockpit.

A typical weight and balance placard is shown below:

Payload (Pilot & Parachute) - Twin Astir		
Maximum flying weight	650 kg	1435 lb
Minimum front cockpit for all flight	70 kg	154 lb
Maximum load front	110 kg	242 lb
Maximum load back	110 kg	242 lb

- The maximum permitted weight must not be exceeded. The maximum pilot weight is important too, because it is likely that if it is exceeded the glider will be flown outside its forward CG limit. This may make it impossible to trim the glider to minimum sink speed and could make it difficult to flare the glider on the landing. More seriously, it could also result in the maximum calculated flight loads on the tailplane being exceeded.
- The consequences of flying a glider outside the aft CG, that is with too light a pilot, are even more serious and could result in loss of control. The implications of flying a glider outside the aft CG limit are as follows.
    - It will be unstable in pitch and possibly uncontrollable.
    - It may be difficult or impossible to trim to a safe speed near the ground.
    - If a spin is deliberately or accidentally entered, it may be impossible to recover.

NEVER fly a glider below its minimum pilot weight. If your weight is marginal and you are not sure whether you are quite heavy enough, add some ballast.

Daily Inspections – Purpose

- You are not expected to perform a daily inspection on a glider at this stage of your training. Daily Inspection is covered in Unit 42 - Daily Inspection, Pilot Maintenance Limits, DI certificate and requires you to be trained and authorised
- You will observe your instructor performing a daily inspection and you will progressively be invited to participate in some aspects.
- There are five reasons for carrying out a Daily Inspection:
  1. To check for progressive deterioration caused by fair wear and tear.
  2. To check for unserviceability's or sudden deterioration which fall outside the category of fair wear and tear.
  3. To check for unreported damage.
  4. To check that the glider is correctly rigged and the control circuits are properly connected and locked.
  5. To check that there are no tools or other loose objects lying around after maintenance.
- When carrying out a DI, it is sometimes difficult to work out how far to go, how deep an inspection to do. Using the above five points as a guide, the answer is to go deep enough to satisfy your curiosity as to whether the glider can safely fly, without going to the extent of starting to overhaul it.
- A DI is basically a visual inspection, using only those tools which are necessary to gain access to essential parts of the structure, such as wing roots or underneath nose fairings.

Basic Glider Instruments

The instruments fitted to training gliders are usually quite simple, although single seaters can be more elaborately equipped, especially those used for competitions. A brief description of basic glider instruments, together with their principles of operation, follows.

The Altimeter

This instrument is simply an aneroid barometer, converted to read in feet instead of hectopascals of air pressure. Since an increase in height results in a decrease in air pressure, there is a direct relationship between the two and this can be shown clearly to the pilot.

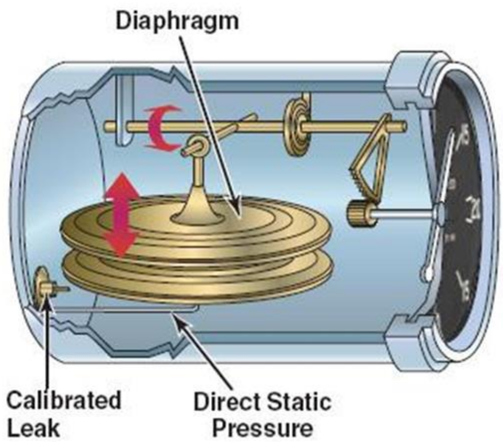
- Most altimeters fitted to gliders are of the so- called "sensitive" type, which means that they have more than one hand, the better to show accurately the thousands and hundreds of feet at which the glider is flying.
- Similar to an ordinary domestic clock display, the large hand shows hundreds of feet and the small hand shows thousands. Many glider altimeters are of ex-military stock, purchased through disposals stores, and some of these have a third, very small, hand which shows tens of thousands of feet.
- Altimeters have a "sub-scale", on which can be set the barometric pressure, using the little knob provided for the purpose. This can complicate the use of the altimeter and at this point it is best to refer to the chapter on altimetry in the GFA publication "Airways and Radio Procedures for Glider Pilots".

The Airspeed Indicator (ASI)

- This instrument uses the pressure built up in front of the pitot head to move a needle around a dial, thus displaying the glider's speed through the air. The diagram explains how it works. Note that the pressures being handled by airspeed indicators are quite subtle and excessive pressure applied to the instrument through the pitot head will cause damage.
- Do not blow into pitot heads until properly taught how to do so when training to become a Daily Inspector. If you see anyone blowing into pitot heads (some people don't seem to be able to resist it), suspect that the instrument has suffered and report it to somebody.
- In the lower levels of the atmosphere, where most training gliders operate, the airspeed indicator is relatively free from serious errors. However, the reduced pressure and density of the air at higher altitudes results in errors progressively creeping in.
- For information on these errors, refer to the "indicated airspeed and true airspeed" section the GFA manual – Basic Sailplane Engineering - in Chapter 7, Basic Airworthiness.

The Variometer

- Arguably the most important instrument in a glider, with the possible exception of the seat of the pilot's pants, the variometer is a very sensitive instrument for measuring rate of climb and descent. In its basic form, it works by measuring the rate at which air flows into and out of an enclosed container, which is a flask of standard .45 litre capacity. The air flowing in and out of the flask moves the needle in an up or down direction to indicate to the pilot whether the glider is climbing or descending.
- As the glider climbs in a thermal, it is moving into air of decreasing pressure. In order to equalise the pressures inside and outside of the flask, air flows out of the flask and passes through the instrument on its way. In doing so, it moves the needle to an "up" indication, by means of suitable linkages. The opposite happens when the glider descends into regions of increasing pressure.



Electrical Systems

Most gliders have an electrical system. Each glider will vary with its equipment and power demands. Your instructor will show in your glider the relevant system and how to fit the battery and turn the system on.

Cockpit Safety

Your instructor will demonstrate in your type of glider:

- entering and exiting the cockpit safely;
- fitting, adjusting and unfastening the seat harness;

- adjusting the seating position to give adequate lookout and easy access to all controls.
- canopy operation, canopy jettison system.
- ventilation controls and their operation.

It's important that you know how to hold the control column without activating the push to talk button and how-to takeover and handover control.

Pre-Boarding checks

- It's vital that we perform checks before we take off to ensure we have a safe flight.
- These checks have been developed by the GFA to cover all glider operations and must be performed before launching.
- There are checks to do before we board and then checks to complete when strapped in the cockpit.
- The GFA pre-boarding checks are ABCD which stand for:

A -Aircraft. Walk around check for damage and defects. Maintenance release checked, including DI validity.

B- Ballast. Glider loading is within placarded limitations and trim ballast, if required, is secure.

C- Controls. Check the controls, including airbrakes and flaps, for correct sense and full deflections.

D-Dollies. All dollies and ground handling equipment removed.

Pre-Takeoff checks

Once we are in the cockpit and strapped in we conduct the pre-take-off CHAOTIC Checks which are:

C-Control Access Seat adjustments are secure and positioned to allow for comfortable access to all flight controls, switches & knobs and the tow release. Rudder pedals positions are adjusted.

H-Harnesses Secure the harness, lap-belt low on hips, for all pilots.

A-Airbrakes & Flaps Watch as airbrakes are cycled and set for launch, or closed and locked. Where they're fitted, flaps set as required for take-off.

O-Outside Options Airspace and take-off path are clear. Wind velocity and direction checked. Enough competent ground crew are available. Note the glider's critical speeds for the launch method and safe speed near the ground. Have emergency plans in case of launch failure.

T-Trim Correct ballast is confirmed. Trim set as required.

I-Instruments Altimeter is set, other instruments are reading normally with no apparent damage. Radio is turned on, volume up and set to the correct frequency.

C-Canopy Closed and locked

C-Carriage Undercarriage is locked down

C-Controls Checked for full and free movement.

C-Cable Hook on

Distraction can be a killer if the pilot is interrupted during these checks, so we have what's called a **"Sterile launch point environment".** This means the pilot should not be interrupted during this process but if the pilot is interrupted then the checks must be started again.

Parachute Operation

Generally, pilots will wear parachutes when flying to provide protection in the case of mid -air collisions.

Some clubs when training in twin seat trainers will not require their use.

Your instructor will at an appropriate time demonstrate to you how to:

- Confirm the parachute serviceability.
- Operates all adjustments straps to fit securely.
- Adjust the straps to correct tension and will
- Describe steps to deploy parachute in an emergency.

FLIGHT EXERCISES FOR THIS UNIT

- No flying for this unit, but you will experience many aspects that have been covered here in your first flights

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- There are many items and procedures to learn in this unit. You are not expected to have learnt all these procedures on day one! As your flying progresses you should be able to come to terms with these items before your first solo.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Obtain a weather briefing
- Pre-flight a Glider which includes inspecting documentation and fitting ballast.
- Operate the aircraft systems.
- Prepare cockpit and perform the pre-flight checks.
- Prepare and fit a parachute if your club uses these in your training glider.

RESOURCES & REFERENCES

- Australian Gliding Knowledge pages 91 – 95

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What ballast will you require in the cockpit for you to comply with the weight limits for your training glider. What must you do if there is too much or too little in the cockpit.
- What are the checks that must be performed in the cockpit before Take-Off.
- How can you confirm that your glider has had a Daily Inspection.
- What is the purpose of the variometer instrument?

Gliding Australia Training Manual

Pilot Guide

Unit 4

Orientation and Sailplane Stability

WHAT THIS UNIT IS ABOUT

To:

- develop the knowledge and skills required to orient yourself in the three- dimensional flight environment in the local area;
- gain an awareness of the glider's inherent stability; and
- develop an understanding of terminology to be used in future training units.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 3 Pre-flight Preparation.

COMPLEMENTARY UNITS

- Theory Course TL1

KEY MESSAGES

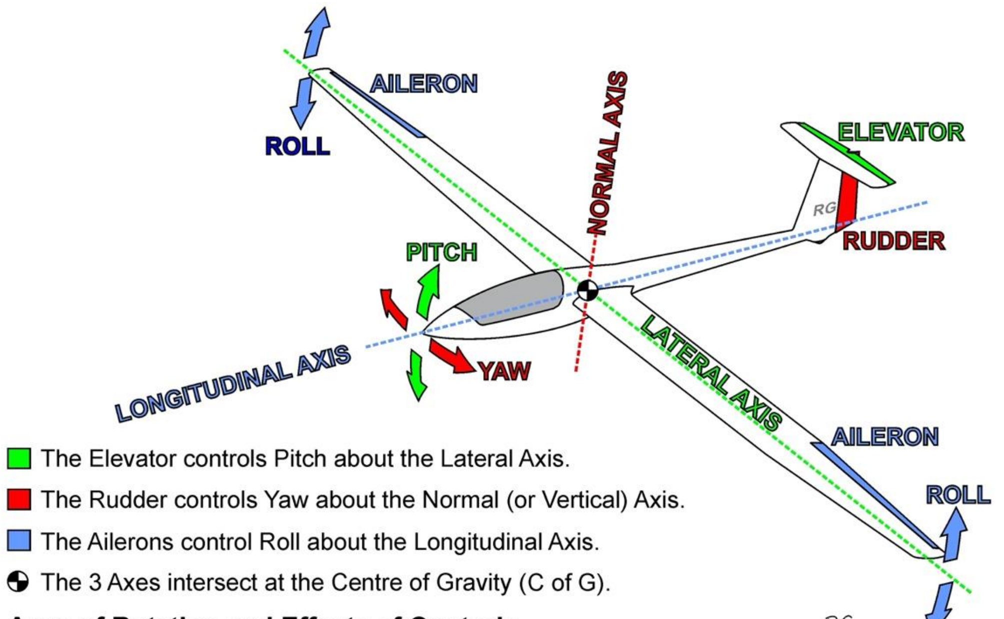
- Lookout and Visual orientation in the air is an essential skill.
- The horizon is our primary attitude reference.
- The glider is a stable platform; it will fly hands off at a particular attitude, in a straight line or shallow bank angle.

PILOT GUIDE FOR THIS UNIT

Your instructor will show you that modern gliders are designed to be both stable and controllable. Stability can be explained as follows. If a glider is in straight and level flight and the pilot takes his hands and feet off the controls, the glider will fly on by itself, and if disturbed, the glider will tend to recover automatically. If the glider is disturbed by a gust or turbulence, it also tends to return to a stable trim or speed without any input from the pilot.

Glider Stability

We now need to know how the aircraft flies and its controls. Below is a diagram of the flight controls and axes of rotation.



Axes of Rotation and Effects of Controls

- There are three axes of control. We can control the glider in the pitching plane, about the lateral axis between the wingtips, where the nose goes up and down.
- We can control the glider in the rolling plane, about the longitudinal axis between the nose and tail, where the wings are banked left or right.
- We can control the glider in the yawing plane, about the vertical axis up and down, where the nose moves left or right.
- The glider has some positive stability in pitch; the nose will gradually return to a normal flying attitude.
- The glider has neutral or positive stability in roll; the wings will tend to remain at a constant bank angle until disturbed.
- The glider has strong yaw stability; the nose will move quickly back to the direction of flight.
- The glider is controlled in the pitching plane with elevator, in the rolling plane with aileron, and in the yawing plane with rudder.

Attitude

- The elevator is the only speed control on a glider. As a glider's speed changes, you may notice a change in noise level in a training two -seater but in a high-performance glider the change in air noise may be slight.
- The airspeed indicator inside the cockpit will tell how fast the glider is flying but as your flying progresses, you will notice most of your time will be spent looking outside when manoeuvring the glider so we need an alternative source of airspeed indication.
- Your instructor will show you that as the glider pitches nose up or nose down under the control of the elevator, the distance between the horizon and the nose changes very visibly. This change has a direct relationship to your airspeed.
- The position of the nose of the glider relative to the horizon, or more correctly, the angle of the glider's fuselage to the horizon is known as "Attitude".

- It is this “attitude” that glider pilots use to determine their airspeed.

See Figure 7 below.

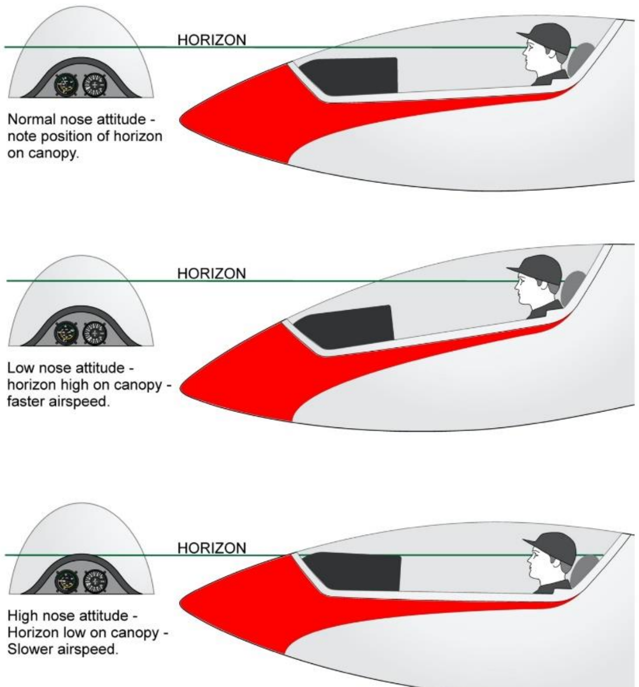
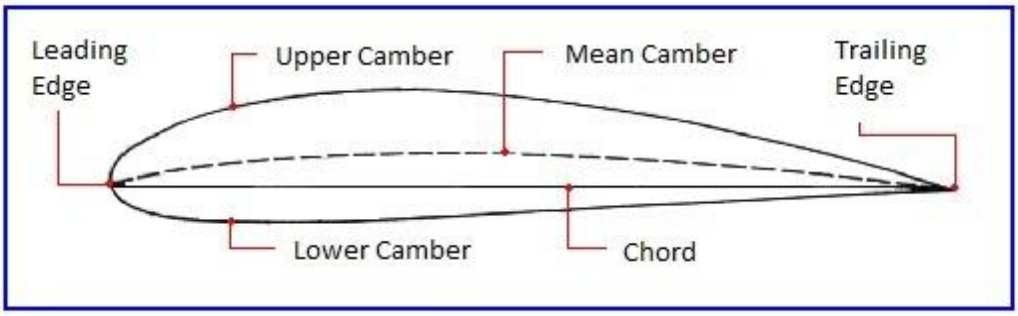


Fig 7. Pitch Attitude

Lift

The diagram below shows a cross section (aerofoil) of the wing of the glider.



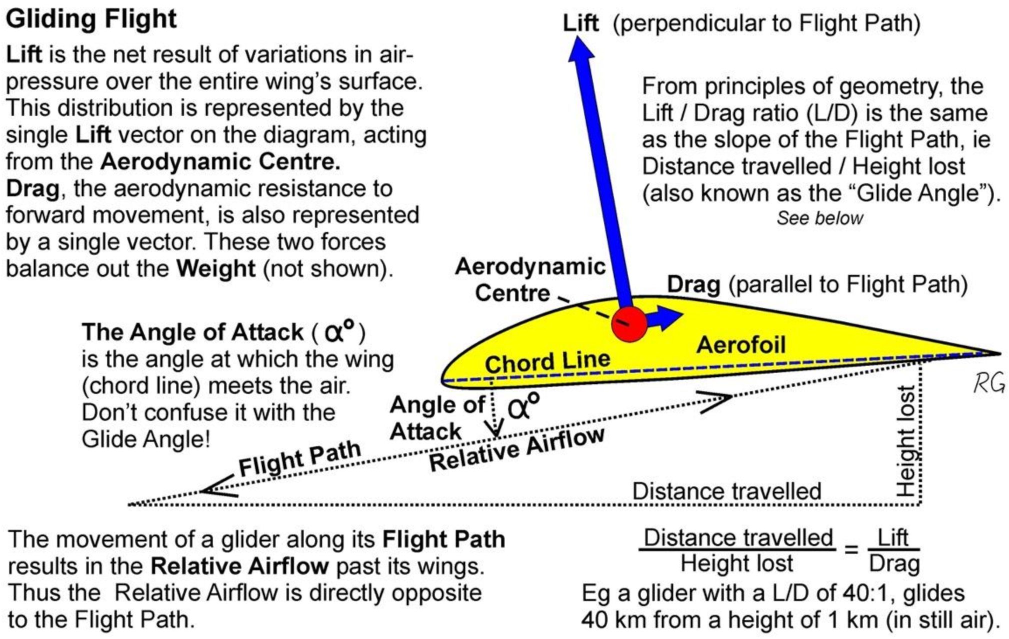
A wing produces lift in a number of different ways.

- The actual shape of the wing encourages a speeding up of the airflow over the cambered top surface. This in turn results in a lowering of the pressure over the top of the wing (Bernoulli's theory), in effect causing a “suction” upwards. Generally speaking, the thicker the wing and the more pronounced the camber, the more lift will be produced at a given speed.
- Lift is a reaction force and an aerofoil deflects the air as it passes. Since the aerofoil must exert a force on the air to change its direction, the air must exert a force of equal magnitude but opposite direction on the foil (Newton's laws of motion).

- Speed of the wing through the air is also a factor; the faster the speed, the more lift is produced.
- The angle at which the wing meets the air also plays a part. This angle, known as the Angle of Attack (AoA), has an important effect on the amount of lift produced by the wing.
- A symmetrical aerofoil will generate zero lift at zero angle of attack. But as the angle of attack increases, the air is deflected through a larger angle and the vertical component of the airstream velocity increases, resulting in more lift. For small angles a symmetrical aerofoil will generate a lift force roughly proportional to the angle of attack.

The diagram below shows the terminology used when explaining the lift and drag forces when flying.

Your instructor will enlarge on this diagram before you go flying.



FLIGHT EXERCISES FOR THIS UNIT

- As this will be your first flight your instructor will point out the local features, including the airfield. This will include the boundaries of the local flying areas which can be identified by maps and charts.
- The instructor will also show you how far the glider can travel from the airfield and safely return to give you an appreciation of the glide angle.
- It's also important to notice how stable the aircraft is when flying. You will also have your first feel of the controls but the main purpose is to enjoy the experience of glider flying.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

As its your first flight and the aircraft will be turning you may lose your bearings.

To overcome this, keep your head outside the cockpit and keep track of a prominent feature such as a town or your airfield.

HOW DO YOU DEMONSTRATE COMPETENCE?

In your next few flights you will be able to identity key landmarks, and demonstrate a relaxed control of the glider.

RESOURCES & REFERENCES

Australian Gliding Knowledge pages 35-42

Theory Lesson 1 – Orientation and Stability section

Gliding Australia Training Manual

Pilot Guide

Unit 5

Primary Effects of Controls

Unit 5 - Primary Effects of Controls

WHAT THIS UNIT IS ABOUT

To:

- develop effective reference to the horizon for controlling aircraft attitude;
- explain the primary effects of controls in both their aerodynamic effect and their effect on the airframe;
- demonstrate use of controls to vary pitch, bank angle and yaw.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC 1 – Lookout Awareness
- GPC 4 – Orientation and Sailplane Stability

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

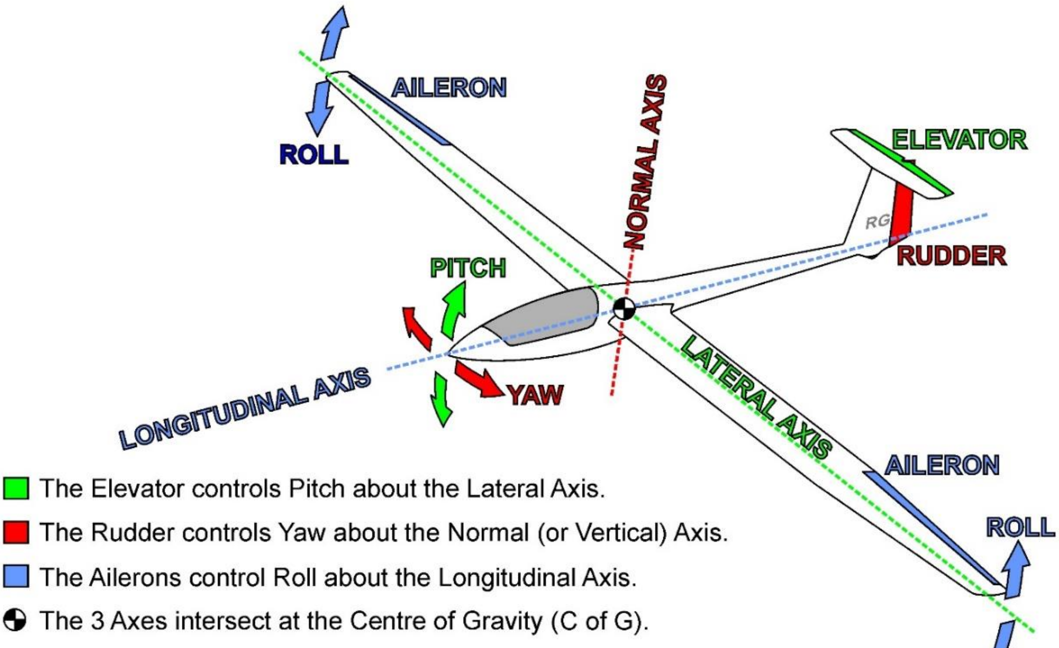
- Nil

KEY MESSAGES

- The aircraft is a stable platform with three axes around the Centre of Gravity – the flight controls provide rolling movements along each axis.
- Fly the aircraft by attitude, our primary attitude reference is the horizon.
- Different amounts of force on the controls will result in different rates of effect on the aircraft.
- Elevator is used to exert change in aircraft pitch - changing airspeed. Ailerons are used to exert change in aircraft bank – creating a roll. Rudder is used to exert change in aircraft yaw.

PILOT GUIDE FOR THIS UNIT

- As the glider flies it can rotate about any of three axes as shown in the following diagram.

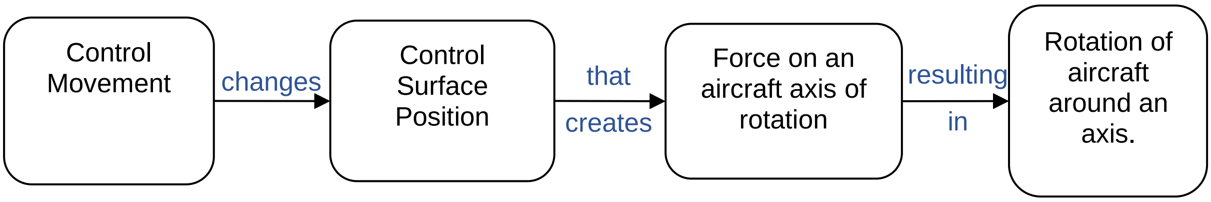


Axes of Rotation and Effects of Controls RG

- A glider in flight is a stable platform which can be readily controlled. The aircraft we use will fly in a stable manner. Without any external force applied in free flight the aircraft will continue to fly. This applies whether the aircraft is flying straight and level or in a banked turn.
- This stability means it requires a force to move the aircraft in any of these axes.
- The primary controls of a glider provide the ability to exert a force on the three axes. These controls and effects are the same as any other conventional aeroplane. The elevator and ailerons are controlled by the stick. The rudder is controlled by the rudder pedals. Whilst there are other controls in the cockpit, this unit concentrates on these three.
- Each of the primary flight controls in the aircraft link to an aircraft control surface.
    - The elevator is connected to the control column’s forward and aft movement.
    - The ailerons are connected to the control column’s side to side movement.

  - The rudder is connected to the rudder pedals.

- Different amounts of force on the controls will result in different rates of effect on the aircraft. If we use a lot of force on the control we get a large control surface movement and therefore a large amount of rotation on the aircraft axis that it effects. Conversely a small amount of force results in a small effect.



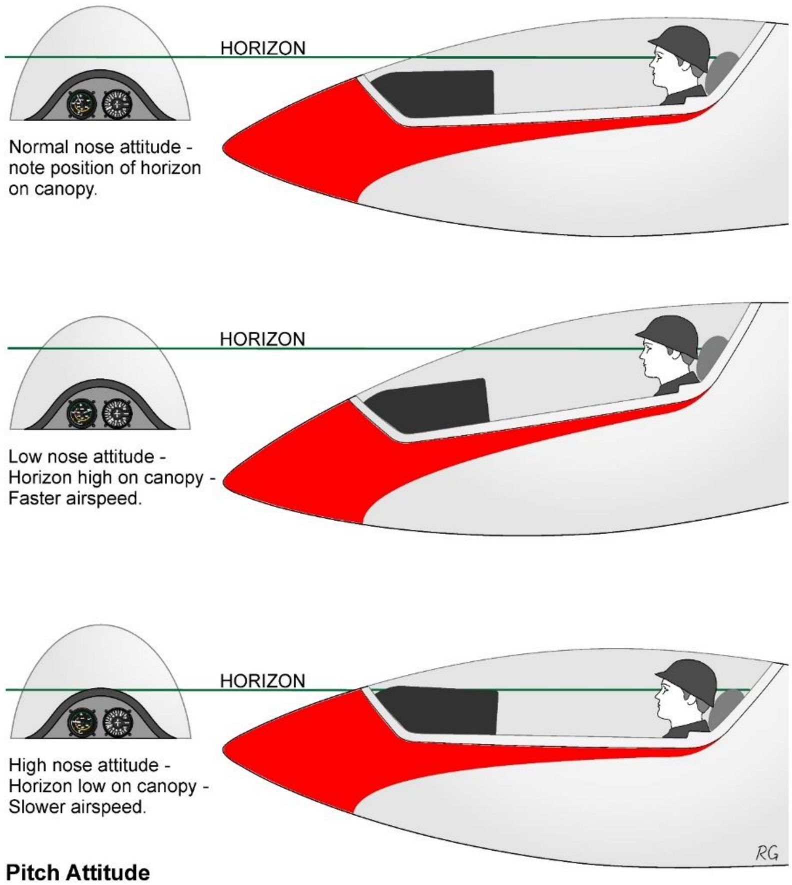
- The rotation of the aircraft in each axis is around the Centre of Gravity (C of G) of the aircraft.

Our Reference – the Horizon

- Before discussing the effects of controls, we need a reference point that can be used to consider their effects in flight.
- This reference point is the view of the horizon in front of the aircraft. As the aircraft moves the horizon will move as well.
- Glider pilots use the horizon as an important reference point for flying and your instructor will continually refer you to it.
- Using the horizon as a reference also focusses the pilot’s attention outside of the cockpit which has benefits in maintaining overall situational awareness and collision avoidance.

Elevator

- The effect of the elevator is to control the pitch of the glider. Firstly, the glider is placed into its correct attitude with respect to the horizon. “Attitude” is the standard gliding term used to describe the position of the nose in relation to the horizon. When this is done, we have our “stable platform” referred to earlier. The illustration following shows how this appears from the cockpit of the glider.



Pitch Attitude

- First observe the effect of the elevator. Hold the stick lightly in the right hand and move it smoothly forward. Look ahead at the horizon while doing this and it will be observed that the nose will go down below the previous attitude. The sound level in the cockpit increases as the speed builds up, due to the increase in speed of the airflow past the cockpit. During training, this sound level is an important clue to changing speed in a glider. The increase in speed is confirmed by a glance at the Air Speed Indicator (ASI).
- Still looking ahead, the stick is brought smoothly back and the nose will come up (horizon falls). The airflow noise will decrease and a glance at the ASI shows that the speed is decreasing. See below.
- The elevator controls the attitude of the glider and therefore controls its speed. If the nose is low, the glider dives and the speed is high. If the nose is high, the glider flies slowly.
  - Stick forward, nose down, speed increases.
  - Stick back, nose up and speed decreases.
- This is the only effect of the elevator. In a glider the elevator changes the aircraft's attitude, and ATTITUDE = SPEED.

Ailerons

- The effect of the ailerons is to control the bank or roll of the glider. Starting at the stable platform again, the stick is held lightly in the right hand and moved smoothly to the left. The left wing will go down and it will keep going down if the stick is kept over to the left. If the stick is brought back to the central position (this is called "centralizing" the stick) the glider will stay banked over to the left - it will not return to the wings-level position of its own accord. If the pilot wants to get the wings level, the stick has to be moved in the opposite direction, in this case to the right. When this is done, the glider will start rolling to the right until it reaches the level position. The stick is then once again centralized and the glider will remain steady with its wings level. The glider is back at the stable platform.

- It will be obvious that the same principles apply to banking to the right.
- To recap, stick to the left and the glider banks to the left. Stick to the right and the glider banks to the right. The glider does not return to the level position when the stick is centralized - it stays at the bank angle chosen by the pilot. The stick needs to be moved in the opposite direction if the pilot wants to return the glider to level flight.
- The primary effect of the ailerons is to bank or roll the aircraft.

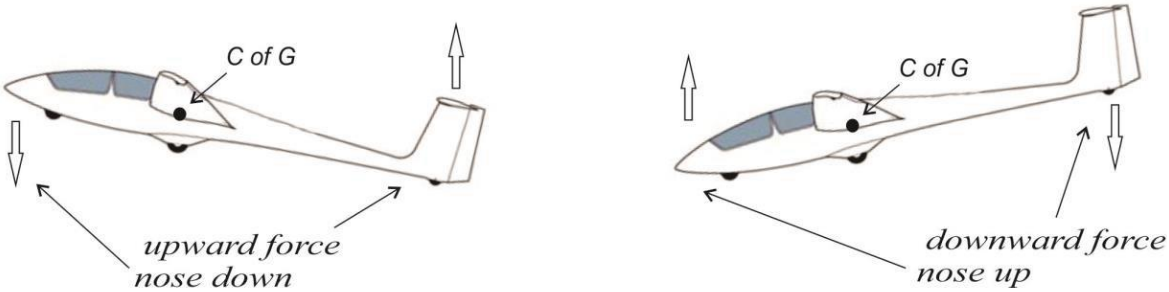
Rudder

- The effect of the rudder is to control the yaw of the glider. Once again we start at the stable platform. Moving the right rudder-pedal forward (which naturally causes the left one to move back) results in the nose of the glider yawing (swinging) to the right.
- One thing that is noticeable is that, when rudder is applied, the nose will only swing so far and then it will stop. This is because the rudder has only a limited ability to yaw the glider before it comes up against the yaw stability provided by the fin. Even though the rudder-pedals are kept deflected, the nose will only yaw so far and no further. This is the first clue that the rudder is not the control which turns the glider. The primary turning control is the aileron, not the rudder.
- There is usually not much need for a pilot to yaw the glider during flight, although there might be some need to use the rudder to PREVENT yaw, in rough air for example. The really useful purpose of the rudder is to act as a helping or "balancing" control to cancel out the adverse yaw caused by the aileron drag which will be shown in the next unit.
- This use of rudder in combination with the ailerons is known as "coordination". The coordination of your feet and hands is a very important part of learning to fly gliders.

Glider Stability and Control

- These two words “stability” and “control” are very important when talking about any aeroplane, and gliders are no exception. Stability means that the glider must be able to fly for short periods of time without the pilot touching the controls. If it can do this, it means it is a good safe design which will not be too difficult or demanding to fly. Control means the opposite of stability - it means that the glider should be manoeuvrable about all of its three axes of movement (pitch, roll and yaw), using its controls.
- If a glider is too stable, it is not very manoeuvrable and is tiring to fly. If it is not stable enough, it is difficult or even dangerous to fly. The designer has to produce a glider with just the right amount of each of these qualities so that it is stable enough to allow us to take our hand off the stick (to unfold a map, for example) without changing our flight path very much, yet still be very manoeuvrable when we want it to be.

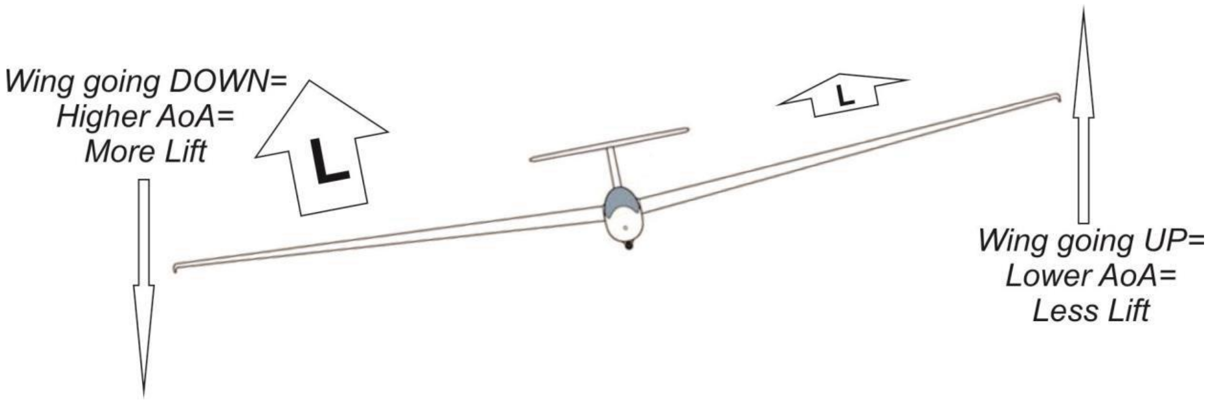
Longitudinal stability or stability in the pitching plane



- The diagram above shows that the tailplane (or horizontal stabilizer) is like a small wing placed at the rear of the glider. This is exactly what it is, and it will produce an upward or downward force to make the nose go back to where the pilot originally put it, if it should get moved from that position for any reason. If the nose tries to go up, the tailplane forces it back down again. If the nose tries to go down, the tailplane makes it go up again. Pitch positive stability in gliders is provided by the tailplane.

Lateral damping and Lateral stability, or stability in roll

- Stability in roll, known as lateral stability, is best considered in two parts.
- The first part is when the glider is rolling or banking, either because it has been tipped by a gust or because the pilot has made it roll. When the glider rolls, there is a difference in the amount of lift produced by each wing. The wing going down will produce more lift than the wing coming up, because of the difference in their angles of attack. This tends to reduce the rolling motion or "damp" the rolling of the glider and for this reason is known as lateral damping. Lateral damping is a very important factor in roll stability and it is always present as long as the wing is not stalled. If a stall occurs, lateral damping can be lost See unit 12 and Unit 18..
- The second part of lateral stability comes into effect when the glider has stopped rolling and is stuck at a particular bank angle. A combination of dihedral effect of the wings and pendulum effect of the fuselage will help restore the glider back to level flight. The diagram following illustrate both effects.



Directional stability or stability in yaw

- Stability in yaw, known as directional stability, is provided by the fin. When a glider yaws, the airflow blows against the side of the fin, producing a force which pushes the glider back into straight flight. This is similar to the behaviour of a weathercock on a church steeple, and in fact this kind of stability is known as directional positive stability.

How Aircraft Controls are Used

- It was mentioned earlier that the rudder may be used to prevent yaw developing, as well as to actually produce yaw. This principle is in fact true of all the controls in their respective axes of operation:
- Elevator is used to change (or to STOP a change) the pitch of the aircraft, thus changing its airspeed.
- Ailerons, suitably coordinated with rudder, are used to change (or to STOP a change) to the aircraft's angle of bank that creates a turn.
- Rudder, as well as being used in coordination with ailerons, is used to change (or to STOP a change) to the yaw of the glider.

For example, rough air can cause changes in nose attitude or bank angle and the appropriate control can be used to resist this unwanted change.

FLIGHT EXERCISES FOR THIS UNIT

Hand-over/take-over Procedure

- It is essential to set the pattern for a formal hand-over/take-over procedure between trainer and student, to eliminate confusion over who has control at any one time.
- Whatever expression is used ("your aircraft/my aircraft" is quite satisfactory) a formal procedure must always be followed. Similarly, whatever expression is used it must receive a response. Your Trainer will demonstrate this essential procedure. This formal hand-over/take-over procedure must NEVER be varied.

Demonstration and Practice

- Your Trainer will demonstrate to you the aircraft stable platform, the use of the three flight controls of the aircraft and how they affect that stability in pitch, roll and yaw.
- You will have the opportunity to use the controls and feel the amount of force required to move them, and the subsequent effect on the aircraft. You will be asked to identify the effect that each control has on the aircraft in terms of pitch, roll and yaw.
- This unit may require several flights to exercise all controls to the point where you become competent in their use.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Solution**
• Looking at glider instruments for input.	You must lookout to the horizon and reference all instructions to aircraft attitude. It is more accurate and a faster response.

• Excessive force is used on controls	Hold the control column with just 2 or 3 fingers.
• Minimal control input used such that effect is difficult to see or there is tentative use of control inputs	The Trainer will demonstrate that smooth and positive control inputs give positive control over the aircraft.
• Failure to return control column to neutral resulting in continued rolling force and continued change to the aircraft's angle of bank.	Learn and practice centralising the controls.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe the need for aircraft controls, and how they are activated from the cockpit and their effect on the aircraft.
- Demonstrate use of the three flight controls individually to control the aircraft in three axes.

RESOURCES & REFERENCES

- Video – Primary Effect of Flight Controls.
- Theory Lesson 2

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What are the three axes of rotation of an aircraft?
- What is the primary effect of the elevator?
- What is the primary effect of the ailerons?
- What is the primary effect of the rudder?
- Through which point do the axes of rotation act?
- How would you increase the airspeed of an aircraft?
- What is the use of the horizon?

Gliding Australia Training Manual

Pilot Guide

Unit 6

Aileron Drag & Rudder Coordination

WHAT THIS UNIT IS ABOUT

To

- explain how aileron drag is generated whilst applying aileron
- describe and demonstrate how aileron drag affects the aircraft;
- demonstrate use of controls to counter the effects of aileron drag resulting in coordinated flight at an angle of bank; and
- describe and demonstrate the secondary effect of rudder.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 5 Primary Effects of Controls

COMPLEMENTARY UNITS

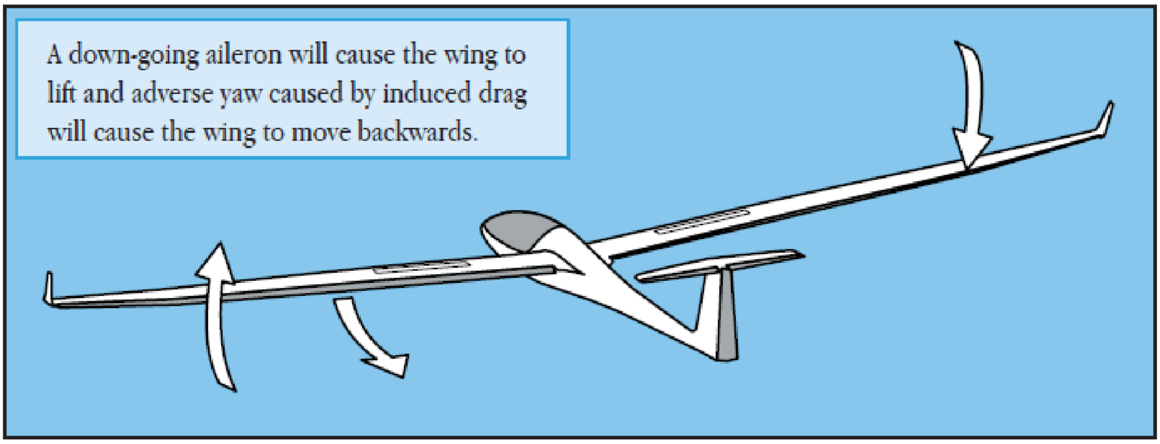
Nil

KEY MESSAGES

- The aircraft is flying in a coordinated manner when there is no yaw on the aircraft (yaw string is centered).
- Aileron drag is produced when the ailerons are used which impacts on coordination.
- Rudder is used to counter aileron drag and maintain coordinated flight.
- When the yaw string is off to the side, the aircraft is not coordinated. ("pull the string to bring it straight")

PILOT GUIDE FOR THIS UNIT

- Because of their long wingspan, relatively large ailerons and generally low operating speeds, gliders suffer from another effect of ailerons which becomes apparent as soon as they are used.
- When the ailerons are deflected to roll the aircraft, we get the results we want because the ailerons change the shape (aerofoil section) of the outer part of the wing. This in turn changes the amount of lift produced by each wingtip. For example, moving the stick to the left moves the left aileron up and the right aileron down. Lift over the left wingtip is reduced and lift over the right wingtip is increased. The glider therefore rolls to the left.



- Unfortunately, an increase in lift at the wingtip brings with it an increase in INDUCED drag, and the effect of this is to YAW the glider in the opposite direction to which it is being rolled. This unwanted yaw is adverse to the direction we want to roll in, and for this reason is known as ADVERSE YAW.
- Adverse yaw, caused by aileron drag, is present on all gliders and cannot be eliminated. Glider pilots must therefore learn how to cope with it.
- Glider designers try to reduce the amount of adverse yaw generated from aileron drag by providing a difference in deflection between the up going and down going ailerons – this is called 'differential ailerons'. Whilst this can reduce the adverse yaw it will not eliminate it. You can see this visually with your instructor by inspecting the use of an aircraft's ailerons on the ground.
- Rudder is used as the "balancing" control to cancel out the adverse yaw caused by the aileron drag.
- Every time the ailerons are used, the rudder is used in the same direction at the same time to prevent the aircraft yawing due to adverse yaw.
- This use of rudder in combination with the ailerons is known as "coordination". The coordination of the feet with the right hand is a very important part of learning to fly gliders.

FLIGHT EXERCISES FOR THIS UNIT

- The instructor will demonstrate the creation of aileron drag by using ailerons to roll the aircraft in flight. You will see how the drag occurs at the upgoing (lifting) wing – creating the drag in the adverse (opposite) direction to the intended roll.
- You will see that the induced drag creates a slip towards the lower wing.
- The instructor will demonstrate the induced drag (and effect) will be more pronounced at lower airspeeds.
- The instructor will demonstrate how rudder is used to counter the yaw created by the aileron drag.
- The instructor will demonstrate how the yaw string is used to indicate the amount of yaw on the aircraft.
- You will be given the opportunity to use the ailerons to create roll whilst also using the rudder to cancel the aileron drag and maintain aircraft coordination.

- Rolling on a point exercise
- Secondary effect of rudder exercise

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Actions required**
• Insufficient rudder used such that there is no, or minimal countering of aileron drag:	• Simultaneous application and removal of rudder force with aileron use. • Refer to the yaw string to check correct amount of rudder is applied. • Rudder often requires more force than that applied to control column –follow instructor through on the controls.
• Student continues to use rudder force when ailerons are returned to neutral:	• Centre the rudder when centering the control column.
• Glider nose swings backwards and forwards	• Ensure you move the rudder in the correct direction in time with the left/right movement of the control column. • Practice with less aileron and slower pace until you get used to it. • Rolling on a point exercise

HOW DO YOU DEMONSTRATE COMPETENCE?

- Ability to use the flight controls to achieve coordinated flight.

RESOURCES & REFERENCES

- Theory Lesson 2

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What is aileron drag?
2. How is aileron drag produced?
3. What is the effect of aileron drag on the aircraft?
4. How can aileron drag be countered?
5. How does the pilot know when s/he has correctly countered any aileron drag?

Gliding Australia Training Manual

Pilot Guide

Unit 7

Straight Flight, Various Speeds and Trim

WHAT THIS UNIT IS ABOUT

To develop the knowledge and skills required to fly a glider in straight flight at a steady speed, in a set direction, with wings level, without slip or skid.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 6 Aileron drag, rudder co-ordination
- GPC Unit 9 Lookout Scan Procedures

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 8 Sustained turns, all controls

KEY MESSAGES

- A relaxed grip on the stick is required to feel the air and effectively fly the glider.
- Airspeed is determined by attitude
- Looking in the distance makes it easier to maintain attitude / airspeed; and heading / track; and Lookout / Scan. Looking inside the cockpit makes it harder to fly
- Select the attitude you want by moving the stick and then adjust the trim to help you maintain that attitude. Do not move the trim to change the attitude.
- A small angle of bank or rudder deflection will cause you to fly away from your desired track

PILOT GUIDE FOR THIS UNIT

Changing speed and Trimming the glider

- Remember the stable platform – the glider will maintain its current situation until it is displaced by a control movement or via air movement.
- If you want to change your airspeed you need to change the attitude, in reference to the horizon, by moving the stick forward (faster) or backward (slower).
- Each attitude corresponds to a specific airspeed, so by remembering the attitude required for any desired speed. E.g. 50kt, 60kt, 70kt, minimum sink speed, best glide speed, circuit speed, you can select the attitude/speed without needing to constantly look at the instrument.
- When you change the attitude, the glider must accelerate and the instrument must register the change, so the Airspeed Indicator takes a small time to show the actual airspeed. When you select the attitude that you want you will need to wait a few seconds before checking what the instrument shows.
- If you fly at 50 knots and want to increase speed to 80 knots you will need to make a definite but smooth attitude change by moving the stick forward to the attitude that you expect will give 80 Knots. Hold this attitude for a few seconds and then confirm that the ASI shows 80 Knots. An additional or correcting control movement may be required.

- If you relax the pressure on the stick the attitude will rise on the horizon and return to the 50 knot attitude and speed (stable platform). If you want to maintain 80 knots you have to hold the forward pressure on the stick, or you can move the Trim lever.
- The **green** Trim lever adjusts the tension on some springs on the elevator mechanism, or it moves a small control surface on the elevator itself (depending on the glider) which re-sets the speed for the stable platform. A bit like a cruise control in a car.
- If you are having to hold forward pressure on the stick to maintain 80 knots then you will need to move the trim lever forward to re-set for 80 Knots. You will feel the reduction in pressure needed and if you set it correctly then you can completely relax your hold on the stick and the glider will be a stable platform at 80 knots.
- If you want to reduce speed to say 60 knots, firstly move the stick backwards to show the attitude you expect for 60 knots. Hold the backward pressure on the stick and check the ASI. Adjust accordingly to give 60 knots. As you now need to apply backward pressure on the stick to achieve the required attitude then you will need to move the trim lever backward.
- Hold and maintain the stick position and pressure to achieve the desired attitude/speed. Then move the trim to remove the pressure. Do not move the trim to achieve the attitude that you want. The trim control is a little coarse in its action so trying to fly by moving the trim will not be smooth and is slower to give the required outcomes.
- Whenever you change the attitude/speed and wish to return to the stable platform, you must adjust the trim also.

How do you achieve “Feel” when flying

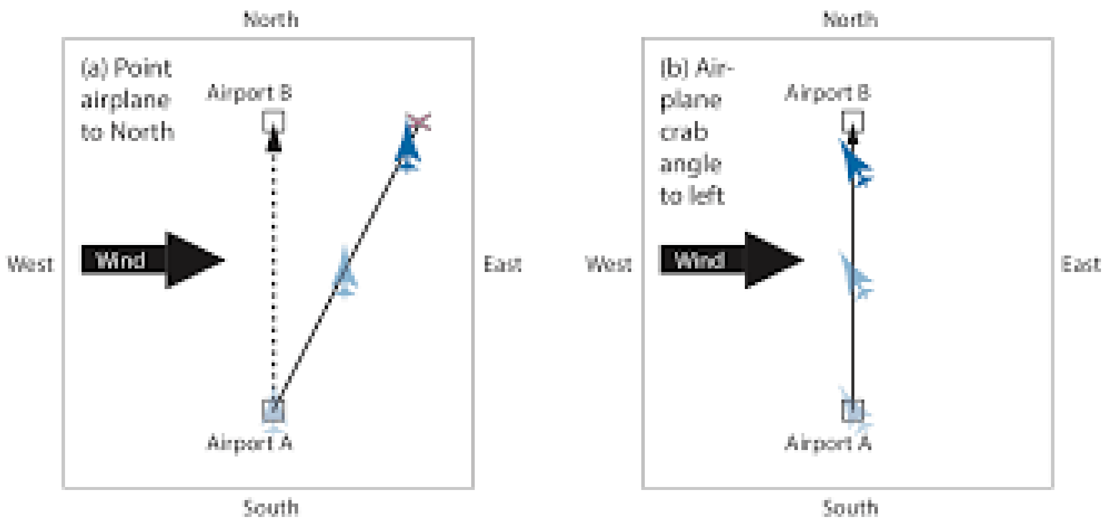
- This typically relates to how you hold the stick. If you grip the stick hard then you will not feel responses from the glider, you will constantly fight it and by the end of a 30 minute battle you will be tired, your hand sore and you will have not had a chance to relax and enjoy the view. The aim is to relax in the seat, relax your hands and feet. A light grip on the stick will let you feel what the air is doing to the glider which will improve your control and also your ability to feel thermals.
- Most problems you will have with aircraft control at this stage of your training will be caused by a tight grip and unnecessary, small control movements, Sit back and relax your body, and relax your grip and relax your legs and the glider will stop moving all over the place.
- When changing attitude, you will need to apply smooth pressure on the stick, and then move the trim to remove that pressure. When you can completely relax any pressure the glider will “fly itself”.

Flying Straight

- When flying back to the airfield, or to a thermal, or travelling to a nearby town, or flying the circuit, you need to fly in a straight line.
- To achieve this, you need to look into the distance and identify a point to fly towards. Looking ahead in the distance lets you spot any deviation from your proposed track as well as letting

you keep a better lookout for other traffic. Detecting that the glider is not flying straight takes some practice but it is an important skill in flying.

- If you fly directly into wind or downwind the glider will not drift so your heading (direction that you are flying) and track (direction of where you want to go) will be the same. If there is a cross wind then to achieve your intention of flying to a certain point you will need to head slightly upwind of your track so that you achieve your goal. It is like swimming across a river, if you head directly to the opposite bank you will end up well down stream by the time you get across. You would have to swim aiming for a point upstream of your target.
- You cannot achieve this just by using the rudder, you have to turn the glider so that it is heading in the new direction, with all controls centred and the yaw string straight.
- If you have even a very small bank – one wing slightly lower than the other, the glider will slowly turn and you will no longer be flying toward your target. With practice you will learn to see even a small bank angle when looking ahead at the horizon.
- The pilot's task is to see small deviations and then change the heading through coordinated use of the controls.
- Practice will mean that you can fly straight towards your desired goal even whilst adjusting your attitude/speed.



FLIGHT EXERCISES FOR THIS UNIT

- Trimming for a required speed and flying straight to a goal are simple tasks but it needs some practice.
- You will practice flying ahead at a set speed and then changing the nose attitude to achieve a faster or slower speed. You will quickly learn to identify the nose attitude that is needed to give you a desired speed, and you can rely on this for future flights. Whilst you are doing this, you will find that the pressures required to maintain a speed become annoying and difficult to maintain, so you will practice how to use the trim to set the new speed.
- You will use the Air Speed Indicator (ASI) to verify that you have reached the speed that you want, but you cannot just keep looking at the ASI. The ASI is slow to react to changes in attitude and if you fly by the ASI your speed will constantly change. If you maintain the nose

attitude your speed will remain constant. If you struggle to do this then the Instructor will cover the ASI so that you have to rely on attitude.

- Your instructor will then ask you to fly towards a certain target (a town or a hill or a cloud etc). Looking to a spot on the horizon will help you to see if you are really flying in the desired direction. Look into the distance. You will use this technique when you are learning to land and want to fly straight down the runway – look far ahead.
- You will need to understand the difference between your heading (the direction that the glider is pointing) and the track you make across the ground. The track is determined by where you want to go, and you control the heading but turning the glider slightly so that its heading is changed. As you practice this you will be able to correct for a strong cross wind so that you still get to where you want to go.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- Watching the ASI rather than the horizon attitude will cause the attitude and hence your speed to vary.
- If your grip on the stick is too tense it will make trimming very difficult. Relax your grip.
- Pay attention to the nose attitude – noting where the horizon cuts the canopy.
- Don't try to change attitude and speed by using the trim, it is slow and inaccurate. Change speed with the elevator/stick, then adjust the pressure with trim.
- To fly to a target point you identify if the glider wanders off track – often because of small control movements – relax your grip.
- A small bank angle – wings not level – will result in the glider turning away from your target goal. Use aileron to level the wings.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Conduct a flight in a constant heading and airspeed at various speeds.
- Trim the aircraft
- Maintain straight flight on a nominated track

RESOURCES & REFERENCES

- Theory Lesson 2

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Q1. If the glider is trimmed for 60knots and you let go of the stick, what will happen to the nose attitude of the glider?

  A. The nose will pitch up above the horizon

  B. The nose will stay at the current attitude

C. The nose attitude will drop lower

- Q2. You are trying to fly at a constant speed of 60 knots but the speed constantly varies, sometime 65, sometime 55. What is the likely cause?
- Q3. You are having to hold back pressure on the stick to keep the same speed. Which way should you move the trim to remove this pressure?
- Q4 You want to fly at 70 knots but you are only getting 65 knots on the ASI. How do you correct this?
- Q5. The airfield is directly upwind of your current location and you turn to fly towards the airfield. How much drift will you experience as you fly to the airfield?
- Q6. The airfield is due west (270 degrees) of your current location and is about 10km away. There is a strong Northerly wind (wind blowing from the north). Which of the following 3 options A,B,C would be the best estimate of:

a. The track to the airfield

b. The heading you should fly to reach the airfield

A. 255 degrees

B. 270 degrees

C. 285 degrees

Gliding Australia Training Manual

Pilot Guide

Unit 8
Sustained Turns, All Controls

WHAT THIS UNIT IS ABOUT

To develop the knowledge and skill to:

- Use all primary controls to enter, maintain and exit a sustained turn in a coordinated manner;
- Identify and correct coordination errors in the turn;
- Vary the angle of bank in a turn;
- Describe the relationship between the angle of bank and the radius of the turn; and
- Demonstrate smooth and coordinated entry, maintenance and exit of sustained turns at various angles of bank and speeds.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 6 Aileron Drag & Rudder Coordination.
- GPC Unit 9 Lookout Scan Procedures

COMPLEMENTARY UNITS

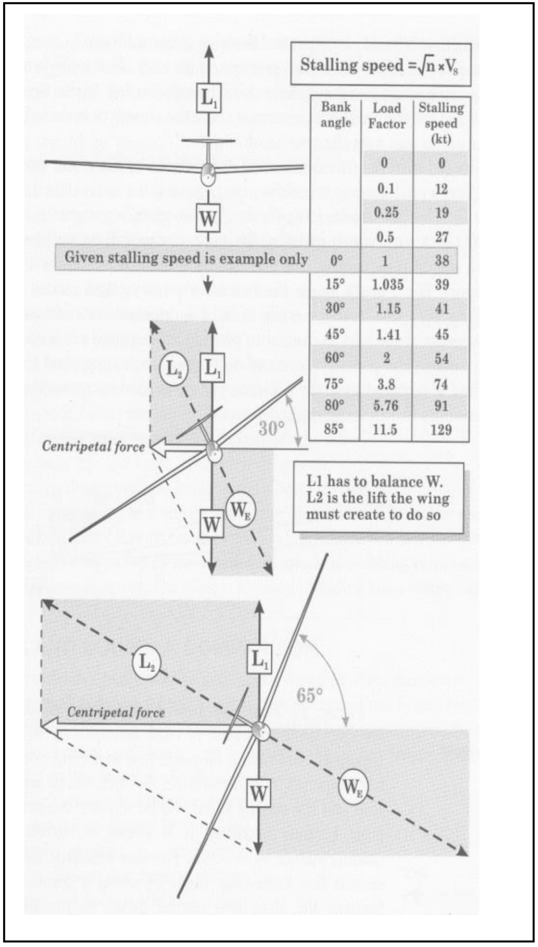
- NIL

KEY MESSAGES

- Gliders spend most of their time aloft in sustained turns.
- Lookout is essential – before entering, during and before exiting the turn.
- Have a relaxed grip on the control column.
- Correct hand-over/take-over procedure and expected action and verbal response to each.
- Lookout to clear any airspace before turning into it.
- Use of all controls must be coordinated.
- Use elevator to maintain aircraft attitude and trim to relieve workload on the control column for each new configuration.
- Use moderate angles of bank whilst learning.
- It takes time to master coordination of controls.

PILOT GUIDE FOR THIS UNIT

General



- Lookout is essential – before entering, during and before exiting the turn.
- Gliders spend most of their time aloft in sustained turns.
- It is therefore important that you correctly understand the forces that cause a glider to turn and how to influence those forces to achieve the desired result.
- Learning to turn a glider follows logically from learning the primary and secondary effects of the controls. When the glider is banked into a turn, the lift force is tilted over with it; [remember that lift acts at right angles to the airflow around the wing]. This tilted lift force, as well as trying to balance out the weight of the glider, also "pulls" the glider in the direction the pilot wants to turn. The more the glider is banked over, the greater the rate at which the glider will turn.
- You need more elevator to provide the extra lift required for the turn.
- The primary turning controls are the ailerons, not the rudder.
- The ailerons are used to bank the glider and it is the bank angle which produces the force which turns the glider.

Entering the Turn

- Ensure a good targeted LOOKOUT scan <u>away</u> from the direction of turn and then into the direction of turn. Then look ahead over the nose and apply aileron and rudder together in the appropriate direction.
- Correct coordination can be checked by noting whether the nose moves smoothly around into the turn as the bank develops.
    - If the nose "hesitates" before moving in the direction of the turn, insufficient rudder has been used in conjunction with the ailerons.
    - If the nose moves noticeably in the turning direction before any bank has developed, too much rudder has been applied.
- The most common fault in the early stages of learning turns is insufficient rudder.
- Yaw string indicates success.
- Elevator is utilised as required to maintain aircraft attitude.
- Higher angles of bank require greater control inputs.

- Aileron and rudder must return to neutral at desired angle of bank.
- Resume Targeted Scan. Scan regularly inside the turn along the horizon, not the wingtip and back to the nose. Each time you scan ahead, also check the nose attitude.

Sustaining the Turn

- During the turn, monitor and if necessary control bank angle with Aileron, suitably coordinated with Rudder. Maintain correct nose attitude with Elevator. Remember the little mnemonic A-R-E. "ARE we maintaining a correct turn?"
- Maintain targeted scan and regular full scan to maintain situational awareness.
- Each time you scan towards the glider's nose, check the nose attitude.

Correcting Coordination or Attitude Errors in the Turn

- Uncoordinated flight is indicated by the yaw string and is corrected by use of the rudder.
- Any change in attitude is indicated by referencing the nose to the horizon.
- The nose should remain smoothly tracking at the same angle to the horizon "like a well-oiled conveyer belt" without nodding up or down.
- "The Nose Knows" telling you a change in airspeed before the ASI does, use the elevator smoothly to return the nose to the correct attitude/speed then use trim to relieve workload.
- Look around frequently!

Varying the Angle of Bank

- To change angle of bank, the control column & rudder move the same way, maintaining coordination.
- Use the rudder proportional to the ailerons and note the change in aircraft angle of bank on horizon.
- If there is a steep angle of bank, the outer wing is travelling faster than the inner, developing more lift; so there is a tendency for the glider to overbank, especially large wingspan gliders. If the glider is allowed to overbank, the nose will drop further. If this is corrected by more back pressure, the turn will tighten into a spiral dive.
- If the glider starts to overbank, demonstrate how to coordinate controls to take off bank to desired angle.
- Check "ARE".

Exiting the Turn

- Note the point on the horizon where we want to exit the turn, then conduct a targeted scan to the outside of the turn and then in the direction that you will exit to maintain situational awareness.
- Before that point is reached in turn use simultaneous use of aileron and rudder to reduce angle of bank.
- Adopt wings level position just before the desired heading is reached (remember the glider has some inertia)
- Relax the back pressure on the elevator to counter the nose rising on exit of the bank.
- Coordinated flight is indicated by centering the yaw string.

- Use elevator trim for the new configuration.
- Maintain cruise scan and regular full scan to maintain situational awareness.

FLIGHT EXERCISES FOR THIS UNIT

- Turn entries
- Sustaining Turns
- Correcting coordination or attitude errors in the turn.
- Varying the angle of bank.
- Varying the speed
- Exiting the turn pointing to a specific heading
- Reversing turns

- The table below gives a guide to the various factors to be considered in making turns.
- The table represents a modern training two-seater of about 600kg All Up Weight (AUW) and 34 to 1 glide angle.

To complete a 180 degree turn at 65 knots

Bank angle	Time (Secs)	Height loss(ft)	Turn radius (ft)
10 degrees	60	240	2,100
20 degrees	30	120	1,000
30 degrees	20	75	650
40 degrees	13	55	450

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- Failure to look out properly before turning.
- Insufficient rudder with aileron at turn entry.
- Not looking ahead while rolling into the turn.
- Not scanning while turning.
- Not removing rudder once bank achieved and aileron is neutral.
- Failure to maintain back pressure in the turn.
- Looking at ASI instead of monitoring nose attitude (The Nose Knows!)
- NEVER try to turn a glider in flight by using rudder alone. Only on the ground is this acceptable when steering the glider.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe how you use the primary flight controls to turn the aircraft.
- Show how you enter and exit a coordinated turn.
- Maintain a coordinated turn with varying bank and airspeed.

RESOURCES & REFERENCES

Gliding Basics: British Gliding Association 2019

Gliding Handbook: FAA 2013

The Glider Pilot's Manual: Ken Stuart: 2nd Edition; Airlife 1999.

Understanding Gliding: Derek Piggot: 3rd Issue; AC Black 1996.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What action must never be omitted before turning the aircraft?
2. What are the controls used to turn the aircraft?
3. Why does the nose drop in a turn?
4. What controls the airspeed in a turn?
5. What does the pneumonic “ARE” stand for and when is it used?
6. What does the “Nose Know”?
7. What is adverse yaw and what causes it?

8. What is the secondary effect of rudder?
9. What does being "coordinated" mean in a turn.
10. If the yaw string is to the right of centre, which control is used to correct it?
11. If you are turning and the glider starts to noticeably increase its bank angle without any input from you, what is the problem and what would be your action?

Gliding Australia Training Manual

Pilot Guide

Unit 9

Lookout Scan Procedures

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge required to apply appropriate lookout procedures and scanning techniques.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 1 Lookout Awareness
- Theory Lesson 3

COMPLEMENTARY UNITS

This unit may be read in conjunction with:

- GPC Unit 21 Radio use and endorsement
- GPC Unit 22 Use of Situational Awareness Aids
- GPC Unit 31 Thermal Entry
- GPC Unit 32 Soaring with other gliders

KEY MESSAGES

- Lookout must be top priority at all times. This supports Situational Awareness where you are aware of all other traffic and can predict and avoid potential conflict situations.
- When communicating location of other traffic to a co-pilot, use the clock code.
- An effective lookout requires head movements, and focused attention, not just glances.
- Require different scan techniques for different circumstances.
- Alerted see-and-avoid is more effective than unalerted see-and-avoid, so radio must be monitored attentively and used wherever possible.

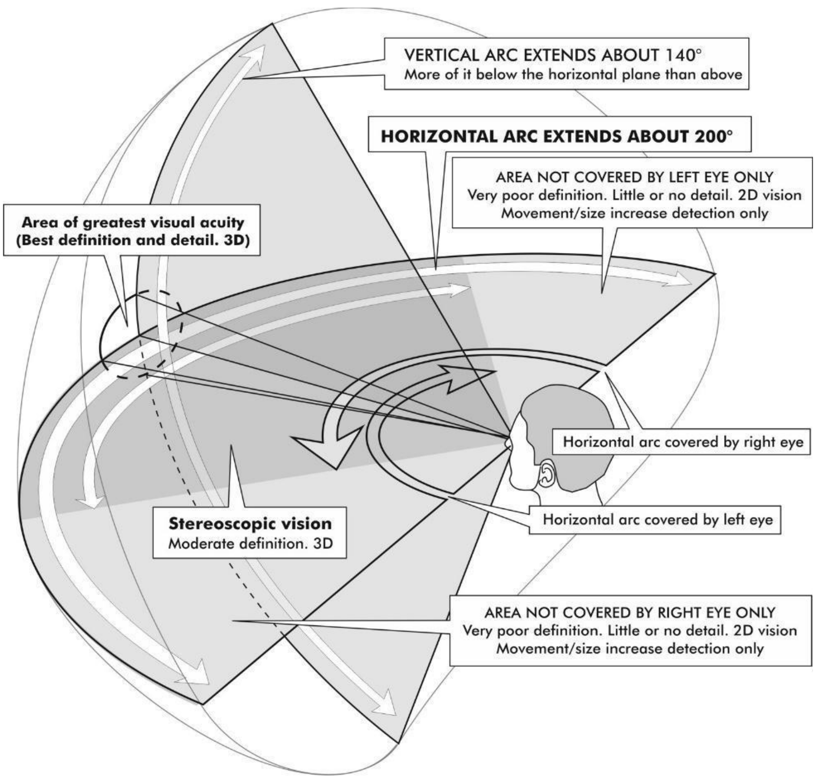
PILOT GUIDE FOR THIS UNIT

Notes

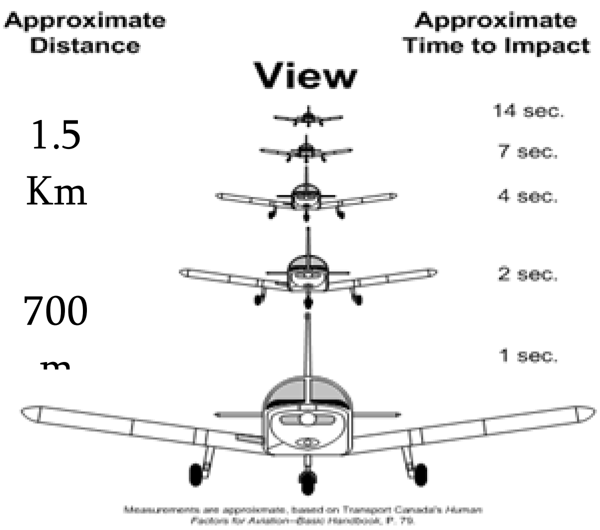
- Mid air collision is a high risk and can be managed through an effective lookout.
- The human eye has limitations and you must take actions to reduce these impacts. (see diagram below)
- If vision correction is needed, use spectacles and carry a spare pair.

Limitations of our vision

- The diagram below shows where it is possible to see.
- Now include barriers such as the instrument panel and cockpit walls and the wings, and your opportunity is greatly reduced.
- If you move your head and neck and bank the glider, you can see much more, and reduce conflict

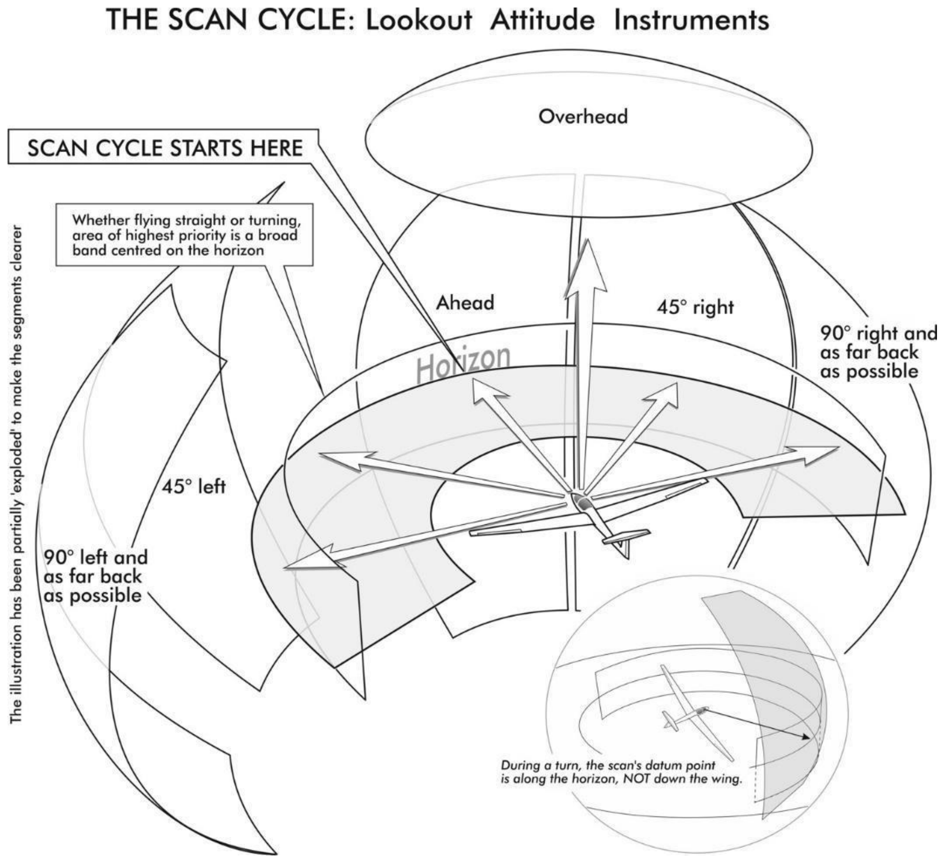


- To see an aircraft, you have to focus your eye on the area where it is or may be. This means that you have to look and focus then move to another area and look and focus, etc.
- We have scanning techniques to ensure that we look at the key places and focus on that area. A passing glance is not appropriate as the eye will not focus on the object
- Aircraft fly fast, 60 knots airspeed is approximately 120kph, so highway driving speed. A small speck a few Kilometres away can quickly become an aircraft that can collide with you in the time that it takes you to complete 2 circles in a thermal.
- The following picture gives you some idea of the problem. Note that closing speed is the sum of the speed of the two aircraft if flying directly towards each other.
- If one glider is circling then the time to impact is double what is shown here. Given that a single circle in a thermalling glider takes 15-20 seconds, you need to be aware of the other aircraft and increase your targeted scan as you circle because 1 turn later it will be too close.



The Scanning Technique:

1. FULL SCAN: A Systematic scan along the horizon from behind our left-wing tip, directly ahead through to behind our right-wing tip, Including the area above and below the horizon, and directly overhead our glider and below the glider. This will take a few minutes to do correctly and should be repeated regularly depending on traffic density.



We may also have aircraft coming from the side, across out flight path, or overtaking us on either side, so we also need to monitor these areas. The technique is to focusing on a spot for a few seconds, then moving our view 20-30 degrees ahead and repeating the process.

This **FULL SCAN** can be completed in stages, interrupted by a **CRUISING** scan or **TARGETED** scan as required.

2. CRUISING SCAN: When flying straight the most dangerous area is straight ahead and 60 degrees cone around the flight path, including the area above and below the horizon, We need to see aircraft in this region quickly so we can avoid any collisions risk. So we would focus on this cone of airspace (a CRUISING scan).

In situations where there is random traffic (cross country, training area, etc) it may pay to broaden the size of the Cruising Scan cone to 120 degrees.

3. TARGETED SCAN: This is where we focus on a smaller area which has potential increased traffic or greater risk. Examples include:

a Turning the glider. You will be turning into an area that you may not have had clear vision of previously. You start this scan by firstly looking in the opposite direction to the planned turn to identify threats from behind and the side, then scanning around the horizon through straight ahead and finishing at the area behind the wing in the direction you are turning. This will progressively let you see any aircraft that may be coming from behind you.

b Joining a thermal with other gliders. You need to identify all of the gliders in the thermal, not just the first one you see. Also look for other gliders that are also trying to join the thermal, they may come from any direction.

c Thermalling: Looking at the horizon in the direction of the turn to identify any aircraft that is approaching you. Remembering that it will be another 20 seconds before you see this view again so you need to identify potential conflicts so that you can monitor their movement.

d Leaving a thermal: Before straightening up to leave, first focus on the area outside the turn to detect if another glider is joining or overtaking in that area.

e Joining the circuit for landing: There is likely to be increased traffic, arriving from many different directions. You should conduct a TARGETED scan before you get to the circuit joining area so that you have better situational awareness of all gliders that may be in conflict with you. Monitor radio and visually identify any aircraft that calls.

Recommended Procedures

Be conscious of your Lookout responsibility 100% of the time. Set up your cockpit to maximise your time outside the cockpit. Instrument layout, GPS operation, map handling and etc. should be set up to allow maximum time looking outside

1. Use a scan technique appropriate to what you are doing. Good situation awareness is essential.

   Cruising Scan – Straight glides.

   Full Scan – Cruise scan plus appropriate priority to the flight situation, e.g. in circuit or when establishing climb in lift.

   Targeted Scan – Cruise scan plus targeted priority to the flight manoeuvre before initiating e.g. Pull-up into thermal.

2. Look in particular for turning gliders indicating a gaggle thermalling ahead.
3. Slow down before entering an identified area of lift especially if it already contains gliders.
4. In particular when pulling into a turn, remember that you have changed the situation significantly so you need to take primary responsibility for remaining clear of other gliders.
5. Particularly scan back along the tack direction when entering a thermal looking for expected and unexpected gliders on that same track.
6. Because gliders around us will sometimes be easy to see and other times will disappear as we look, it is necessary to make a conscious effort to maintain situation awareness – i.e. keep track of the gliders around you and what they are doing.
7. Remember modern gliders in particular have high energy. Speeds are high. Height gain in pull-ups is significant, and rapid.

Physiological Effects

Finally, be aware of and allow for the effects age, fatigue, low blood sugar, dehydration and mild anoxia. If you have any of these be sure to concentrate more than ever on technique.

FLIGHT EXERCISES FOR THIS UNIT

Using Full Scan

- Your instructor will demonstrate a full scan, describing where you are looking and the pace of progressing around the horizon.
- Your instructor will emphasise the need to move your head and to focus for a few seconds at each step.

Using Cruise Scan

- Your instructor will demonstrate flying towards a prominent landmark, or back to the airfield. Whilst flying straight you will be shown how you conduct the Cruising Scan. This will be focusing on a cone directly ahead which spans say 30 degrees each side of the direction of flight.
- Where the traffic pattern is random (lone cross-country or in the terminal area, i.e. local soaring) concentrate the scan on straight ahead and then to about 60 degrees to each side. When flying fast, concentrate more on straight ahead; when flying slower expand the area of concentration.

Using Targeted Scan.

- This will be delivered over a series of flights and repeated/assessed often. Entering a Turn and entering the circuit can be described on every flight.
- The terminal area (within, say, 5 miles) at a crowded site is a high traffic area with random traffic. This is particularly dangerous airspace and lookout needs to be excellent. High speeds in this area are not appropriate.
- Gliders on a reciprocal heading are very difficult to see. Avoid such circumstances and where this is not possible, take special care.

Other Considerations:

- Your instructor will show you the glider's blind spots; for example, following another directly astern and higher. The glider that is behind and can see the glider ahead is responsible to maintain separation.
- A glider doing a pull-up can be in a double blind situation where you cannot see the glider above and behind you, and you may be below the nose of the glider behind you and therefore not visible to it– there is no obvious fix for this so prevention is the only defence.
- Avoid flying directly above or below another glider with less than 500 ft clearance.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

Initially getting used to the rate of scanning and developing the skill to apply the appropriate scan to suit the situation.

Failure to move your head and neck. Eye movement is not sufficient

HOW DO YOU DEMONSTRATE COMPETENCE?

- By demonstrating Full Scan, Cruising Scan and Targeted Scan as appropriate at all times.

.RESOURCES & REFERENCES

- Theory Lesson 3
- Australian Gliding Knowledge pages 240-246
- MoSP Part 2 Operations
- GFA Human Factors Manual (OPS 0010) – refer Limitations of the eye.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- When an aircraft reports its position relative to you what type of scan would you use?
- When flying between thermals in a straight-line, what type of scan would you use?
- What is the recommended scan cone in the cruising scan?

Gliding Australia Training Manual

Pilot Guide

Unit 10
Use of Ancillary Controls

WHAT THIS UNIT IS ABOUT

To develop the practical skills and knowledge to operate the Airbrakes, Flaps, Undercarriage, Canopy and Tow release in various gliders.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 4 Orientation & Sailplane Stability
- GPC Unit 5 Primary Effect of Controls
- GPC Unit 6 Aileron Drag & Rudder Coordination
- GPC Unit 7 Straight Flight, Various Speeds & Trim
- GPC Unit 9 Lookout Procedures

COMPLEMENTARY UNITS

- Nil

KEY MESSAGES

- The airbrakes are used to control the rate of descent of the glider, typically on approach to land. They are not used to control the airspeed – the elevator controls airspeed.
- Extending airbrakes will increase the stall speed of the wing by increasing the wing loading.
- Flaps enable the camber of the wing to change and enhance slow and high-speed flight characteristics. Typically used on landing to allow a slower touch down speed and steeper approach.
- Canopies are expensive and easily damaged parts of the glider.

PILOT GUIDE FOR THIS UNIT

Notes

Locate - Identify - Operate

- All ancillary control must be positively located and identified as the one required prior to use. This eliminates any possibility of error in selection of the wrong control.
- The principle applies to all ancillary controls - airbrake, flaps, and undercarriage - and in the latter case extends to ensuring that the undercarriage selector is placed in the appropriate position (ie. Down and Locked prior to landing) in accordance with the placards fitted to the glider.

- For standardisation gliders will have the following colours painted on the relevant controls. This is to avoid confusion when flying different types of glider. The standard colour coding are:

CANOPY Normal Release – WHITE.

CANOPY Emergency Release	-	**RED**
TRIM	-	**GREEN** (lesson carried out in GPC 9)
AIRBRAKES	-	**BLUE**
TOW RELEAE	-	**YELLOW**
FLAPS	-	**GREY**
UNDERCARRIAGE	-	**BLACK**

NOTES:

- Some manufactures may not conform to colours for Flaps and Undercarriage
- Always identify the control before using.

Airbrakes. (BLUE)

- The primary purpose of the airbrake is to control the angle of descent of the glider on approach to land. It is this control that controls the angle of the glider on approach where the elevator controls the speed.
- The airbrake control colour is always **BLUE** and this control handle should always be identified before using.
- All spoiler and airbrakes have maximum speeds for activation. See Aircraft Flight Manual and placards in cockpit.
- Airbrakes can also be used in other circumstances such as trying to reduce height quickly or to reduce the chances of an overspeed.

Flaps: (GREY)

Why flaps are fitted?

- Flaps enable the camber of the wing to be changed so the wing will be at its optimum for the speed being flown.
- Correct use of flaps will keep the wing operating near its optimum angle of attack and will result in the fuselage meeting the airflow at the angle which causes the least drag.

Flap settings

- The flaps normally found on gliders will allow the trailing edge of the wing to be lowered through typically two stages (pre-set angles). This is **positive** flap.
- The first stage will be about 5 degrees for flight at slow speeds (thermalling) and the second stage will be about 30 degrees for landing.
- On high performance gliders the flaps can also be raised above the neutral (or 0 degree setting) to reduce the camber of the wing. These settings are for flight at high speeds. There are usually 2 or 3 high speed settings available. These flap settings are negative flap.
- The flaps may be linked to the ailerons, so that as flap is raised or lowered both ailerons rise or lower in unison, making sure that as much of the wing as possible has the best camber for the phase of flight.
- The flaps are normally controlled by a single lever in the cockpit which is moved aft to lower them, and forward to raise them.
- Generally, positive flap lowers the stall speed; negative flap raises the stall speed (check your flight manual)
- It is worth noting that lowering ('drooping') the ailerons reduces the roll rate of the glider and thus selecting full landing flap in such gliders may need to wait until after the turn on to final is complete.

Use of flaps on take off

- For take -off, the flaps should be set to give the wing enough camber to produce the maximum amount of lift as early as possible without creating too much drag. This would normally be at the thermalling setting.
- Some gliders may begin the take off with flaps set at zero to ensure adequate aileron control during the ground run, others may use a negative (upward) setting such as -7 degrees. This will raise the ailerons and give the maximum aileron control at low speeds, which may be necessary in light or cross wind conditions to prevent wing dropping during the early part of the ground roll.
- As soon as good aileron and directional control is achieved (before the glider reaches flying speed), the flaps can then be lowered.

  If this technique is used it is essential that the Pilot maintains their hand in proximity to the release handle until aileron control is achieved before moving their hand back to the flap handle. Again, the handle must be positively identified.
- As changing the flap setting at this stage of the flight may cause the glider to become airborne suddenly, be prepared for this to prevent the glider getting too high.

Use of flaps in flight

- The large airspeed ranges used by modern gliders means that if flaps are fitted they should be adjusted as the airspeed is changed. This will keep the gliders wing flying at the optimum angle of attack and give it the best camber for the phase of the flight at any one time.
- When a glider is thermalling or flying slowly in rising air the flaps should be lowered to a positive setting (about 5 degrees). Refer to the Aircraft Flight Manual as to which setting to use.
- Zero flap setting (0 degrees) is used to achieve the best glide angle.
- Once the glider accelerates to fly at speeds of over 60 knots then a thinner less cambered wing is an advantage, with less drag as the lift increases with speed. So you can move to negative flap settings.
- The glider must be flown within the speed/flap range or performance will suffer.
- You should keep your hand on the flap lever when in flight smoothly easing the flaps up or down as the airspeed is increased or decreased. Try and avoid jerky flap movements and unnecessary changes of flap.
- When rolling into thermals it may be best to delay application of large positive flap settings until the aircraft is established in the thermal, to maintain aileron control and reduce drag..

Use of flaps during approach and landing

- NOTE: Use of positive flap gives a lower nose attitude for a given speed. It is important to ensure you establish the correct speed on final and verify it on the airspeed indicator.
- For normal landings positive flap should be set to enable lower speed, with airbrake used to control the rate of descent. This will enable a lower approach speed due to the lower stall speed with flaps deployed.
- The landing flap position lowers the flap beyond the point where a useful amount of extra lift is produced to a setting where a large amount of drag is produced. This setting should not be used unless you are on finals and can safely reach the landing area. It is only for short landings over obstacles where a steep descent is required.
- Flap should not be raised once on final as it will cause a loss of lift (and hence, height) and increase the stalling speed.
- After touchdown selecting negative flap on the ground run may give better aileron control, however if it may cause a distraction so often better to give full concentration to the ground roll.

Limiting flap speeds

- The maximum speed permitted will vary according to the flap setting. Exceeding the maximum speed for a given flap setting could cause damage to the aircraft.
- See Aircraft Flight Manual or cockpit placards and the ASI for details.

Summary

- The primary reason for flaps fitted to some gliders is to enable the camber of the wing to be modified so the wing will be operating at its optimum for the speed being flown.
- Flaps on gliders are lowered by a single handle moved aft which lowers them and forward to raise them.
- When the flaps are lowered, they will increase lift but also drag. Normally there are two settings down about 5 degrees for slow speed flight and 10-30 degrees for landing.

- Some gliders, to increase the performance, have flaps can be raised above the neutral setting and may have 2 or 3 settings. This is known as negative flap.
- When flaps are lowered which is positive flap the stall speed will be lower. If the glider has negative flap the stall speed will be higher.
- In some gliders the flaps maybe linked to the ailerons so that when the flaps are lowered the ailerons move in the same direction to provide maximum lift and control along the wing.

Undercarriage: (BLACK)

- Gliders are fitted with retractable undercarriage purely to reduce aerodynamic drag in flight.
- Each glider type will have different mechanism and handle to raise and lower the undercarriage which your instructor will brief you. All systems are manual with no assistance from a power source.
- It is important to identify which direction the handle must be moved in order to raise and lower the undercarriage. Different glider types may move in the opposite direction, which could add embarrassment and cost if you put the undercarriage up when landing.
- Again, it is very important to identify the handle before use to ensure you have the correct handle before moving. The use of the F.U.S.T checks remind you at the release point and before landing when to activate the gear.
- Due to the importance of the gear when landing some gliders have an electrical warning system that either displays a red light or horn and sometimes both. This warning can be activated by the use of the airbrake or another system.
- Your instructor will indicate any potential down-but-unlocked scenarios if this is possible with your aircraft.

Canopy: (White Normal. RED EMERGENCY).

- Your instructor would have indicated the normal and emergency handles for your glider type in your previous flights.
- It's very important in your pre take off checks that all these handles are in the correct locked position as having a canopy open during take- off or flying can be very dangerous.
- It's also important to note the actions required in your glider to jettison the canopy in an emergency.
- When on the ground be careful when opening and closing the canopy in high winds as they can be easily damaged. Again, never leave a canopy open when unattended.

Tow Release: (YELLOW)

- The tow release handle will always be coloured yellow.
- After giving the thumbs up to take off, your hand should be near this release so that you can disconnect quickly in an emergency.

FLIGHT EXERCISES FOR THIS UNIT

Airbrake

- You should be able to practice and "feel" the airbrake before take-off.

- Remember before use identify BLUE Handle.
- You would have observed the use of the airbrake by the instructor when landing on previous flights.
- You would have seen a relatively large change in attitude with full activation of airbrake. If this causes a discomfort, please notify your instructor.
- Your instructor will let you operate the airbrake first at altitude so that you can feel the forces involved and the changes in nose attitude to maintain speed before using on the approach to land.
- Remember it's used to adjust the angle of descent not the speed. The speed is controlled by your elevator.

Flaps

- If your training glider has flaps then your instructor will demonstrate the attitude at various speeds for positive and negative flap.
- Remember to identify the correct control. You will practice and maintain the new attitude and trim. The flap can be used for themalling at slower speeds.
- Your instructor will demonstrate full positive flap and attitude which you will also practice maintaining correct attitude and trim.

Demonstration of Undercarriage:

- You should be aware of the undercarriage movement from previous flights.
- Your instructor will indicate the action required to raise and lower your type of undercarriage. Your instructor will also show you the up and down indicators and any electronic warnings and any potential down-but-unlocked scenarios if this is possible with the aircraft.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- initially you may have issues identifying the correct lever – take your time.
- as you will be looking inside for handles and indications don't forget your lookout!

HOW DO YOU DEMONSTRATE COMPETENCE?

- Knowledge of the Ancillary controls, and how they are activated from the cockpit.
- Ability to use the airbrakes and flaps controls to control the aircraft and the correct use of the undercarriage.

RESOURCES & REFERENCES

- Australian Gliding Knowledge pages 45,48,58-61,89

SELF-CHECK QUESTIONS

- Where would you find the airspeed limitations of the flaps, Airbrake and Undercarriage in your glider.

- Does the Airbrake control the airspeed or angle during an approach to land?

Gliding Australia Training Manual

Pilot Guide

Unit 11

Introduction to Soaring

WHAT THIS UNIT IS ABOUT

Congratulations on taking on the challenge of the sport of gliding. You've made great progress with your training. The aim of this unit is to introduce you to soaring and what can be achieved by progressing through GPC training and beyond. It aims to inspire you to continue training and show what the sport can offer in the longer term.

You'll also refine your new essential aircraft handling skills (maintaining a constant nose attitude, and angle of bank and flying towards a point) and be introduced to thermal soaring.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 7 Straight flight, various speeds, trim
- GPC Unit 8 Sustained turns, all controls
- GPC Unit 9 Lookout scan procedures

KEY MESSAGES

- Soaring is not just about safely taking off and landing. There are many opportunities such as flying advanced aircraft types, cross country flying, mountain flying, flying competitions, badges and records, and aerobatics. Training is available for all of these pathways.
- Soaring in thermals is a key skill essential for longer duration flights and cross country flying.
- More advanced soaring concepts are trained in the GPC syllabus after solo.
- Soaring is a great sport where you never stop learning.

PILOT GUIDE FOR THIS UNIT

Where do you want to go with the sport?

The sport of gliding (soaring is a better term) is not just about safely taking off and landing. There are many opportunities such as flying advanced aircraft types, cross country flying, mountain flying, flying competitions, badges and records, and aerobatics. Training is available for all of these:

- By completing the GPC syllabus, you'll be a competent soaring pilot – able to fly independently, fly family and friends, and soar cross country.
- Fancy flying an open class glider, flying in the French Alps, flying with enough ballast to sink a ship, or flying upside down? Beyond the GPC syllabus is an advanced training syllabus that will introduce advanced cross country flying, mountain flying, competitive soaring, badges and records, aerobatics and many more topics.
- It doesn't stop there – you'll never stop being challenged and learning in this sport.

The gliding pathways that you can follow are listed in the GPC Logbook.

Thermal soaring

Soaring in thermals is a key skill essential for longer duration flights and cross country flying. Gliders fly cross country by climbing in thermals and cruising to the next thermal; climbing again etc. There are other ways to fly cross country but thermal soaring is most common.

Thermals are columns of rising air, so to climb in them you'll need to circle in the rising column. And to do that you'll become an expert at thermal centring. Take a quick look at *GPC unit 30 Thermal*

Centring Techniques. As part of Introduction to Soaring you'll be introduced to two thermal centring methods discussed there:

1. Using feel
2. Using the variometer

FLIGHT EXERCISES FOR THIS UNIT

If the weather is suitable, you'll be taken on a fantastic cross country flight and be introduced to identifying thermals, centring them, and flying a task. Enjoy the experience.

If a cross country flight is not possible, make sure that you come back and do a cross country flight with an instructor or coach as soon as the weather allows. Many clubs have cross country camps – these are a fun and great way to experience cross country flight.

Review the flight. What did you enjoy most about it? What else do you want to do? Your trainer will help you achieve your goals but you'll need to put in the effort. It's a rewarding experience.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
Speed varying in turns	1. Flying using airspeed indicator instead of nose attitude relative to the horizon 2. Not trimmed correctly

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe the pathways that you can take in the sport and to set some goals beyond flying solo.
- Demonstrate basic aircraft control including cruising at a constant attitude and heading; maintaining a constant attitude while rolling into a turn; and maintaining constant angle of bank and attitude in a sustained turn.
- With trainer guidance, demonstrate basic thermalling skills by identifying a thermal and performing basic thermal centring with minor corrections.

RESOURCES & REFERENCES

- Unit 30 Thermal centring techniques
- Unit 31 Thermal entry

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What are the pathways available in the sport of gliding?
2. What is the most common way that gliders can fly long cross country distances?
3. What are two standard techniques for centring a thermal?

Gliding Australia Training Manual

Pilot Guide

Unit 12

Slow Flying and Stalling

WHAT THIS UNIT IS ABOUT

To ensure you

- can fly accurately and confidently close to the stall;
- always maintain a safe margin from the stall whenever close to the ground i.e. below 1000 feet AGL;
- can recognise the approach of a stall; and
- will initiate prompt prevention and recovery from stalls. …

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 7 Straight flight various speeds and Trim
- GPC Unit 8 Sustained turns all controls

COMPLEMENTARY UNITS

Nil

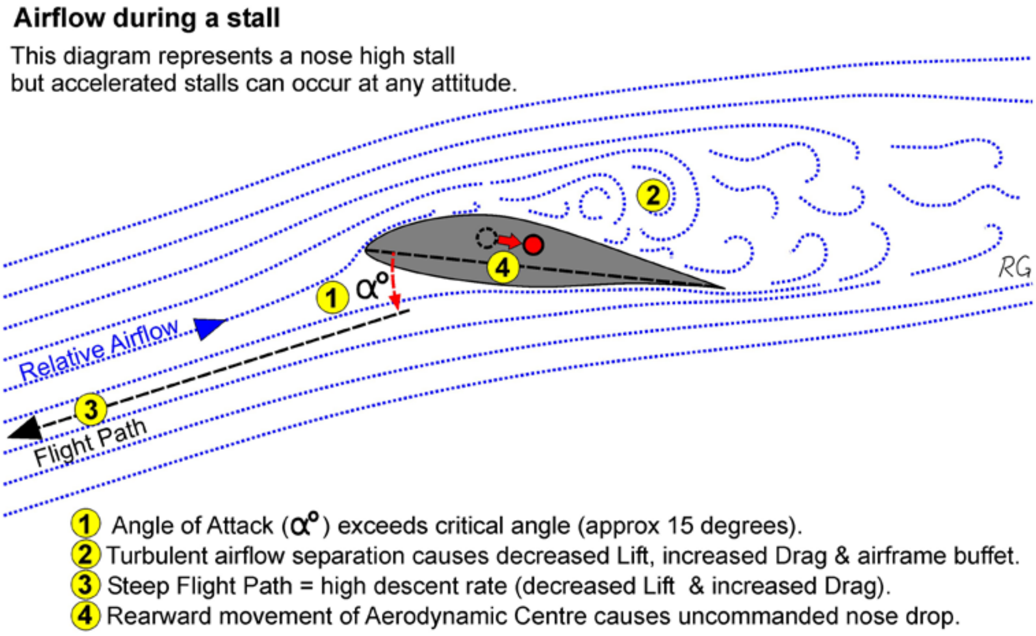
KEY MESSAGES

- Prior to flying as pilot in command solo, the pilot must demonstrate their ability to fly constantly at their designated safe speed and confidently stall and recover.
- Sometimes pilots who do not fly frequently lose these competencies.
- If you feel that the glider is not responding correctly, move the stick forward (to unstall the wing).
- Allow the glider to establish normal flight at an appropriate airspeed prior to trying to undertaking a turn The glider takes some time to stabilise once the nose has been lowered

PILOT GUIDE FOR THIS UNIT

A stall in straight and level flight is quite simply a progressive loss of lift over the top section of the wing, causing the glider to lose height at an exaggerated rate. It occurs because the glider is made to fly in such a way that the angle of attack of the wing becomes too great and the smooth airflow breaks down over the top surface.

It is achieved by bringing the stick progressively further and further back, slowing the glider down and increasing the angle of attack of the wing until the stall occurs.



From the pilot's point of view, the symptoms of the stall occur progressively and are as follows:-

- Nose position higher than normal. Not necessarily a great deal higher, but noticeably so.
- A continuous backward movement of the stick.
- It becomes quieter in the cockpit because of the lower speed of the airflow past the canopy.
- A falling airspeed indication on the ASI
- Flying controls are less effective.
- There may be some mild buffeting of the airframe caused by the breakdown of the smooth airflow over the wing.

When the stall occurs, the airflow around the wing looks like this: -

The airflow in this picture (flowing over the wing from right to left) is shown by wool strips taped to the glider wing.

The stall is well-developed, the strips indicating that the airflow is still normal near the leading edge (strips blowing straight back), but quite disturbed further back on the wing (strips blowing in all directions, even backwards in some cases).

- When the stall actually occurs there are three possibilities in terms of glider behaviour, depending on the type of glider.

1. It may drop its nose quite markedly. If this does occur, it will occur despite the stick being fully back

2. It may not drop its nose, even though the stick is right on the back stop. In this kind of stall (e.g. Twin Astir), the rate of descent will be very high, and the glider does not respond normally to control input although the nose position gives no clue to this.

3. One wing may go down, i.e. the glider may start rolling. This phenomenon, known as wing-drop, may occur in either of the above two types of stall and it may happen at exactly the same time as the stall occurs or perhaps just before.

- Whichever of the three types of behaviour are apparent at the stall, the same action is taken by the pilot in all cases. This action is quite simply smooth and progressive forward movement of the stick to reduce the angle of attack and "unstall" the wing. Look outside at the horizon while you are doing this, to help orientation, reduce discomfort and make it more obvious when recovery action has been effective.
- There is an interesting point to consider here. Although it is quite logical that a type "2" stall above (no nose drop) can be cured by forward movement of the stick to lower the nose, it is not so readily apparent why it is necessary to move the stick forward when the nose has already dropped, or how it manages to fix a dropping wing.
- As far as the nose-drop is concerned, it is important to realise that the wing is still stalled despite the nose pitching down. If the stick is held back, the nose may pitch strongly up again and go into another stall; it will go on doing this until the stick is moved forward to unstall the wing.

Notes

- This forward movement of the stick when the nose goes down is not an instinctive reaction - all your training up to this point has tended to suggest that you should do the opposite. For this reason, stalling must be practised to the extent that forward movement of the stick when a stall is recognized becomes a CONDITIONED RESPONSE

Loss of Lateral Damping

- Wing drop occurs simply because one wing stalls before the other. When it stalls, lateral damping, the force which provides stability when the glider is rolling, is lost. There is nothing to stop the wing dropping further and further at the stall. In fact, the more the wing drops when stalled, the more it wants to keep dropping. In other words, the stability in roll provided by the lateral damping of an un-stalled wing becomes extreme instability in roll when the wing is stalled.
- The good news is that, when the stick is moved forward, the wing un-stalls, lateral damping is restored and the wing immediately stops going down.
- A characteristic of stall recovery is that, once the stick has been moved positively forward and the angle of attack restored to below the stalling angle, the smooth airflow restores itself instantly and the wing immediately starts working in its normal way. However, care should be exercised in the use of the elevator after recovery from a stall.
- If the stick is pulled back too sharply too early after stall recovery, another stall could result. The average glider needs about three seconds to accelerate from the stalled condition to a safe speed of about 1.5 times the stalling speed during a normal stall recovery.

- To summarise, always look ahead at the horizon during the first stages of stall recovery. Use the ASI as a back-up for ensuring that airspeed is building up. There is no point in diving in an exaggerated manner during stall recovery - it just wastes height. Develop a feel for when the glider has become unstalled and the nose can be safely restored to its normal position on the horizon.

Aircraft Design

- If you look along the underside of a wing from the wingtip towards the wing root, it will be noticed that the aerofoil changes from root to tip, This is called “Washout” and is how the designer ensures that the wingroot aerofoil reaches the stalling angle of attack before the wingtip. This causes wing root turbulence to hit the tailplane and produce stall warning stick shaking, while the wingtip washout delays wing drop.

FLIGHT EXERCISES FOR THIS UNIT

If possible, the in-air exercises will be introduced when thermal conditions enhance the possibility for regaining height. If not, higher than normal aerotows will be used. In winching operations, many launches may be required to cover this unit.

The instructor will ask you to fly at 45 knots and trim the glider accordingly then raise the nose slightly and continue to fly straight and level. The trim may not be sufficient and you may have to hold backward pressure on the stick.

- Try to identify the indicators of an approaching stall
    - Reduced controllability,
    - Reduced noise level,
    - Slight shuddering on the elevator.
    - Loss of lateral damping
- The instructor will demonstrate that moving the stick forward slightly removes these indicators and the glider feels like it is flying normally again.
- Then the instructor will demonstrate what happens when you fly a slightly higher nose attitude where the glider stalls and the nose drops, (in some gliders this may not be possible at a low nose attitude.) Again, the glider flies again when you move the stick slightly forward.
- Now there will be a demonstration that a higher nose attitude should more clearly identify the indicators of the approaching stall. Try to describe these indicators when you then do the same manoeuvre.
- You will be introduced into the techniques to deal with a wing drop close to stall. Forward stick and just enough rudder to stop any yaw which may have developed solves the overall problem.
    - Rudder can pick the dropped wing up but does not recover the stalled wing and is not actually necessary
    - Stick forward reduces the angle of attack immediately and hence recovers normal flight characteristics
    - The glider speed must be higher than the stall speed before the wing will carry the full weight of the glider.
- Over time you may be able to demonstrate a high nose attitude stall with the ensuing nose drop, and that even with the nose of the glider pointing down again it is not flying properly until the stick is moved forward to unstall the wing. Some gliders may let you demonstrate

that pulling the stick back in this situation does not raise the nose. You must push forward on the stick to unstall first and then recover.

- With more experience of stalling, take note to the airspeed as the glider stalls.

Advanced Training

- In later flights, the impact of airbrakes and flaps on stall speed and glider reaction is introduced, then the stall in a turn, primarily to identify the indicators and the effect of moving the stick forward.
- The instructor will avoid a spin developing through these exercises.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- don't be over anxious undertaking stalling, the aircraft will be under control at all times.
- direct attention outside the cockpit towards the horizon to counter any discomfort felt during the stall and recovery.
- ensure that the difference is noted between the nose drop at the stall and the sensations associated with negative "g".
- accidents occur when the stick is held back in the stall instead of easing it forward to recover to get the wing flying again, due to visual perception of dropping towards the ground.

HOW DO YOU DEMONSTRATE COMPETENCE?

- You can confidently fly the glider close to the stall by reference to attitude and air sounds together with the 'feel' of the stick without reference to instruments.
- You consistently demonstrate when a wing drop is experienced, moving the stick forward to lower the angle of attack with sufficient rudder away from the wing drop direction to counter any yaw.
- Demonstrate the GFA Pre-aerobatic checklist HAS(E)LL;
- Determine the use of cockpit ballast to ensure the glider is within centre of gravity limits.
- Maintain a safe speed near to the ground 1.5 Vs when flying below 1000 ft AGL.
- You fly coordinated turns in the circuit and avoid using excess rudder during the turn which may lead the glider to spin.
- Describe the aerodynamics of the stall and describe factors that impact stall speed - excessive elevator movement, G force, angle of bank, flaps and airbrakes.
- Demonstrate stall recoveries with minimal height loss appropriate to type:
  - without and with full airbrake/spoilers and
  - without and with flaps:
  - at various angles of bank
- If flying a self launching glider:
  - With and without engine power

- With and without engine pod extended

RESOURCES & REFERENCES

- Theory Lesson 4
- Australian Gliding Knowledge page 63-66
- Gliding Basics: British Gliding Association 2019
- Gliding Handbook: FAA 2013
- The Glider Pilot's Manual: Ken Stuart: 2nd Edition; Airlife 1999.
- Understanding Gliding: Derek Piggot: 3rd Issue; AC Black 1996

SELF-CHECK QUESTIONS

1. What are the symptoms of a stall in straight flight?
2. What action must the pilot take if the glider stalls?
3. Is it possible to stall in a turn without a nose-high attitude?
4. What action must the pilot take if the glider stalls in a turn?
5. Define "safe speed near the ground". Calculate the speed to fly the circuit in a glider which stalls at 33 knots in straight flight.
6. If you are turning slowly and the glider suddenly starts to noticeably increase its bank angle without any input from you, what is the problem and what would be your action?
7. What happens to the stalling speed when flaps are lowered?
8. What happens to the stalling speed when the airbrakes are opened?

Gliding Australia Training Manual

Pilot Guide

Unit 13A

Launch & Release Aerotow

WHAT THIS UNIT IS ABOUT

To develop and demonstrate the skills and knowledge required to safely fly an aerotow launch, in correct low tow position after transitioning from the initial climb, and then release from aerotow.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 2 Ground Handling, Signals
- GPC Unit 8 Sustained turns all controls
- GPC Unit 9 Lookout Procedures

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 14 Takeoff,
- GPC Unit 19 Crosswind Takeoff and Landing,
- GPC Unit 20 Launch Emergencies and
- GPC Unit 27 Advanced Aerotowing

KEY MESSAGES

- You will be introduced to aerotow when you have acquired competence in smooth and reasonably accurate co-ordination of aileron, elevator and rudder controls. Only when you can maintain straight flight and gentle turns at 60, 65 and 70 knots, without over-controlling or jerky movements will towing instruction be commenced.
- The initial and early attempts to fly the aerotow launch will start at a safe height, say above 300-500 feet AGL, and will be progressively lowered as your skills develop.
- You will be taught to remedy small divergences from position by keeping the glider's wings parallel with the towplane's wings using aileron, and then using rudder only to ease the glider into position. This is supported by the glider's self-centring tendency when using a nose release.
- Lookout during aerotow launch is critical. Look to the horizon, ahead and to the side; do not fixate on the towplane.

PILOT GUIDE FOR THIS UNIT

The terminology is introduced of Launching Pilot – Soaring Pilot – Landing Pilot, each of which require different mindsets and actions to configure the glider correctly for the next phase of flight.

Stages of Aero-tow launch will be described

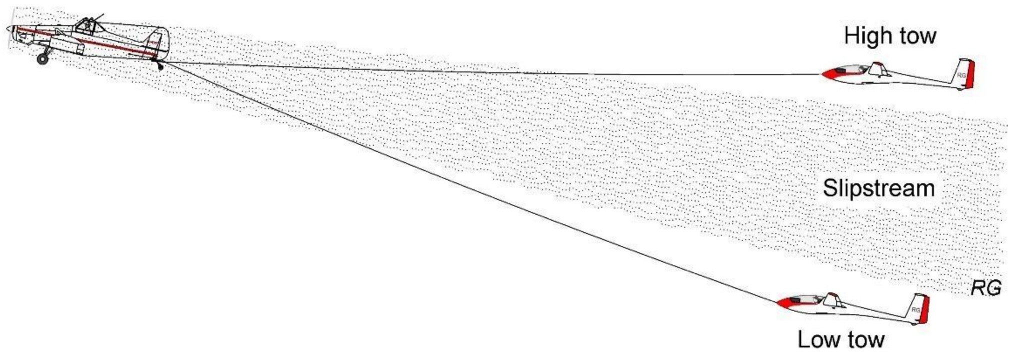
- Normal climb and release (This unit)
- Ground roll, separation, and initial climb (Unit 14A)
- Correcting for crosswinds (Unit 19)
- Emergencies (Unit 20A)

Normal Climb

- Development of skills for normal climb commences above 300-500 feet AGL for safety reasons, above any hazardous wind gradient.
- The stable platform is just as effective on tow as it is in free flight. This will be backed up by a demonstration.
- Because the airspeed is higher than has been accustomed to in handling the controls in free flight, the control forces are higher, but at the same time the controls are more effective.
- Some gliders are very heavy on the ailerons at aerotowing speeds; others tend to run out of elevator trim in low tow, leading to a residual push force. It is important to know the characteristics of the aircraft in use.
- You will probably over-control and this is quite normal. There is a need for small movements on the controls. From a learning perspective, remember that mistakes will need to be made for learning to take place and correct feel to be developed.
- The correct towing position is relative to the tug slipstream. If there is any doubt whether the glider is in the right place, find the slipstream and then position the glider accordingly.

Correct Low Tow Position

- Tug aircraft produce a turbulent slipstream in flight, consisting of a combination of wingtip vortices and propeller wash. Gliders are normally positioned either just below, or just above this slipstream while on tow. The positions are known as low tow and high tow respectively.
- The low-tow launch is the standard procedure for GFA clubs using aerotow. (Low tow reduces the risk of tug upset emergencies.)
- In straight line climb, the glider's nose will normally be pointed at the tail of the towplane. the pilot should be able to see both sides of the towplane at the same time.
- In a shallow turn, the glider's nose will normally be pointed slightly to the outside of the turn towards the towplane's outer wingtip rather than directly at its tail.
- Wings are maintained parallel to the towplane's, in a line astern position, in straight and level flight.



Correcting Out of Station Position

- If a very small diversion, just apply a small amount of rudder whilst holding the wings level.
- You don't have to take urgent correction provided the diversion is small.

- For larger diversions, you will need to apply a coordinated turn in the correct direction, but using small movements.
- After some experience, using all three controls will be introduced to maintain position and gradually extend to cover the whole tow including the release. Coordination takes time to develop and will come as experience is gained.
- If using coordinated controls, note that just centralising the stick will mean that the turn will continue. The turn must be stopped by using opposite aileron and rudder, and then centralise.
- It is typical that the glider will wander from side to side until you get the coordination correct – relax more on the stick, make small movements. Most out of station diversions are the result of the pilot moving the controls.
- Hazards associated with out of station flight are discussed in GPC Unit 20A Launch Emergencies Aerotow.

Correct Procedure to Correct Bow in Tow Rope

- If you end up with a bow in the rope a gentle correction is required otherwise you risk breaking the rope. Apply a little drag through use of rudder.
- In more extreme cases the gentle application of airbrake can be used.
- Be aware that the airbrakes of some gliders are apt to suck out if opened at aerotow speeds, and with some types just cracking the brakes can start them juddering in and out. Timing is important. Close the airbrakes or remove the sideslip just before the rope goes taut again, to avoid a violent jerk which may:
    - pitch the glider;
    - yaw and roll it;
    - break the rope and/or the weak link;
    - catapult the glider forward and create an even bigger bow.
- If you have to release with a big bow in the rope, wait until just before the rope goes tight again. Releasing without getting rid of the bow first can lead to the rings flying back and hitting the glider. In the worst case they could become entangled with it.

Situational Awareness

- **Lookout**. Look ahead at the towplane but also search for possible conflicting traffic. Scan ahead, above and to each side on a regular cycle.
- **Position**. Throughout the tow, remain aware of position in relation to the airfield and safe landing options.
- **Emergencies**. Be alert to the possibility of a rope/weak link break and have a plan to deal with abnormal situations.

Release

Pre-release and release actions

- Plan to release. Check location and height – is this suitable?
- If towing in low-tow, release from low-tow, if towing in high tow release from high tow.
- Lookout: It is essential to check that, prior to release, the airspace is clear:

(a) to the right where the glider is just about to turn, and;

(b) to the left and below where the tug is just about to descend.

- If there is conflicting traffic, continue towing until clear.
- **Locate, Identify, Operate:** The release should not be operated until it has been positively located and identified as the one required. This eliminates any possibility of error in selection of the wrong control. This principle applies to all ancillary controls.
- Pull the release, observe the rope go, and begin a right turn without delay applying normal targeted scan.
- The release should be operated while the towrope is still under some tension and the glider pilot, on noting its separation, will immediately commence a clearing turn to the right thereby obtaining a maximum clearance from the rope.
- The tug pilot, after feeling “release” should check that the glider has in fact released and begin a descending turn to the left.
- You will probably need to reduce your airspeed on turning right, as you have been towed at 65-70kts and will need to slow down.
- Monitor the tug to ensure that separation is maintained.

FLIGHT EXERCISES FOR THIS UNIT

- Instructor will demonstrate the correct tow position:
  - The wings are parallel to towplane wings,
  - In line behind the towplane,
  - Just below the slipstream.
- Feeling for the slipstream will find the right position.
- The student will be asked to follow through on the controls.
- Notice the small movements.
- A relaxed grip on the controls helps success in the exercise.
- When comfortable, a hand over from the instructor to the student will be conducted (Handover/Takeover routine).
- Small bows and horizontal displacements can usually be ignored. Bows will gradually pull out if nothing is done to worsen the situation, and any displacement will automatically correct itself.
- Corrections – small movement, use small rudder pressure to move back into line. Find the slipstream by gentle use of elevator, and then move back to position. Make small bank changes and observe the ensuing turn. – put wings back parallel to towplane wings and then use rudder to correct.
- The instructor may have to take over at various stages of this practice.
- If serious over-controlling occurs, return to the stable platform, which works perfectly well on tow if the trim has been correctly adjusted.
- Should the glider get out of station laterally, it must be because bank has developed. The first requirement is therefore to ensure that the glider’s wings are parallel with those of the towplane by gentle application of aileron and rudder. This will stop the glider getting further

out of station, and in most cases the glider will tend to return to the central position of its own accord after a few seconds.

- At lower altitude there is a small advantage in having a slightly nose heavy trim, in case of a rope break. The trim will help with maintaining safe speed near to the ground. Once established at a safe height, adjust the trim to reduce workload.
- Look around to identify landmarks and other aircraft. The aim is to do this without moving the controls to follow their head.

Release

- Confirm that height and location are as expected.
- Perform a suitable lookout to ensure the airspace is clear in the direction both the tug and glider will be flying post release.
- **Locate** and **Identify** the release knob, and then **Operate** it when safe to do so.
- Monitor the tug position to ensure it has identified release and that separation is maintained.
- Once it is confirmed that the rope is released, execute a turn to the right.

Notes

- Once released, the pilot transitions from Launching Pilot to either Soaring or Landing Pilot and should configure the glider appropriately.
- The GFA does not mandate any single post-release action list or checklist, however some clubs choose to apply local checklists, which may vary for particular sailplanes and prevailing local environmental conditions such as FUST – Flaps set as required or fixed, Undercarriage set as required or fixed, Speed as required and Trimmed for speed.

High Tow

- Once you are capable at flying in Low tow, you can progress to flying in High tow.
- Transitioning through the slipstream there is the need to maintain a small amount of backstick so it doesn’t get stuck in the slipstream.
- This is good practice for when doing the take off and having to transition down to low tow when climbing out.
- The correct position is just above the slipstream.
- Note the problem of getting too high where you can lose sight of the tug (Release)
- Practice releasing in High Tow, and then in later flights return to Low Tow and release.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
PROBLEM	**PROBABLE CAUSE**
• Glider swinging from side to side behind tug.	Trying to use aileron alone to control the glider in roll, thereby inducing large amounts of adverse yaw.
• Glider much too low behind tug (very common)	Failure to use slipstream as primary reference for towing position. Failure to adjust trim to provide stable platform in normal low-tow position.
• Student over-controlling on aerotow.	Not adopting the stable platform, which works just as well on tow as in straight flight.
• When moving the glider back into position, student has difficulty in stopping the glider in the correct place.	Student has not developed the required amount of anticipation needed to apply corrective controls a little before the glider gets into position

HOW DO YOU DEMONSTRATE COMPETENCE?

- Tug slipstream is identified and glider held below slipstream (through use of elevator).
- Glider bank angle is maintained parallel to towplane bank angle at all times (through use of aileron).
- Maintain line astern position behind towplane (through use of rudder).
- Recovery from out of station position is demonstrated using coordinated controls.
- Correct procedure to correct bow in tow rope is demonstrated.
- Correct transition between low and high tow is demonstrated.
- Release altitude is determined.
- Pre-release lookout for tug and glider is conducted.
- Locate-Identify-Operate release is conducted.
- ‘Rope Gone’ is visually verified.
- Right turn is commenced and post release actions are conducted.
- Transition from launching pilot to soaring or landing pilot is conducted

THREAT AND ERROR MANAGEMENT

- Learning aerotow often results in such concentration on the towplane that Lookout tends to vanish. Try to lookout whilst learning aerotow to develop good habits.
- Whilst on aerotow, maintain your situational awareness of height, position and other aircraft.
- Releasing too low or too far away or downwind results in not being able to execute a proper circuit. Remember YOU are the pilot who releases from the towplane and only do so if you can make it back to the circuit.

RESOURCES & REFERENCES

- The Glider's Aircraft Flight Manual
- Gliding Basics: British Gliding Association 2019
- Gliding Handbook: FAA 2013
- Australian Gliding Knowledge (AGK) pages 92-94, 104-110
- The Glider Pilot's Manual: Ken Stuart: 2nd Edition; Airlife 1999.
- Understanding Gliding: Derek Piggot: 3rd Issue; Ac Black 1996

SELF-CHECK QUESTIONS

- What is the primary reference for establishing the correct towing position on aerotow?
- What is the difference between high tow and low tow?
- What should be the trim position during an aerotow?
- Describe how a "bow" in the rope is corrected.
- List the sequence of events prior to and during release from aerotow.

Gliding Australia Training Manual

Pilot Guide

Unit 13S
Launch & Release (Self-Launch)

WHAT THIS UNIT IS ABOUT

To develop and demonstrate the skills and knowledge required to safely fly a self-launching glider through a normal climb and engine shut down to transition to soaring pilot.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Units 1-10, and
- GPC Unit 12 Slow Flight, Stalling

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 14S Take Off Self Launch
- GPC Unit 20S Launch Emergencies

KEY MESSAGES

- Care must be taken in operating low powered self-launchers in high density altitudes or in the lee of mountain ranges as sink areas may prove in excess of the powered climbing performance.
- Conduct regular engine parameter checks until top of launch height.
- Don't climb under power using thermal assistance under and through the towing pattern, normal circuit area or in conflict with any winch launching.
- Every different type of self-launcher has a different shut down and restart procedure which must be observed otherwise engine damage may result.
- Engine restarts must be initiated above a safe height that in the event of failure to start, a normal circuit and landing to a suitable landing area can be achieved.

PILOT GUIDE FOR THIS UNIT

Review Aircraft Flight Manual

Close study of the self-launching glider's Aircraft Flight Manual is required to obtain:

- Expected climb rates at ambient air temperatures.
- Temperature limitation on operations.
- Any limitations on use of full throttle (e.g., Rotax 912 maximum 5,800 RPM with five-minute limitation on full throttle above 5,500 RPM).
- Detailed shutdown procedure involving cooling down before engine shutdown and/or retraction.
- Detailed in-flight restart procedure.
- Safe heights for restarts and safety procedures in the event of a failure to engine start.

Self-Launch above 300 Ft AGL

- To ensure clearance of obstacles, transition to Vy (best climb rate speed) rather than Vx (best angle of climb speed) for obstacle purposes.
- Conduct full scan lookout, lowering nose momentarily if necessary to clear ahead.
- Climbing turns no steeper than 15° unless using thermal assistance.
- Engine parameter check with close monitoring of any tendency to overheat.
- Maintaining runway heading until 500’ AGL unless keeping within gliding range of the airfield.

Take-off pattern

- Situational awareness of and provide separation between the launch and any other powered traffic (especially towing combinations).
- Aerotow traffic will typically climb better than self-launch, so be aware of the aerotow launch pattern and adopt a pattern to avoid conflict.
- Remain clear of any winch launch area.

Engine Management

- To shut down the engine requires focus on key procedures in accordance with the Flight Manual. For complex procedures use of a printed checklist is strongly recommended to prevent engine or airframe damage.
- Ensure an appropriate level of lookout while shutting down the engine. It is easy for the pilot to become distracted.
- Smooth transition to soaring pilot (or landing pilot if conducting circuits).
- Demonstrate restart procedure in accordance with the Flight Manual above a safe restart height. Restart at low altitude has potential to place the glider too low for a safe landing if the engine fails to start.
- Review Safety procedures after engine failure to start. This relates to maintaining situational awareness with a priority to fly the glider at a safe speed and height, ensuring access to a safe landing area, removing excess drag (feather propeller, retract engine), fuel management.

Notes

- Do not let shutdown nor restart procedures distract you from the primary duty to see and avoid.
- If shutdown and restart procedure is complex, use of a printed checklist is strongly recommended to prevent engine or airframe damage.
- Gliders with a retractable engine usually have operational speed limits, the engine may not deploy or restart if those limits are not observed.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Failing to monitor engine parameters.	Pilot distraction or confusion. Note position of key gauges and identify normal operating ranges (green arcs). Ensure monitoring of parameters is part of launch work cycle.
• Maintaining throttle outside engine operating limits.	Pilot distraction or failure to note passage of time. Note need to confirm engine is operating within required limits throughout the launch.
• Failure to climb at expected rate.	Best climb speed is not being maintained. Monitor airspeed during launch and note attitude for Best Climb. Heavy sink or incorrect aircraft settings, or tailwind will impact on climb performance. Monitor performance minima and abort launch if these are reached.

HOW DO YOU DEMONSTRATE COMPETENCE?

Demonstrate

- use of Vy (best climb rate speed) and Vx (best angle of climb speed).
- Full scan lookout, lowering nose momentarily if necessary to clear ahead.
- Climbing turns no steeper than 15° unless using thermal assistance.
- Engine parameter check with close monitoring of any tendency to overheat
- Situational awareness ensuring separation between the launch and any other traffic.
- Shut down procedure and restart procedure in accordance with the Flight Manual

RESOURCES & REFERENCES

- Aircraft Flight Manual.
- Powered Sailplane Manual: GFA Ops 0009 Aug 2015.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Explain engine start, shutdown and restart procedures.
- State the engine parameter limits for your glider.
- State the parameters that would require you to abort the takeoff.

Gliding Australia Training Manual

Pilot Guide

Unit 13W

Launch & Release Winch

Unit 13W - Launch & Release Winch

WHAT THIS UNIT IS ABOUT

To develop and demonstrate the skills and knowledge required to safely fly a winch launch, from the initial climb stage through to release.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC 7 – Straight Flight various Speeds & Trim
- GPC 8 - Sustained turns, all controls
- GPC 10 – Use of Ancillary Controls
- GPC 12 – Slow flight & Stalling

COMPLEMENTARY UNITS

- Nil

KEY MESSAGES

- Winch stages occur quickly – pilot must remain ahead of the aircraft.
- Always remain in the safe winch speed range for the aircraft.
- Use the too-fast signal prior to the speed exceeding the upper limit.
- Winch upper limit may be exceeded by up to 10% in the initial climb stage only.
- Learn to use speed signals and know when to abort a launch.
- Conduct launch work cycle continuously through the launch.
- Always abort the launch if the speed is unsafe (fast or slow).
- Release should be performed manually with as little cable tension as possible.
- Never allow the winch launch to continue outside Visual Meteorological Conditions (VMC).

PILOT GUIDE FOR THIS UNIT

A winch launch consists of 5 stages – ground run, separation, initial climb, full climb and release. This unit covers the last three stages.

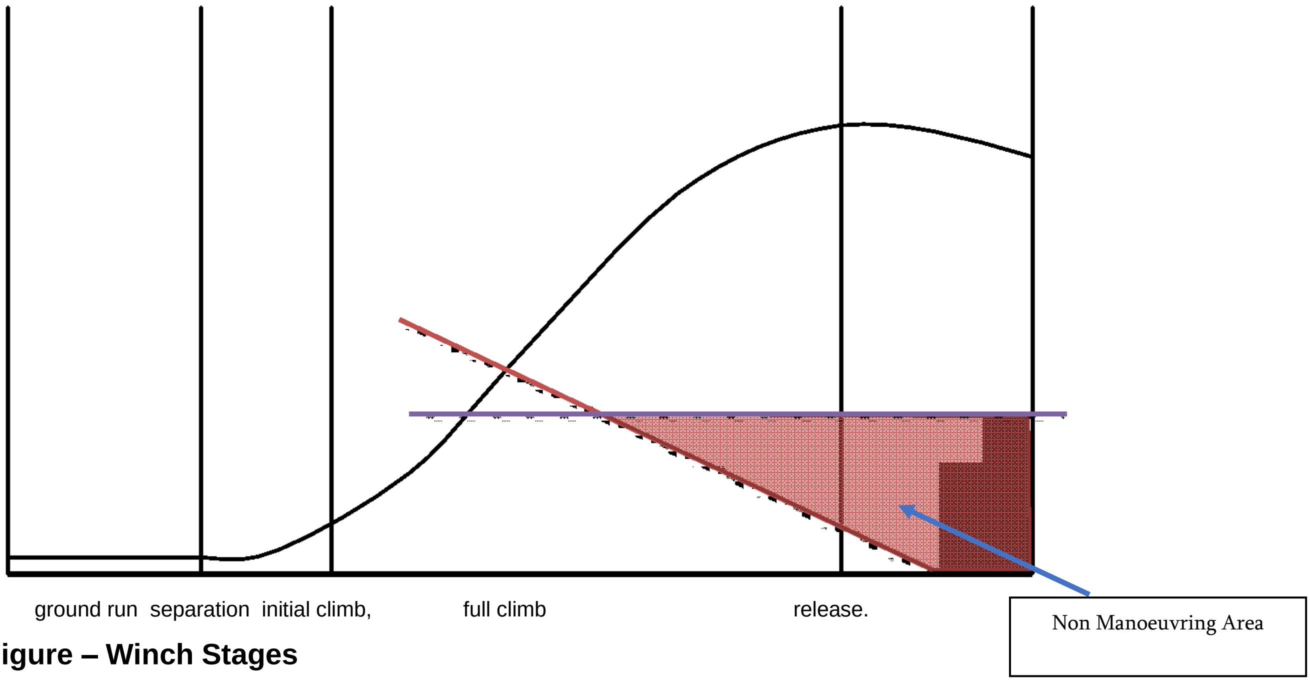
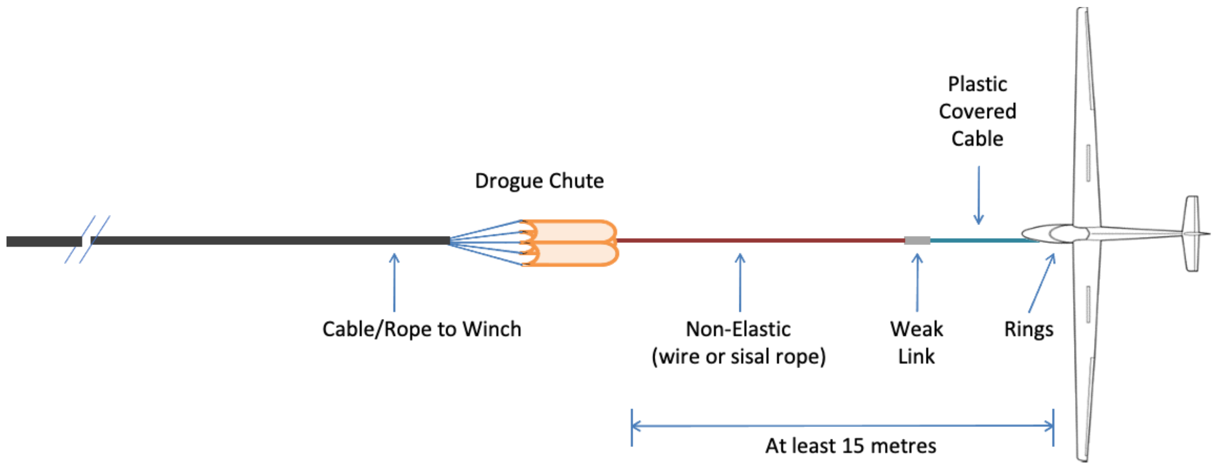


Figure – Winch Stages

- A winch is a static device, consisting of a powerful engine driving a large steel drum on which is wound about 1500 metres of wire. Modern winches may use a number of different cables – single strand wire, multi-stranded cable and Dyneema® rope.
- The gliders are launched by being attached to the end of the 1500 metres of wire, appropriate signals then being given to the winch-driver by the crew at the glider launch point.
- In the full climb the gliders climb steeply, at about 45 degrees nose-up, and reach a typical height of 1500ft in under a minute. As a rough guide, the height gained on a winch-launch in a light wind will be about one-third of the length of the cable at the start.
- A weak link is in place between the cable and the glider release to ensure that the load from the cable does not exceed the weak link rated value. It is critical that the right weak link is used for the aircraft being launched. A drogue chute is often used further down the cable to reduce the speed at which the cable falls back to the ground.



- After the cable is released, the wire is wound back into the winch.

The advantages of winch-launching are:

- A reasonable cost per launch;
- it is easier to train winch-drivers than it is to train tug-pilots;
- it gives a reasonable launch-height very quickly in comparison with aerotowing; and
- winches are much cheaper to build and maintain than tug aircraft.

The disadvantages of winch launching are:

- Winches are fairly complicated, and reliability is not as good as with aerotowing.
- The launch cable breaks more frequently than aerotow ropes do; and
- Calm conditions reduces the launch height.

Initial Climb Stage

- This is the stage following separation from the ground where the attitude of the glider is gently and smoothly graduated from the separation attitude to the full climb attitude. Before doing this, the pilot will check that the speed has risen to the minimum permitted value for commencing the climb and is still rising.
- The lower third of the launch places less aerodynamic load on the wings and is the only part of the launch where the maximum winch speed (VW) can be exceeded by a small amount and never more than 10%. Once beyond this point the upper airspeed limit must be strictly enforced.
- You should always refer to the winch speed information provided for the aircraft in the Aircraft Flight Manual.
- The minimum permitted speed is 1.3 times the stalling speed - 1.3Vs. If the speed is falling towards the minimum safe speed of 1.3Vs at this stage of the launch, you need to treat it as a launch failure and release the cable.

- It is dangerous to climb steeply near the ground, even if the speed appears to be adequate, as it may be impossible to lower the nose to a safe attitude in the available time if a failure occurs.
- It is also dangerous to rotate from initial to full climb too quickly, particularly with a powerful winch as this may induce a high-speed stall as the wings exceed the critical angle of attack.
- Pulling back aggressively in the initial climb may cause the cable to break or create a more dangerous situation where one or both wings stall due to a high angle of attack. This latter situation can rapidly result in the aircraft being out of control and cartwheeling into the ground.

Full Climb Stage

- Before entering Full Climb, the airspeed must be between the minimum of 1.3VS and the maximum (VW) as displayed on the cockpit placard. This defines the "working speed band" which differs from type to type and must be known for each glider you fly.
- The exact degree of steepness of the Full Climb stage depends on the airspeed; if the speed tends toward the low end of the band, ease off the climb angle, if it is toward the high end, it is safe to maintain a steeper angle. Climb angle is determined by glancing out at one wingtip. Never exceed a climb angle of approximately 45 degrees.
- During the full climb stage, the pilot has a ‘work cycle’ of things to continually manage, these are:
    - Airspeed: is the airspeed within the winch speed band, or approaching a limit?
    - Angle: is the angle of the horizon against the wingtip correct, or too steep/shallow?
    - Drift: is a crosswind drifting the aircraft to a point where a correction is required, left or right?
- A typical full climb is steep, about 40-45 degrees nose up.
- The full climb stage of the launch however is characterised by a very high climb rate, typically in excess of 2,000 ft/min (20 knots). Height is obviously gained very rapidly, and it is quite safe to climb steeply during this phase, provided that the speed is safely within the working band.
- The maximum placarded winch/auto launch speed must not be exceeded when in full climb.
- Due to the nose angle of the aircraft there is no forward view of the ground, but direction may be maintained by glancing outside down each side of the instrument panel.
- The wings are kept level, or at an appropriate bank angle in a crosswind, by glancing to each wingtip in turn.
- The pilot will notice that they need to keep easing back on the control column in order to maintain the climb angle due to the increasing down force exerted by the cable as the launch proceeds. The force on the column will be significantly more than normal flight loads.
- If the winch launch will take the aircraft outside Visual Meteorological Conditions (e.g. into cloud) you must release the launch whilst the aircraft is still in VMC.

Release Stage

- The correct time to release is usually signified by the winch or car driver positively closing the throttle.
- The loss of power at the top of the launch is easily discerned by the pilot. At that point, lower the nose just below the horizon. LOCATE-IDENTIFY-OPERATE the cable release <u>twice</u>.

- Hold the glider straight and level for a few moments to allow the speed to settle at the value you want, and re-trim.
- The cable back-release mechanism may activate prior to the pilot operating the release. In this case still operate the release to be certain that the cable has been released.
- The **non-manoeuvring area** is the area of sky on a winch/auto launch in which, if a launch failure occurred, a glider is too low to carry out a circuit but too high to land ahead in the remaining strip length. See the red shaded area on the diagram above. You will note that there are no absolute height values mentioned in the description of the non-manoeuvring area.

Signals to the Winch Driver

- The pilot can advise the winch driver if the speed is approaching the upper end of the working band.
- The "too fast" signal is provided by yawing the aircraft left and right, until the signal is recognized, and the speed reduced by the winch driver. The signal needs to be visible to the winch driver.
- If the airspeed reaches or exceeds the top of the working speed band the launch you must release.
- There is no signal for when speed approaches the lower end of the working band, in this case the pilot lowers the aircraft nose to remain within the speed band. The winch driver may notice this and increase speed as a result.
- If the airspeed reaches or drops below the bottom of the working band the launch must be aborted.

FLIGHT EXERCISES FOR THIS UNIT

- In these flight exercises the instructor will assume responsibility for handling any launch failures or emergencies that occur. Your responsibility is to fly a 'normal' launch profile.
- Initial training in this unit will focus on the full climb and release stages. As your training and skills develop your instructor will progressively hand more launch responsibility over to you. Ensure that you always have a thorough pre-flight briefing on expectations and effective transfer of control in flight (my aircraft – your aircraft).
- Your instructor may take you off to a safe position on the ground to observe a winch launch from the side and identify the different stages.
- Initial flying will concentrate on the top part of the full climb stage and recognising the drop in power at the top of launch and the subsequent process of releasing the cable. You will need to practice the launch work cycle and maintain control of the aircraft on the cable.
- As you become proficient the instructor will give you control of the aircraft at the lower part of full climb stage. Once you can manage that well you will be given control of the aircraft from just after Separation Stage of the launch.
- The instructor will also show you how to perform the 'too fast' speed signal (yawing) at height when not attached to the cable. You will then need to perform this signal as required on subsequent launches.
- When you are competent in this unit of training you will be assuming responsibility for conducting the winch launch from just after separation to the point where the cable is released.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Solutions**
• Failing to ease back to maintain a correct launch angle in full climb.	Ensure that you monitor the angle the wingtip makes with the horizon and use this to determine whether you need to adjust the pressure on the control column during the launch.
• Pulling back too much in the transition from initial climb to full climb.	Ensure that you have allowed the aircraft to climb approx. 50 feet above ground prior to commencing the transition to full climb. Allow for a period of a few seconds to go from the initial climb to full climb attitude. Ask your instructor for guidance and a demonstration if you still need assistance.
• Failing to practice the winch launch work cycle.	Ensure that you don't focus continually on one aspect, you need to scan continuous to ensure that Airspeed, Angle and Drift are all within acceptable limits.

HOW DO YOU DEMONSTRATE COMPETENCE?

- The conduct of a winch launch from just after Separation Stage through the Initial Climb and Full Climb Stages in a variety of wind conditions using an appropriate climb angle.
- A normal release of the winch launch cable and post-release actions.
- Your reaction to airspeed changes during the Launch with the appropriate actions and signals.
- You can describe the threats present during a winch launch

RESOURCES & REFERENCES

- Aircraft placard for winch speeds
- GFA Winch Manual (OPS 0007).
- Australian Gliding Knowledge
- Video – Winch launch, normal flight profile.
- BGA Winch Videos – what can go wrong.

SELF-CHECK QUESTIONS

- What are the three last stages of a normal winch launch?
- What is different about the maximum speed limitation in the lower third of the launch?
- What is the work cycle that needs to be conducted during a winch launch?

- How do you know when to commence the release stage of the launch?
- How do you release the launch cable from the glider?
- How do you know what the min and max winch launch speeds are?
- What actions do you take if the airspeed on launch is moving towards the min or max?
- What actions are needed when launching in a cross wind?
- What are the dangers of pulling back aggressively at the initial climb stage?
- What is the back-release mechanism and how does it operate?

Gliding Australia Training Manual

Pilot Guide

Unit 14A

Takeoff (Aerotow)

WHAT THIS UNIT IS ABOUT

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

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 2 Ground Handling, Signals
- GPC Unit 7 - Straight flight, various speeds, trim
- GPC Unit 8 - Sustained turns, all controls
- GPC Unit 9 Lookout Procedures
- GPC Unit 10 - Use of ancillary controls
- GPC Unit 13A – Aerotow Launch and release.
- 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

KEY MESSAGES

- Plan ahead. Anticipate possible emergency options.
- The Pilot in Command is responsible for confirming “airspace clear for launch” and “pilot ready - launch approved”.
- Keep wings level with aileron, nose pointed at towplane with rudder, takeoff attitude set with elevator, ALL independently, until the glider is airborne.
- The towing pilot has a release and WILL use it if an unsafe launch is evident, or the towplane runs out of elevator authority.

PILOT GUIDE FOR THIS UNIT

Preparation for Take off

- Pre Boarding and Pre Take off checks must be performed (ABCD-CHAOTIC) and options discussed for launch emergencies. Your instructor will indicate areas on your runway and around the airfield where you can land if the rope breaks.
- You will be shown the hand signals and correct procedure in connecting the rope to your glider.
- You will be given clearance from the ground crew that the airspace is clear.

- When ready you will give the “thumbs up” signal to the ground crew who will lift the wing indicating you are ready for takeoff.

Ground Run and Separation

- Before takeoff on aerotow the trim should be set slightly forward as required during the cockpit check. The controls used independently to get the glider into the wings level takeoff attitude, from which it will separate naturally when flying speed is attained. The glider should not be “rotated” in the nose-up sense at the separation stage.
- At this stage the wings are kept level (or banked slightly into any crosswind) with aileron, position behind the tug is maintained with rudder and takeoff attitude maintained with elevator. Coarse control movements will be required until the glider gains speed.

Ground Run, Separation, Initial climb - Pre-Flight Briefing

- There are three parts to this:
    - Glider and tug on ground.
    - Glider airborne, tug still on ground.
    - Both glider and tug airborne.
- **Glider and tug on ground**. Due to the slow acceleration of the tug/glider combination, the controls will be sluggish and unresponsive at the start of the launch, and will become more responsive slowly. The glider should be placed in the flying attitude as soon as the controls are functioning and kept in this attitude until flying speed has been attained and the glider separates. Primarily, set the glider up so it runs on the mainwheel.
- **Glider airborne, tug still on ground.** When the glider lifts off, it will start to climb higher and higher as the airspeed continues to increase. This must be resisted by a progressive forward elevator pressure, holding the glider no higher than the towplane’s tail fin. DO NOT GO HIGHER THAN THIS, AS YOU PULL THE TUG’S TAIL UP ON ITS GROUND RUN.
- **Both glider and tug airborne.** When the tug lifts off, maintain the glider in a position above the slipstream until the tug is positively established in a climb. Typically 100-300 feet AGL. Then move gently but positively down through the turbulence of the slipstream until the glider is once again in smooth air.

Initial Climb

- The glider should remain just below the turbulence of the tug with its wings parallel to the tugs wings.
- Its important that a good lookout is maintained for conflicting traffic and we maintain a good situational awareness during the climb.
- As we climb, our options for launch failures change. Call out the change in options when they become available.

FLIGHT EXERCISES FOR THIS UNIT

- The Instructor will demonstrates and explains the process.
- Then they will invite the student to come on controls to feel the stick and rudder movements.
- The Student practices under supervision and guidance.

- Whether intending to carry out an aerotow in the high tow or the low tow position, the separation and climb-away stages are identical. The glider will lift off before the tug and should be held at a height of two metres / six feet above the ground (about the height of the tug's fin) until the tug also separates. In this situation the glider will be just above the tug's slipstream.
- **If intending to carry out a high tow**, this position above the slipstream is maintained as the combination climbs away. Remember that high tow is, by definition, just above the slipstream, not above the tug. The slipstream is the primary reference, not one of the fixtures on the tug.
- **If intending to carry out a low tow**, maintain station above the slipstream as the tug leaves the ground. When the tug is positively established in a climb, move the glider gently but positively down through the turbulence behind the tug until once again in smooth air. The glider is now in the low-tow position. Once again the slipstream is the primary reference. Do not go too low in relation to the slipstream - it is not necessary.

Notes

- **Important Note:** The glider going too low in the low-tow position results in the tug pilot needing more and more forward stick to compensate. Although this could get to the stage of running out of elevator power to keep the tug under control, it is rather unlikely to become this serious and in any case such a situation usually develops slowly enough for the tug pilot to release the glider before control is lost.
- In contrast, it is **<u>dangerous</u> to go too high behind the tug in high tow**, because this situation can get out of control very quickly and the tug pilot may not have enough time to pull his release before a "tug upset" occurs. See section on "implications of glider going too high behind tug". If the glider goes so high that the pilot loses sight of the tug, the glider's release should be pulled WITHOUT DELAY.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- As a prolonged ground-run is normal with aerotowing, it may be expected that you will initially have difficulty in keeping position behind the tug. Use Aileron, Rudder and Elevator independently of each other.
- Wings not kept level – you may not identify that one wing is lower. You 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. Instructor intervention will likely be required in the first attempts.
- Glider continues to climb after separation due to increasing effectiveness of the elevator.
- When the tug separates, it is likely that the student will have difficulty in moving cleanly into the low-tow position.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Pre -Take Off checks are performed with options for launch emergencies identified (CHAOTIC).

- Airspace clearance for launch is confirmed.
- Locate and identify yellow release handle and place hand in close proximity.
- Independent non coordinated control inputs are applied whilst on the ground:
    - Glider is kept straight behind tug using rudder;
    - Wings are kept level using aileron;
    - Elevator is used to balance the glider on the mainwheel in the correct takeoff attitude.
- Aircraft is allowed to separate from ground, held in position no higher than the height of the tug's fin.
- Use coordinated control movements once off the ground.
- Controlled transition to low tow is achieved when the tug is positively established in the climb at a safe height.
- Maintain position just below slipstream of tug.
- Maintain wings parallel to tug wing.
- Monitor options for cable break actions.
- Maintain lookout for conflicting traffic.
- Maintain situational awareness.

RESOURCES & REFERENCES

- Australian Gliding Knowledge (AGK) pages 106-8, 111.
- GFA MoSP 2 Operations

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- When are emergency options planned for takeoffs?
- What clearance is required by the pilot before takeoff?
- What should be the trim position for an aerotow takeoff?
- Which control is used to maintain directional control on the takeoff run?
- Which control is used to put the aircraft level on its mainwheel on the takeoff run?
- What height is climbed to after glider separation and what reference point is used?
- When is transition to low tow conducted?

Gliding Australia Training Manual

Pilot Guide

Unit 14S
Takeoff Self Launching

Unit 14S - Takeoff Self Launching

WHAT THIS UNIT IS ABOUT

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.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

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

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

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

KEY MESSAGES

- Care must be taken whilst taxying 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 operation;
- An abort point must be preselected in the event of non-performance of the aircraft.

PILOT GUIDE FOR THIS UNIT

Motor Glider check list

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.

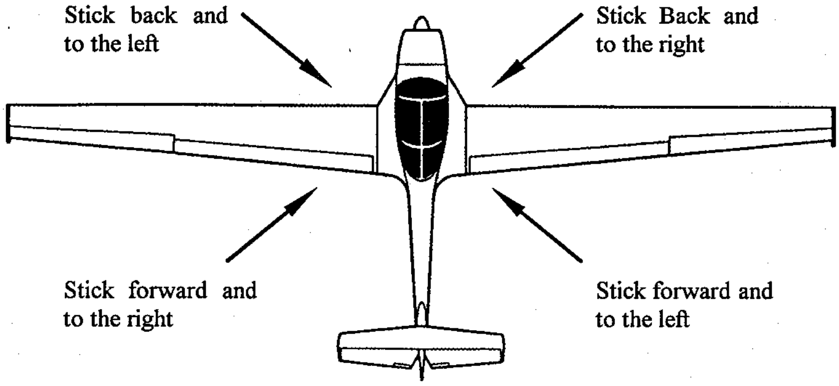
From Inside Cockpit	I	**Ignition**: Magneto check carried out, magneto or magnetos on both.
	F	**Fuel**: On and sufficient, most full tank selected if applicable.
	P	**Propeller**: Set for take-off/ fine position, plus checks required by Aircraft Flight Manual.
	C	**Choke/Carburettor Heat**: Off **Cowl 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.

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.

Ground-Handling and Taxying Techniques

- Glider pilots are not used to taxying 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 taxying should be in accordance with the following diagram. Arrows denote wind direction. Note that, whenever the stick is forward during taxying, 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 Usual Operations

- Taxying
- 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 tend 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.

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, this 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 Lift Off

- 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!)

FLIGHT EXERCISES FOR THIS UNIT

Instructor demonstrates takeoff with student lightly on the controls.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• 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
• Instability on takeoff	• Failure to adopt the takeoff attitude results in very fast taxiing with unstable handling. • Instructor 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;
• 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.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Takeoff distance is calculated;
- Taxi route is planned allowing for wingtip clearance;
- Pre Takeoff checks are performed with options for launch emergencies briefed in accordance with Flight Manual;
- Abort point on the takeoff run identified in the event of expected performance not achieved;
- Aircraft engine checks are carried out;
- Appropriate radio calls are transmitted;
- Airspace clearance for launch is confirmed;
- Aircraft is manoeuvred safely to take off point using appropriate controls for conditions;
- Independent non coordinated control inputs are applied;
- Glider is kept straight on centreline;
- Wings are kept level using aileron;

- Elevator is used to balance the glider on the mainwheel(s) in the correct takeoff attitude;
- Aircraft is allowed to separate from ground and held in ground effect until the Take Off Safety Speed (TOSS) is established;
- The aircraft is pitched to the appropriate climb speed (Vx or Vy).

RESOURCES & REFERENCES

- Powered Sailplane Manual: GFA Ops 0009 Aug 2015

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What are the additional radio calls that are recommended for a powered sailplane?
- Where would the takeoff distance calculations be found?
- Why does a powered sailplane need additional rudder on climb?
- What is the cross wind limitation on the powered sailplane you use?
- What is meant by Vx?
- What is meant by Vy?

Gliding Australia Training Manual

Pilot Guide

Unit 14W
Takeoff (Winch)

WHAT THIS UNIT IS ABOUT

To develop and demonstrate the skills and knowledge required to safely commence a winch launch, from the cable hook on through to initial climb.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 2 Ground Handling, Signals
- GPC Unit 5 Primary Effects of Controls
- GPC Unit 13W Launch and Release (Winch)

COMPLEMENTARY UNITS

- Where crosswind is a factor in the launch, consider complementary training in GPC Unit 19:
- Whilst the precursor for launch emergencies is discussed here (speed out of tolerance) the actual briefing and handling of the emergency is covered in GPC Unit 20 – Launch Emergencies.

KEY MESSAGES

- Winch launches progress quickly – you must plan ahead to remain ahead of the aircraft.
- Keep your close to the release to ensure quick launch abort if required.
- On ground maintain positive control of aircraft in direction and keeping the wings level (or held into crosswind).
- Allow aircraft to take-off whilst running on main wheel without using elevator.
- Always abort the launch if the speed is unsafe (fast or slow) or if wing drops and hits the ground.

PILOT GUIDE FOR THIS UNIT

This unit is about the first 2 stages of the launch (ground run/separation & initial climb).

Preparation for take-off

- Pre-launch lookout is critical. Identify clear airspace, conflicting traffic, suitable ground crew.
- The Launch occurs quickly – any issues need to be identified & resolved.
- Ensure that the seating position and cushions used in the cockpit will enable the pilot to easily reach and operate the release throughout the launch.

Hook On

- Ensure a Sterile environment - no distractions.
- Confirm that correct weak link is used – refer to cockpit placards.
- Confirm Minimum (1.3 Vs) and Maximum winch launch speed (Vw). (see aircraft placard)
- Complete pre-take-off checks, including airspace clear for launch and options in case of a cable break. Trim forward in case of cable break.
- Locate & identify release handle. Keep hand close.
- Perform radio launch broadcast if required.
- Monitor cable for commencement of ground run. Check that it does not snag on a ground obstacle or vegetation. If concerned, release.

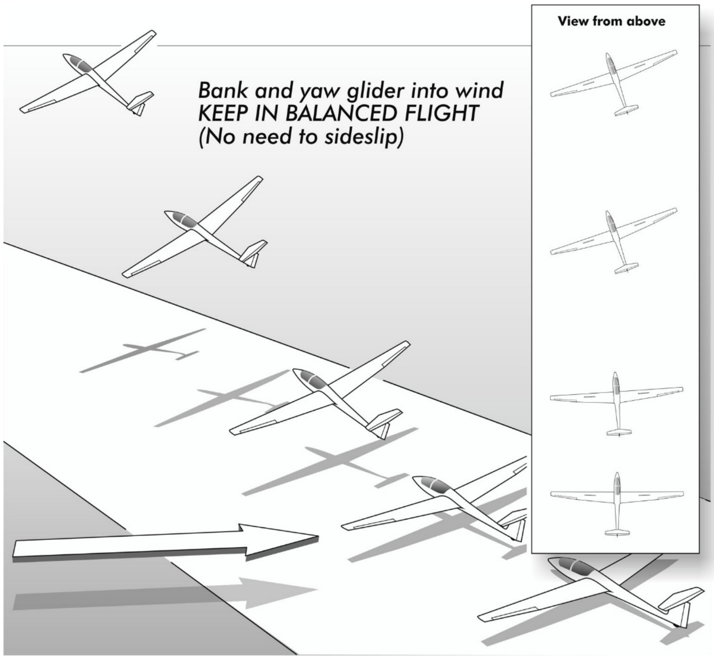
Ground Run

- Maintain wings level - use opposite rudder to pick up lowered wing at low airspeed, use aileron to keep wings level when airspeed allows. Initial ground run has low airspeed so large control movements are necessary, but acceleration is high and speed builds quickly. If a wingtip drops and hits the ground, release immediately.

- Control column starting position as required for aircraft – typically slightly forward but this varies with aircraft type.
- Looking down the runway
  - maintain direction with rudder,
  - keeping wings level and position the aircraft so that it is balanced on the main wheel (i.e. in the take-off attitude).
  - Glider will separate from the ground as airspeed increases.
- Actions in the event of a cable overrun - Typically, the release is close to the main wheel and there is potential for the cable to become entangled. Release immediately and shout STOP.

Separation

- The aircraft flies when lift generated exceeds weight. Lift increases with speed and you must maintain flying attitude. Do not use elevator to force the glider into a climb, allow the aircraft to rise in the take-off position whilst airspeed is building.
- Avoid large manoeuvres close to ground.
- Allow the glider to weathercock into any crosswind once clear of the ground. Ensure the glider is tracking along the runway.



- Use of flap as appropriate for aircraft.
- Climb not initiated in this stage. If the cable breaks close to the ground then you must be in a position to lower the nose and land. If the nose it too high you risk a stall if the cable breaks.

Transition to Initial Climb - allowing height & speed to build

- Maintain take-off attitude.
- Confirm airspeed at $1.3V_S$ prior to continuing into Initial Climb.
- Once speed is positively increasing you can raise the nose to adopt the initial climb. You must not pull back to a steep angle until you have enough height/speed to recover from a cable break.
- Progressively increase the climb angle monitoring acceleration and speed.
- Airspeed MAY exceed V_W (Max winch) at this point of the launch but not by more than 10%. Airspeed MUST be back within limits by the start of the full climb stage.

FLIGHT EXERCISES FOR THIS UNIT

- You will be asked to prepare the glider for take-off.
- Instructor will demonstrate the ground run, separation and initial climb, and then allow you to come on the controls for one or more flights. You will then be allowed to take control under verbal guidance.
- You will be expected to
    - maintains directional control with wings level during ground run;
    - verbally identify early stages of launch;
    - allow aircraft to lift-off and gain height in take-off attitude;
    - identify criteria for commencement of initial climb.
- As experience is gained you should monitor launch airspeed and take appropriate action:
    - You should recognise loss of airspeed and reduces aircraft nose attitude;
    - You should recognise increasing airspeed likely to exceed permitted upper limit in Aircraft Flight Manual AFM (+10%) and provide effective signal.

Notes

- Maintain a relaxed grip on the control column and ensure controls are adjusted correctly for reach during flight. Ensure that you can reach and operate the cable release whilst on the ground.
- Comply with the correct hand-over/take-over procedure.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

PROBLEM	PROBABLE CAUSE
• Failure to transition aircraft to run on main wheel on the ground:	Not repositioning control column to neutral position as airspeed increases; Not exerting sufficient force on control column to overcome nose or tail mass. Reposition control column smoothly into take-off attitude position as airspeed builds.
• Inadequate or excessive pull up through initial climb.	Not maintaining nose attitude.
• Coarse control of airspeed and climb angle.	Excessive force used on controls. Maintain a relaxed grip.
• Lack of directional control:	Incorrect operation of rudder pedals during ground run. Look towards the winch to identify track
• Aircraft separates at low speed and/or tail wheel/skid hits ground on rotation.	Attempt to pull aircraft off ground with elevator. Ensure enough time is allowed for sufficient airspeed to allow lift generation over aircraft weight.
• Student uses forward stick to hold aircraft on the ground after flying speed is attained.	Not recognising speed build up or holding aircraft in incorrect take off position. Aircraft will lift off when speed is sufficient. Aircraft should not be held on ground with elevator.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe the threats associated with a winch launch through the separation and initial climb.
- Demonstrate Pre-take off checks with options for launch emergencies identified (ABCD-CHAOTIC).
- The need for the correct weak link to be used and how to confirm this is fitted.
- State the airspeed limitations on the aircraft during the early stages of a winch launch.
- Describe the actions of the pilot in each stage of the launch.
- Demonstrate:
    - positive control of aircraft during ground run;
    - holding correct attitude for separation;
    - ability to maintain wings-level in variety of wind conditions;
    - smooth transition to take-off attitude;
    - separation and adopts appropriate initial climb attitude;
    - monitoring speed and direction and correct accordingly

RESOURCES & REFERENCES

- Australian Gliding Knowledge (AGK) pages 19,65,88,89,99-103
- GFA Winch Manual (OPS 0007).
- The Aircraft Flight Manual.

SELF-CHECK QUESTIONS

- What is the minimum and maximum winch speed for your glider?
- Describe your actions if the winch cable breaks on the ground run and on the initial climb?
- What is the correct weak link strength for your glider?
- What should you do if the glider wing drops to the ground during the ground run?
- How should you get the glider to commence the initial climb?
- How steep should the initial climb be?
- What do you do in a cross-winch winch launch?

Gliding Australia Training Manual

Pilot Guide

GLIDING AUSTRALIA

Unit 15
Break Off & Circuit Planning

WHAT THIS UNIT IS ABOUT

To

- Decide when a flight is to be terminated - to transition from soaring pilot to landing pilot.
- Identify a circuit pattern appropriate to the airfield, weather, traffic and other factors.
- Determine location of the circuit joining area, based on the selected circuit pattern.
- Configure the aircraft for circuit and determine when to use the pre-landing check.
- Demonstrate good lookout and traffic separation in the terminal (circuit) area.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 7 Straight Flight Various Speeds, Trim.
- GPC Unit 9 Lookout Scan Procedures
- GPC Unit 10 Use of Ancillary Controls

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 16 Circuit Joining and Execution.
- GPC Unit 19 Crosswind take-off and landing.
- GPC Unit 20 Launch Emergencies.
- GPC Unit 21 Radio Use and Endorsement.

KEY MESSAGES

- Landing is a high-workload phase of flight – ensure distractions are minimised and aircraft configured correctly at height.
- Identify options for joining a circuit with other traffic (refer CASA CAAP 166-01).
- Break off from soaring flight with enough height to return safely to the chosen landing area.
- Landing areas are generally high traffic areas – Situational awareness of traffic is critical.
- Maintain separation from obstacles and restricted airspace.
- Be prepared to modify the circuit plan if circumstances – traffic, weather, etc. – require.
- Be prepared to land off-field within the selected circuit area if necessary because of meteorological reasons, runway blockage or pilot error of judgement.

PILOT GUIDE FOR THIS UNIT

Sooner or later we must make a decision to land the glider, either because we have had an enjoyable flight and it's time to bring the glider back for someone else to use, or because we have run out of lift and can't stay up any longer.

You must transition from a soaring pilot to a landing pilot – this is a key decision and lets you focus on the critical decisions for a safe landing.

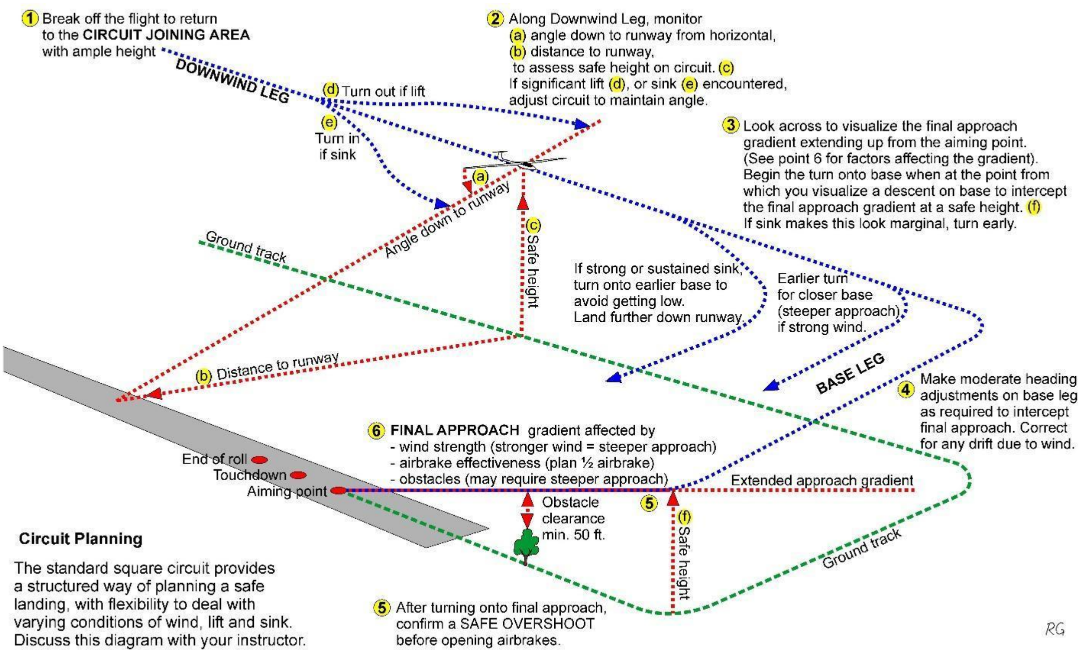
We must therefore consider the factors necessary for a safe landing. For a safe landing we must have:

- A suitable landing area
- A preselected landing direction and
- A final approach path with a safe margin over obstacles.

Break Off

- The variables used for determining when to cease soaring flight and return to the circuit include ensuring there is always **sufficient height** to transit to the circuit and to monitor any changing weather conditions.
- Failure to make this decision with sufficient time and height to plan and conduct a circuit to land will lead to serious difficulties, rushed planning and possible accidents.
- Ensure you can return to the landing area with sufficient height to join circuit on arrival.

Identify Landing area, circuit pattern and circuit joining area



- You'll want to get into the habit of assessing wind, sun, traffic and other factors early so you can decide on your landing area and circuit pattern early and give yourself plenty of time to plan the circuit.
- Identify a clear landing area on the airfield or suitable alternate if insufficient height to reach the airfield.
- Identify an appropriate circuit direction and circuit joining area in accordance with airfield procedures, weather conditions and aircraft performance. We always land into wind unless the circumstances require another option to be taken.
- Consider options for joining a circuit with other traffic.

- Consider options to join on Base, Final, from a 45° angle onto Downwind and Crosswind.
- Ensure that you maintain separation from traffic, other obstacles and remain outside restricted airspace.
- Continual evaluation of alternates – if other traffic appears, if wind changes, if lift/sink occurs etc.
- Consider options for emergency off-field landings within the selected circuit area due to meteorological or human factor reasons taking into account:
    - Wind direction considerations.
    - Minimum field length requirement.
    - Ground looping rather than going through a fence.
- Normally, your landing direction will be into wind, but there are factors which can affect your decision.
    - If the sun is low, you may want to avoid a base leg or finals looking directly into the sun.
    - If the strip has a slope, given the choice of landing downhill and into the wind or making a downwind landing uphill, the uphill option may be the better choice.
- As you approach, you should be prepared to modify your plans based on the current situation on the ground and in the air around the strip.

Transit to Circuit Joining Area

- On approaching the circuit joining area, your first task is to increase your lookout for other aircraft in or near the circuit. Maintain situational awareness of traffic & environment.
- Conduct TARGETED SCAN of circuit area and periodic FULL SCAN to maintain situational awareness.
- Check the volume on your radio as you should be able to hear any radio traffic.
- Transit must not conflict with circuit direction – avoid potential head-on situation.
- Consider tracks over the runway or on the dead side of circuit if appropriate for site. [Not with winch launching in progress].
- Look for obstacles or wildlife on your chosen landing area. The most likely obstacles you are going to face at most gliding clubs are tugs and gliders on the ground or in circuit or other traffic in the area.
- Gliders don't always follow the same circuit pattern, Look out for:
    - gliders who landed earlier and have not cleared from the strip.
    - gliders already on approach to the strip. Beware of aircraft who have decided to land in the opposite direction or on a cross strip.
    - gliders that are still launching. Identify glider and towplane traffic.
    - a circuit may be carried out in any direction if it is necessary. You may see a wide variation in landing approaches any day at a club, including straight in approaches, none of which is breaking any law.
- It is essential that extra care is taken if you are going against the normal direction to minimise disruption to other airfield users. However, it is better to fly a circuit in the wrong direction than risk getting too low trying to get to the conventional side of the circuit.

- If there is a cross wind component and you can choose the circuit direction, the most sensible direction all other things being equal, is one where the base leg is into wind. A down-wind heading on a base leg will make your base leg shorter and can make the turn onto final more hurried than it should be, reducing the time for making decisions.

Radio procedures

It is normal to do a call as you join a circuit and if things are busy in the area; it's a good idea to make another call when you turn onto base or final if the circuit is busy. Your instructor may do this for you until you are more comfortable with circuit planning.

Circuit Preparation

- Manoeuvre aircraft towards the circuit joining area. Judgement is required to arrive at the circuit joining area at a suitable height.
- Do not return to soaring flight.
- Adopt safe speed attitude below 1000' AGL (1.5V_S). Determine the Approach Speed (1.5V_S + ½ Wind speed).[1]
- You should already have a good idea what the wind strength and direction is and know what your preferred landing direction is but check the windsock to see if the wind has changed while you were airborne.
- Configure Aircraft for landing:
  - Straps are tight.
  - Water ballast dumped in gliders so equipped.
  - Engine configuration set.
  - Radio is on the correct frequency, volume and squelch are correctly set, and the microphone is positioned for best performance.
  - Flaps set.
  - Undercarriage lowered. Check the lever against placard for DOWN.
  - Speed required at circuit
  - Trim to an appropriate speed for the downwind leg.
- Reassess landing area feasibility and consider emergency options within the circuit area. Your aim is to arrive at the circuit joining area prepared for landing. Identify a suitable alternate landing area if your original plan is not working.
- Conduct TARGETED SCAN of circuit area and periodic FULL SCAN to maintain situational awareness.

[1] **Determine Approach speed** (1.5V_S + ½ wind speed) at the break-off point.

Set approach speed from the break-off point, but at the latest, before the pre-landing checks, (which is early on the downwind leg).

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Transits through active circuit area, over runway (if winch club) or other inappropriate path to joining area.	• Fixation on joining circuit may result in failure to maintain adequate situational awareness of where aircraft is in relation to airfield. • Incorrect decision as to where to locate the circuit joining area – where possible it should be located such that flying over the strip is not required.
• Inadequate height for aircraft to return to chosen landing area	• Late decision to break off from Soaring Pilot to Landing Pilot
• Student selects same joining area regardless of height or location.	• You may be flying by rote – using the same pattern as done previously in the belief it will still work.
• Fixation on particular circuit direction or landing area.	• Not adapting circuit plan to fit with available height, wind, traffic etc
• Too slow to configure for landing resulting in late checks and rushed planning	• Give yourself time to plan the circuit; rehearse the actions and checks when not training.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Consistently demonstrate when to return to the landing area with sufficient height to join circuit on arrival.
- Identify a clear landing area on airfield or suitable alternate if insufficient height to reach the airfield.
- Locating the landing area and identifying the best return path to avoid conflict with traffic and airspace.
- Ensuring you have adequate height to return to airfield in these conditions and determining the appropriate Circuit Joining Area and expected circuit direction to be used for selected landing area
- Selecting appropriate circuit direction and circuit joining area in accordance with airfield procedures, weather conditions and aircraft performance.
- Demonstrating situational awareness, including monitoring radio traffic.
- Adjusting your plan to accommodate traffic and other factors.
- Aircraft is configured for landing

RESOURCES & REFERENCES

- Australian Gliding Knowledge Pages 116 -120
- AC 91-10 v1.1 Operations in the vicinity of non-controlled aerodromes https://www.casa.gov.au/sites/default/files/2021-10/advisory-circular-91-10-operations-vicinity-noncontrolled-aerodromes.pdf

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Explain the different mindset between Soaring Pilot and Landing Pilot.
- What are the possible impacts of not transiting to the landing area with sufficient height?
- What could influence you not to land into wind?
- How do you configure the glider for landing?

Gliding Australia Training Manual

Pilot Guide

Unit 16
Circuit Joining & Execution

WHAT THIS UNIT IS ABOUT

To fly a circuit from the circuit joining area through to a stabilised final approach and recognise your responsibility to follow circuit procedures to complete a successful flight.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 15 Break-off & Circuit Planning

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 17 Stabilised Approach and Landing
- GPC Unit 21 Radio Use and Endorsement

KEY MESSAGES

- Circuit and landings are a high-workload phase of flight. It is important to ensure distractions are minimised and the aircraft is configured correctly at height.
- The ideal outcome is positioning the aircraft at the top of final approach in correct configuration at correct airspeed and height (>300' AGL) allowing a half airbrake stabilised approach.
- Landing areas are generally high traffic areas, ensure your situational awareness is maintained.
- Be prepared to monitor the landing area & modify the circuit as it is being flown if circumstances traffic, weather or other issues require.
- Maintain a safe speed at all times.

PILOT GUIDE FOR THIS UNIT

Normal Circuit

A circuit is flown in such a way that the glider is always within easy reach of the landing field. For this reason, a particular pattern has evolved over the years which will ensure that this requirement is met.

A typical circuit pattern is shown in the diagram below. Follow through the diagram from Circuit Joining Area, along Downwind leg, Base leg and Final approach. Watch some circuits being flown by other aircraft at your airfield and identify each leg.

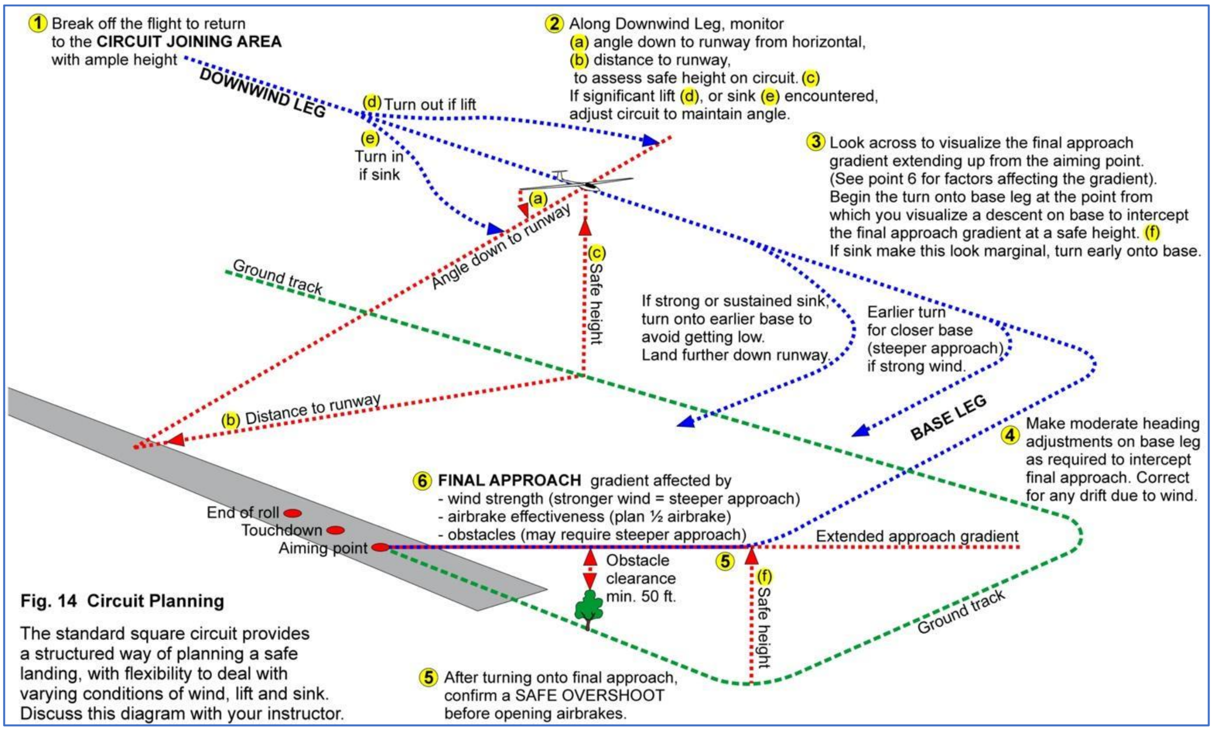


Fig. 14 Circuit Planning

The standard square circuit provides a structured way of planning a safe landing, with flexibility to deal with varying conditions of wind, lift and sink. Discuss this diagram with your instructor.

Setting the Speed

- At the breakoff point, **determine Approach speed** (1.5V_S + ½ wind speed)
- Establish safe speed near the ground (1.5V_S) below 1000ft
- You should **Set approach speed** from the break-off point, but at the latest, before the pre-landing checks, (which is early on the downwind leg).

Crosswind Leg

- Some clubs and sites require a crosswind leg to be executed.
- This would normally be perpendicular to the Downwind leg, entering abeam the other end of the runway.

Downwind leg

- The Downwind leg must be flown close enough to the runway so that you can clearly see any obstructions on the landing area, and far enough away to give you enough room for a base leg. Look out the side of the glider at the runway and determine how steep it is down to the landing point.
    - If the angle is too steep then you are too close and you will not be able to adjust your glide on base leg. To correct for this, turn the glider away from the strip (20-30 degrees) for a few seconds, then resume a track parallel to the strip and re-assess.
    - If the angle is too flat then you may not be able to get back to the runway if you hit sink. To correct for this, turn towards the runway for a few seconds and resume a parallel track.
- Maintain your attitude through reference to the horizon (1.5V_S + ½ wind speed).
- Maintain your track parallel to the runway.

- Make a radio call entering the circuit (generally joining crosswind or downwind) and LOOKOUT.
- If not already complete ensure that aircraft is configured for landing and pre-landing checks (FUST) are completed by mid-downwind leg.
- Don't forget to check the wind direction and strength.
- When passing abeam the landing area on the downwind leg check the landing area is clear and pick an aiming point. This will be used on the final approach and during training it helps if it can be easily identified from circuit height. Typical examples of useful aiming points are – suitable marks or a bare patch of ground on a grass strip. Anything that attracts the eye is useful during training.
- Then, in your mind's eye, draw a line, a kind of "ramp in the sky" up the approach path from the aiming point. This is the line you will follow down to the ground on the final approach. The reason you mentally sketch it all out at this point is that it helps you decide when to make the turn onto base leg.
- As the downwind leg progresses and the landing area recedes behind you, glance back over your shoulder to keep that mental final approach path in view. Then, when you reach a point where a turn onto base leg will intercept the final approach path at a satisfactory height and position, make the turn.
- Judge when to make the base leg turn by assessing height, position, and angle and make any necessary adjustments to the circuit. When the angle starts looking shallow or if you start losing sight of the landing area, it is time to turn base.

Base leg

- Fly the base leg parallel to the runway final heading, adjusting towards or away from the final leg as necessary. The purpose is to adjust height and position to ensure the final turn occurs at correct height/location.
- When you have completed the turn onto base, you should be able to see that the interception of the final approach path will take place as planned and will result in a straight run-in down the "ramp" to touch-down with plenty of time to make fine adjustments.
- The final approach leg must be sufficiently long to allow time on final to settle and assess approach path prior to using airbrakes to establish a stabilised approach.
- Ensure turn onto base leg and onto final is a coordinated (30-40° bank) turn – airbrakes should not be used – but if extended prior to entering the turn do not extend further during the turn.
- Maintain the approach airspeed and monitor situational awareness. Targeted scan for traffic coming head-on from an opposite circuit or for traffic approaching from the side on long final.
- Continue to monitor the approach path and landing area – assess the ability to land or determine changes required.
- Adjust commencement of the final approach turn for head/tail wind component on base leg. If in a tail wind start turn earlier.
- During the Base leg locate and put your left hand on the Airbrake lever.
- If height is excessive airbrakes can be used, provided they are opened before the turn, ensure airspeed is maintained. Ideally we want to be a **minimum** of 300’ AGL when you have completed the turn onto Final.

The Final Turn from Base to Approach

- Refer GPC Unit 17 for Stabilised approach and landing which is covered separate to this lesson. However, you should be aware of the following:
    - The final turn should be a normal (30-40°) banked turn, similar to the one onto the base leg at the selected safe approach speed, having regard to the local conditions.
    - Upon completing the turn and with the wings level, line the glider up with the required landing path into the landing area and confirm the landing area is clear.
    - The turn should be initiated early enough to avoid overshooting the centreline of the intended approach.
    - Turning too late is a common student error, which often induces a steep final turn and misalignment with the landing area centreline.
    - Good energy management is critical to safety, setting up a good stable approach from which a safe landing can be conducted.
    - Poor landings, or landings causing damage or injury, are much more likely to result if the final turn is executed too late, too close to the ground or with poor energy management, all of which make a stabilised approach and controlled landing much more difficult.

Situational awareness

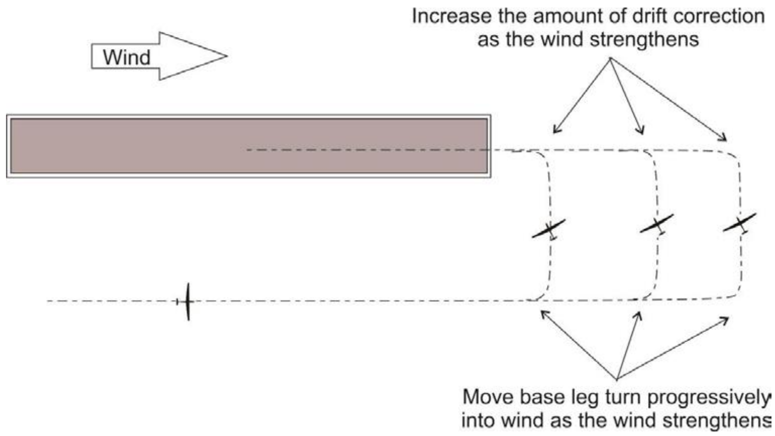
- Maintain a targeted scan of the circuit area and periodic full scan to maintain situational awareness.
- When other aircraft in circuit are sighted coordinate to avoid conflict on approach. This may require extending downwind if safe to do so. Remember rules of the air – lower aircraft and lower performance aircraft have priority.
- Although the use of radio is strongly recommended as a useful adjunct to safety in the circuit, remember the old saying " AVIATE – NAVIGATE - COMMUNICATE ". This neatly summarises the order of priorities which a pilot must remember. Don't over-concentrate on making a radio call, at the expense of losing control of your aircraft.

Modifying the circuit

- If angle becomes too low for a safe landing at the original intended landing area we should modify our circuit and land in the nearest available safe area.
- Monitor the intended landing area for obstacles. Consider options to modify the circuit or landing area if it is not clear (or not expected to be clear) for the approach.

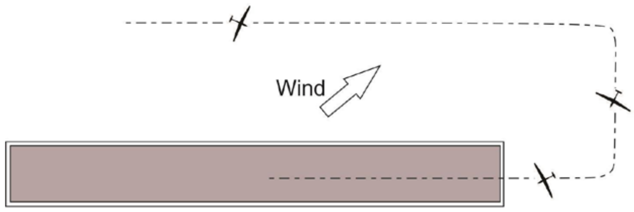
Strong Winds

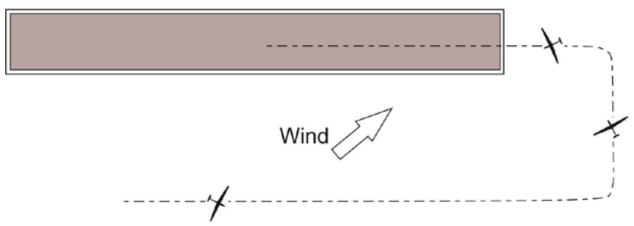
- The base leg turn should be made earlier than usual in strong winds to ensure you don't end up too far away from the aiming point. (see diagram below) The stronger the wind, the earlier the turn. Considerable drift correction will be needed on the base leg in strong winds.



Cross Winds

- It is preferable to do a crosswind circuit on the "downwind" side, i.e. with the wind tending to blow you away from the strip. (see below)
- This means that any drift correction is made TOWARDS the strip, making it easy to see the landing area. The base leg also takes a longer time to complete, resulting in a reduction in workload because of the extra time available.





- If compelled by aerodrome rules to do a circuit on the "upwind" side of the strip, (see above) the drift correction is made away from the strip, putting the strip to some extent behind the glider and therefore awkward to see. The base leg takes a very short time because of the high groundspeed and this tends to make for an increased workload.

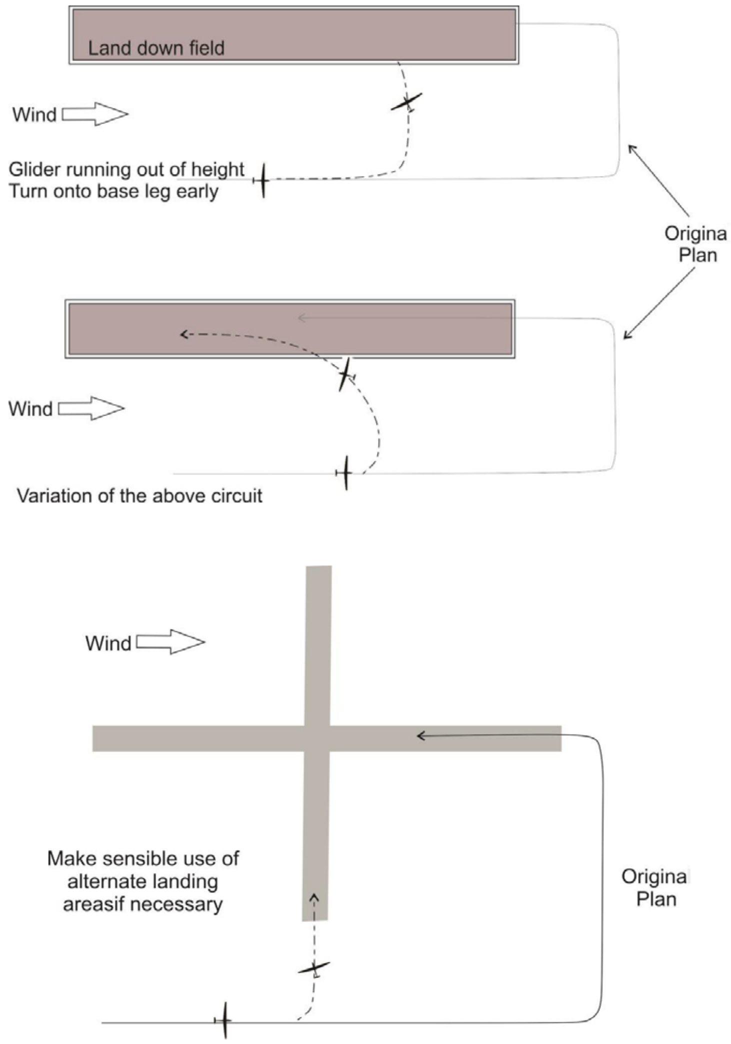
Running out of Height

- If unexpected heavy sink is encountered or a misjudgement of angle/distance relationship made, it may not be possible to complete the circuit originally planned. In this case the whole plan will need to be altered and a turn made onto the base leg much earlier, in some cases right away.
- A new landing area must be selected; anywhere on the aerodrome will do, the only requirement being that it is SAFE to land on. Convenience does not come into the argument.

Anyone can make a misjudgement or get caught by unusual conditions; the important thing is to place safety above all other considerations. Nobody cares if the glider has to be retrieved from several hundred metres down the field.

- NEVER risk a low base leg and final approach. Such a situation may be impossible to fly yourself out of, no matter how capable you are. Turn in early and land down the field. An early turn-in and down-field landing is known as a MODIFIED CIRCUIT.
- Failure to modify a circuit leaves a pilot without an escape route. This in turn increases the risk to an unacceptable level.

Some Examples of Modified Circuits



FLIGHT EXERCISES FOR THIS UNIT

- Your instructor will establish the aircraft on downwind and show you the appropriate angles to landing path - approximately 30 degrees down from horizontal with approach speed set to 1.5 Vs + ½ wind speed.

- You must continually reassess the situation and monitor the aircraft's height and angle to landing area to reassess landing area feasibility and consider options.
- If the downwind angle to the runway is too steep (or shallow), you will move away from (or towards) the runway to correct the situation and resume the parallel track.
- If the angle becomes too low for a safe landing at the original intended landing area your instructor will modify the circuit and land in the nearest available safe area.
- You both will maintain a targeted scan of the circuit area and periodic full scan to maintain situational awareness.
- Your instructor will show you where to turn base leg turn by assessing height, position, and angle and make any necessary adjustments to the circuit. The final approach leg must be sufficiently long to allow time on final to settle and assess approach path prior to using airbrakes to establish a stabilised approach.
- Ideally we want to be a **minimum** of 300' AGL after the turn from base leg to the beginning of the approach.
- It's a busy time for the pilot at in the circuit and perfecting your judgement takes time. For this reason, you will spend quite a few flights practicing this important unit.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Incorrect downwind leg ○ Too close or too far away ○ Incorrect speed ○ Not parallel to the landing direction	Not monitoring angle down to the aiming point Not monitoring nose attitude Not monitoring track
• Late or early turn onto base lag	Poor judgement of angle to aiming point
• Too high turning final	Too early turning base Lack of angle adjustment on base leg

HOW DO YOU DEMONSTRATE COMPETENCE?

- Arrival at the planned circuit area with aircraft correctly configured.
- Correct joining circuit radio broadcast.
- A range of non-standard circuit entries.
- Maintaining required speed and track and angle relative to the aiming point.
- Completion of pre-landing checks.
- Judgement as to when to turn to base leg and when to turn final.
- Arrival at a stabilised final approach no lower than 300ft AGL.
- Adjustment to the circuit path in response to changes in conditions and other factors.

RESOURCES & REFERENCES

- Australian Gliding Knowledge (AGK) pages 116-136
- Theory Lesson PowerPoints
- Gliding Handbook: FAA 2013

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What is the purpose of flying a circuit?
- What is the “formula” to calculate your downwind safe speed?
- If you have a strong headwind on your final leg, what allowance should you make on base leg?
- If you are too close on downwind leg, how should you adjust?
- With a crosswind which side of the runway is the best option to fly your circuit?

Gliding Australia Training Manual

Pilot Guide

Unit 17

Stabilised Approach and Landing

WHAT THIS UNIT IS ABOUT

To perform a safe stabilised approach and landing, for a wide range of environmental conditions.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC 15 Break-off & Circuit Planning
- GPC 16 Circuit Joining and Execution

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 19 Crosswind Take-off and Landing.
- GPC Unit 21 Radio Use and Endorsement

KEY MESSAGES

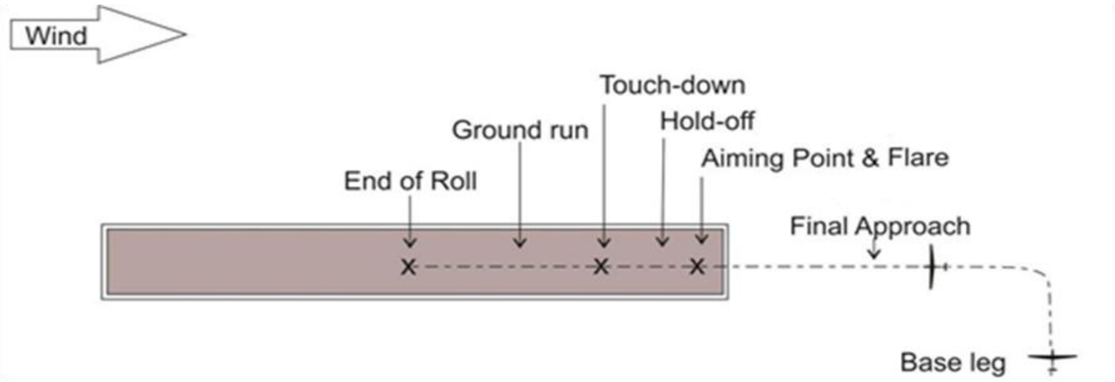
- Stabilised approach involves constant Attitude/Airspeed, Descent rate and Track.
- On approach, attitude/airspeed is controlled with elevator and rate of descent with airbrakes / spoilers.
- During flare and hold-off, the primary control is elevator, not airbrake. Speed will progressively reduce until glider settles on the ground.
- If a landing is bounced or ballooned, reduce airbrakes, establish a safe approach attitude and then repeat flare for landing.
- Positive control must be maintained after touchdown, the landing is not finished until stopped.

PILOT GUIDE FOR THIS UNIT

Early in the Approach

- Once the turn is completed and the glider is wings level on the approach path, check approach speed (, flap setting and heading, and then maintain until the flare or round out.
- Start a work cycle that repeats through the approach – SPEED – DIRECTION – GLIDESLOPE.
- Identify the aiming point, locate and identify the airbrake handle (this should have been completed on the Base leg)
- Airbrakes should not be used until the pilot has assessed that the aircraft is beginning to unmistakeably overshoot the intended touchdown area and will clear all obstructions with a half airbrake approach.
- Control the descent path with the airbrakes and the speed with the elevator:
  - AIRBRAKES control rate of descent
  - ELEVATOR controls speed.

- Once established, airbrakes/spoilers are then used as required to maintain the correct final stabilised approach path.
- Any tendency to undershoot or overshoot the aiming point should be corrected by appropriate fine adjustment of the airbrake/spoiler settings. Coarse movement is to be avoided at this stage of the flight.



Wind gradient

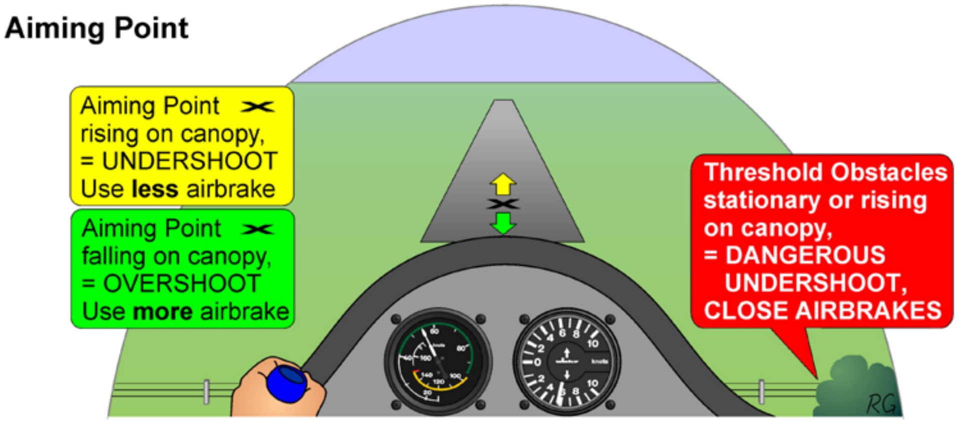
- The glider is now about to enter an air mass which is affected by ground friction, resulting in a phenomenon known as "wind gradient". This means that the wind speed decreases progressively closer to the ground. The effect this has on the glider is to cause a decrease in airspeed at a constant approach attitude.
- The reason it happens is related to the inertia of the glider and the fact that it cannot accelerate quickly enough to keep pace with the falling wind speed. If there is any wind blowing it is normal practice to fly the glider just a little faster than the basic 1.5Vs from this point on. As a rule, one-half the windspeed should be added to the "safe speed near the ground" to establish the Approach Speed.
  - e.g. a glider with a safe speed near the ground of 50kts in nil wind, approaching into a 10 kt headwind, will set an Approach Speed of 55 kts in the pre-landing checks.

Use of Airbrakes

- Control the descent path with the airbrakes and the speed with the elevator. Be prepared to close the brakes and land long to clear obstructions.
- Do not use large and unsafe elevator inputs, particularly close to the ground.
- Use of airbrakes will be introduced at safe altitudes, long before any introduction to their use during approach and during flare and holdoff. The airbrakes should be smoothly opened - “unlock then hold” until the effect is identified. Keep your hand on the airbrakes.
- The final glide path is based on a half to full airbrake setting, therefore the airbrakes/spoilers will typically be used to a sufficient degree to maintain this glide path.
- Note that when increasing the airbrakes, the nose may need to be lowered slightly with gentle forward elevator pressure as the brakes come out further, in order to prevent the speed from decaying due to the increased drag.

Approach – Using the Aiming Point to Maintain Glide Slope

- The aiming point is an approach aid. It is a point (or to be more practical an area) on the ground which will appear stationary from the cockpit when the glider is stabilised on the selected final approach path.
- You will note that changes to the airbrake setting may result in changes to aircraft attitude and therefore light pressure on the elevator is required to return to the correct approach speed.



Maintain airbrake setting & constant airspeed.
Assess any movement of aiming point on canopy.
If necessary, adjust airbrake & hold setting.
Adjust attitude to maintain constant airspeed.
Wait for approach to stabilise & re assess.
Note: An undershoot can be harder to detect.

Overshoot

- When the glider is in an overshoot situation (i.e. it is above the final approach path), the aiming point moves downwards and tends to disappear out of view under the nose as the glider overshoots it. It becomes obvious that the glider will land well beyond the aiming point.
- An OVERSHOOT requires further extension of the airbrakes/spoilers to steepen the final approach path and restore the aiming point to a stationary position.

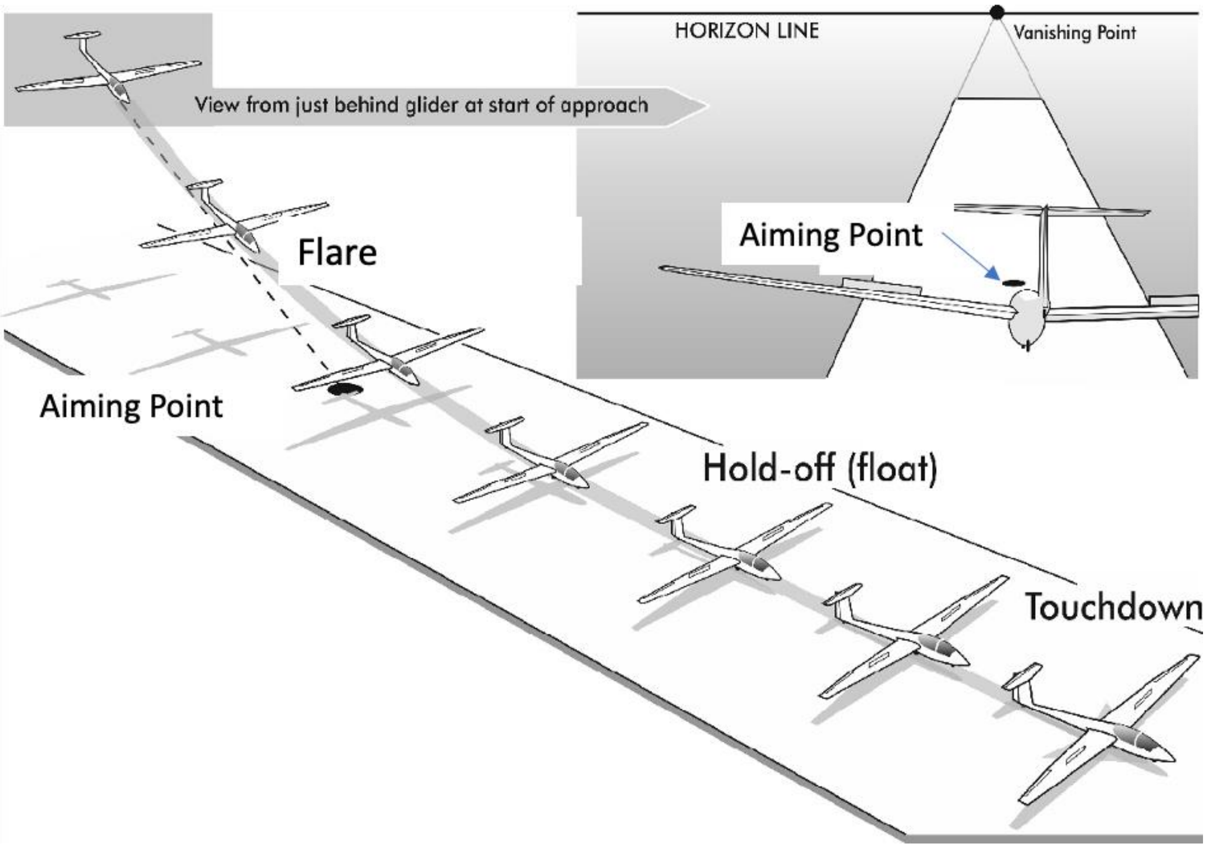
Undershoot

- If the glider is undershooting (i.e. it is below the final approach path), the aiming point moves upwards in the canopy towards the horizon. It becomes obvious that the glider will land before the aiming point is reached.
- An UNDERSHOOT requires reducing the amount of airbrakes/spoilers, in order to make the approach path less steep and once more restore the aiming point to a stationary position.
- Changes to the airbrake setting may result in changes to aircraft attitude and therefore apply light pressure on the elevator to return to the correct approach speed.
- Once the glide path is established, you will hopefully not have to adjust the airbrakes anymore.

Lineup/Directional control

- If the glider isn't lined up with the landing area (turning finals too early or too late, not anticipating the rollout, not holding wings level on finals or cross-wind component). It is easiest to make small directional corrections by "squeezing" small amounts of rudder to steer the nose in the intended direction.

Landing – Flare, Hold-Off and Ground Roll



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- The landing phase covers the transition from the stabilised approach, through a flare and then a hold-off, then a ground roll, until stationary.
- The aim in landing is to fly the glider just above the ground so that it will touch down gently at the minimal possible speed, for a smooth and safe ground roll clear of obstacles.
- The Flare changes the glider from a descending attitude at constant speed to a horizontal attitude with decreasing speed.

- The pilot of this ASW 27 has just carried out "Flare" (levelling the glider off, or "flaring" it), and is just starting "Hold Off" to keep the glider flying at about 50cm above the ground until it touches down at minimum speed.
- This is achieved by slowly moving the stick backwards until the 2 point landing attitude is achieved. (Main wheel and tailwheel should touch at the same time).
- If you move the stick back too early or too quickly then the glider will be too high when it stalls and you get a heavy landing and maybe damage.
- If you move the stick back too late or too slowly then the glider will strike the ground at too high a speed, and you get a bounce and maybe get damage.
- Your gaze should be transferred towards the other end of the landing area, this will help you judging the flare and hold off.
- Judging when to flare is a key skill. A guide to the commencement of the flare is when the runway appears to the pilot to “zoom” in width or the ground appears to “rush” towards the pilot.
- When you have the glider flying in the 2 point landing attitude, this “Hold-off” should be maintained with increasing back pressure on elevator (due to reduced airspeed) until the glider touches down at minimum energy.

Sloped Runways

- To simulate the visual illusions resulting from a sloping runway is to hold your arm straight out from your shoulder, palm down with your hand flat. This is what a level runway looks like on a normal approach.
- Now, tilt your hand up about 10°. This is the view you see when setting up for landing on an up-slope runway. The illusion tells you that you are too steep. The potential danger is that you will respond to the illusion and come in too shallow.
- Tilt your hand downwards to simulate the illusion of the down-slope runway. The illusion is that you are too shallow and, thus, the potential difficulties arise when you approach the runway too steep. Landing on a down-sloped runway is particularly difficult because, as you flare, the runway drops away and the glider will tend to “float” for a long distance.

FLIGHT EXERCISES

Flying for this unit ideally requires benign weather conditions with little turbulence and wind effects for initial exercises, building up to more demanding conditions as experience and competency develop.

You will need to complete quite a few flights to gain the required experience. You will probably have a number of short flights, releasing from tow at say 1000-1200 feet so that you can get a series of landings.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- Turning final too close to the aiming point which requires immediate and excessive use of airbrake:
    - Widen out more on base leg so that there is more time on final to assess the situation before having to use airbrakes.
- Using elevator to ‘point at the aiming point’ instead of using airbrake to control descent to the aiming point.
    - Remember that the elevator controls the speed and the airbrake controls the descent rate.
- Incorrect undershoot identification:
    - Wait until a definite overshoot before using airbrakes.
- Identification and correction for wind shear:
    - Ground proximity wind shear should be compensated for by reducing airbrake as necessary, and if energy reduces, with appropriate forward elevator pressure.
- Failure to judge the flare:
    - Failure to transfer the eyes away from the aiming point is a major contributor to difficulty in judging the glider's height above the ground and is the single biggest factor in late "Flare".
- Glider “balloons” and loses speed:
    - Too much back movement on the stick:
    - The cure is to stop the back movement and reduce the airbrakes or spoilers to enable the wing to keep the glider flying for long enough to sort the problem out and attempt another landing.
    - It may then be necessary to lower the nose VERY SLIGHTLY before attempting another, very gentle Flare, but beware of excessive forward movement of the stick at this stage.
- “Bounced” landing with excessive speed:
    - Not enough back movement on the stick
    - This throws the nose up, increases the angle of attack, resulting in the glider flying away from the ground and gaining height.
    - The cure is to maintain the back movement, reduce the airbrakes or spoilers to enable the wing to keep the glider flying for long enough to sort the problem out and attempt another landing.
    - It may then be necessary to lower the nose VERY SLIGHTLY before attempting another, very gentle Flare, but beware of excessive forward movement of the stick at this stage.

- Some or all of the foregoing errors are made by almost all pilots learning to fly gliders. They are no different from the ordinary errors made by every pilot in the very early stages of learning to fly, errors which are made at some considerable height.
- The difference is that landing errors are made very close to the ground, which obviously makes them more critical and certainly puts the pilot under more stress than would otherwise be the case.
- For this reason, the instructor will not allow such errors to persist and will take control of the glider early rather than late if circumstances demand it.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate Rollout from final turn to line up with intended landing path.
- Identify the landing area and aiming point.
- Identify overshoot and undershoot situations.
- Establish an overshoot and glide path before extending airbrakes.
- Demonstrate Stabilised approach with half airbrake clearing all obstacles by at least 50 feet.
- Use elevator to control attitude in order to achieve and maintain safe approach speed.
- Demonstrate use of airbrakes to correct for undershoot or overshoot.
- Adjust heading to account for drift during approach, to achieve a flight path aligned with intended landing track.
- Monitor and adjust for wind shear.
- Describe illusions present when landing upslope or downslope.
- Demonstrate movement of gaze away from the aiming point towards the far end of the runway, to assist judgement of the correct flare attitude and height.
- Commence flare at a correct height in order to arrest the rate of descent and achieve the hold off height, using elevator as the primary flight control.
- Discuss, identify and demonstrate recovery actions from incorrectly judged flares (late, bounce or balloon).
- Demonstrate hold off height is sustained to a minimum energy touchdown at the correct landing attitude.
- Demonstrate positive control of the aircraft during the ground roll; using elevator, rudder and ailerons independently until stationary.
- Demonstrate that air brake and wheel brakes are correctly applied as required to slow and stop the glider.
- Confirm that planned end of roll is achieved within 5 metres.

RESOURCES & REFERENCES

- Australian Gliding Knowledge (AGK) ages 114 – 140
- Theory Lessons
- GFA MoSP 2 Operations

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What is the final approach speed of a glider which stalls at 34 knots, approaching to land in a 10 knot headwind?
- Define wind gradient. What is its effect on a glider approaching to land?
- What are the features of the aiming point?
- At what point on the approach are the airbrakes used?
- Define a "stabilised approach".
- What action does the pilot take on detecting an undershoot?
- What is the recommended action in the event of the glider "ballooning" on landing?
- What is the recommended action in the event of the glider "bouncing" on landing?
- When is a landing finished?

Gliding Australia Training Manual

Pilot Guide

Unit 18

Spin / Spiral Dive Avoidance and Recovery

WHAT THIS UNIT IS ABOUT

To:

- Understand what a spin & spiral dive are.
- Understand the circumstances that can lead to spins & spiral dives and how to avoid these.
- Understand the aerodynamics of the spin.
- Recognize the symptoms of, and differences between, a spin and spiral dive.
- Efficiently recover the aircraft from a spin or spiral dive.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC 12 – Slow Flight, Stalling

COMPLEMENTARY UNITS

Nil

KEY MESSAGES

- Gliders spend a lot of their time at high angle-of-attack and therefore have a high potential for spin entry.
- Pilots must be trained to PREVENT spins, RECOGNISE when a spin is developing or occurring, and be able to RECOVER from any phase of a spin.
    - Pilots should first and foremost fly their aircraft in a manner that prevents spins. Maintain safe speed above ground when low, do not over rudder turns, do not thermal close to the ground.
    - Pilots need to recognize the precursors of a spin and take action to avoid progression into the spin by recovering early.
    - Every pilot needs to recognise & recover from spins & spiral dives.
- Whilst they may appear similar, Spins and Spiral Dives are different and have different recovery procedures. It is vital the pilot can recognise the difference and apply the appropriate recovery technique.
- Some aircraft may progress into a spiral dive from a developed spin.
- Not all aircraft are certified for Spins, refer to the Aircraft Flight Manual (AFM) or Pilot Operating Handbook (POH) before conducting intentional spinning manoeuvres.
- Recovery from spins is the same basic procedure (with some variations) for all aircraft but ALWAYS read the Aircraft Flight Manual (AFM) or Pilot Operating Handbook (POH) for the specific actions to use in spin recovery.
- Spins & spiral dives consume considerable amounts of height and are dangerous below 1000' AGL.
- Spiral Dives can be dangerous at any height if the forces in the manoeuvre build up to a point where they exceed the aircraft's load limits.

PILOT GUIDE FOR THIS UNIT

While spin and spiral dive recovery are very important - because most spinning accidents occur too low for recovery, spin prevention is at least as important as recovery.

Glider Certification for Spins

Most sailplanes on the Australian Register are built to the standards relevant to the time of certification. The former British Civil Airworthiness Requirements (BCAR) Section E was replaced by the Joint Airworthiness Requirements (JAR) 22 in 1980 and is now Certification Specification (CS) 22. The GFA register also includes amateur-built experimental gliders that are not certified.

Gliders certified to the EASA standard CS-22 must be able to be recovered from a spin in less than 1.5 additional turns regardless of configuration. If the aircraft is in a configuration approved for intentional spins, it must recover in one additional turn or less. Thus, all gliders designed to CS-22 must be recoverable.

However, not all CS-22 aircraft are certified for deliberate spins and, as stated earlier, not all gliders are certificated to CS-22. Furthermore, some certified aircraft may not be approved for spinning in certain configurations (e.g., with water ballast, at certain flap settings or cockpit loads, etc.). Therefore it is **essential** that pilots refer to the Aircraft Flight Manual (AFM) or Pilot Operating Handbook (POH) (and applicable supplements) to understand how to operate the aircraft within its stated limitations. It goes without saying that deliberately spinning an aircraft that is not certified for this, (or in one that is certified but outside the approved configurations) is dangerous.

What is a Spin?

When an aircraft spins, a stall occurs together with yaw, and self-perpetuating rotating forces develop. These forces keep the aircraft in the spin until positive and correct control inputs from the pilot stop them.

In a fully developed spin, the aircraft follows a spiral flight path about an axis going straight down, pitching up as well as rolling and yawing towards the spin axis. Descent rates during a stable spin in gliders are typically between 300 to 800 feet per rotation (a rotation could take as little as 2½ seconds), depending on type.

All aircraft will spin, but not all aircraft can be recovered from a spin. Your aircraft's particular spin characteristics are listed in the Aircraft Flight Manual or Pilot Operating Handbook. An aircraft may be approved for spins, but only under certain weight and balance, and centre of gravity restrictions.

A spin will not exist without both stall and yaw.

Pre-aerobatic check

Spinning is an aerobatic manoeuvre and typically significant heigh is lost during the spin and recovery.

It is important that before doing spins that you complete the Pre-aerobatic Check. (HASELL).

HEIGHT – Sufficient for recovery by 1,000ft AGL (2,000ft if within a 2-NM radius of a licenced aerodrome).

AIRFRAME – Flaps, airbrakes, undercarriage set as required. Trim as required. Hatches and vents closed and locked as appropriate.

SECURITY – Harness secure. Loose objects stowed.

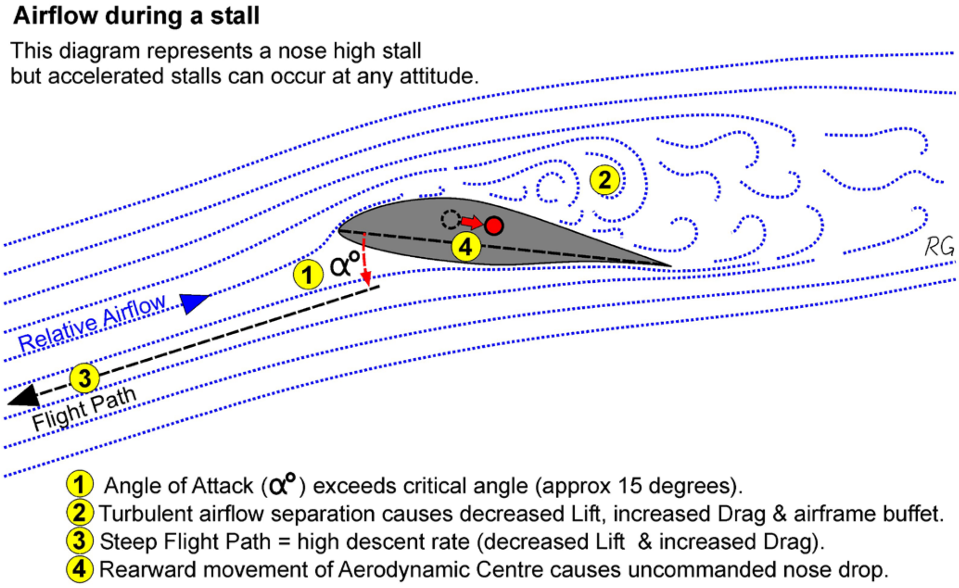
ENGINE and PROPELLER (power and propeller set as required, engine off/ propeller feathered, engine retracted for retractable engine configurations).

LOCATION – Clear of built-up areas, cloud, controlled airspace, circuit traffic.

LOOKOUT – 180° turn plus 90° turns in the opposite direction, checking carefully around, above and underneath. Do not do a 360° turn – otherwise other pilots may believe you are thermaling and come over to your location.

How does a Spin Originate?

One requirement for a spin is that the aircraft is in a stalled condition. The stall angle of attack is the critical angle which, when exceeded, will cause the normally streamlined flow of air that follows the curvature of the upper wing surface to separate from the wing and leave as turbulent air flow. At the stall angle of attack, lift reduces rapidly.



Pilots use a quoted indicated airspeed (for straight and level flight at a given weight and configuration) to correspond to this stall angle for each aircraft. But in reality, the stalling airspeed varies depending on the weight the wing has to support which is influenced by factors such as the weight distribution in the cockpit and the angle of bank that the aircraft is at. Airspeed is therefore only an indirect measure of an approaching stall.

When evaluating how close an aircraft is to the stall, pilots should think angle of attack rather than airspeed. The elevator position (how far back the stick or control column is held), is actually a better indication of how close to the stall the aircraft is.

In GPC 12 (Slow Flight and Stalling) we saw that a wing-drop could occur at the stall. As the wing drops it generates a very large angle of attack, resulting in loss of lateral damping and a tendency to keep rolling uncontrollably. The large angle of attack also produces a lot of induced drag. The high value of induced drag causes YAW in the same direction as the dropping wing, thus starting the spin autorotation. The term ‘autorotation’ is used as no input from the pilot is required to start the spin rotation, the stall and yaw from the lowered wing is sufficient.

Although wing drop is quite easy to recognise when in a level-flight stall, it will be more difficult if the glider stalls during a turn. This can occur, for example during a thermaling turn, if a pilot tries to fly very slowly in an attempt to reduce the radius of turn and fly into the centre of the thermal.

A stalled condition is a more difficult thing to recognise in this case because it is possible during a turn for a glider to get close to the stall without the nose being noticeably higher than normal. It is also common for the glider to experience buffeting in the rough thermal so pre-stall buffet may not be obvious or it may miss striking the rear fuselage at all.

The inner wing in a turn operates at a higher angle of attack than the outer wing and is therefore likely to reach the stalling angle while the outer wing is still below that critical angle. This means that the first thing a pilot might know about the onset of an incipient spin from turning flight is an "uncommanded" roll in the direction of the turn - the glider increases its bank or rate of roll without any aileron input from the pilot.

This is the first sign of a stalled inner wing in a turn, and it is caused once again by the loss of lateral damping as the wing stalls. It is important to realise that, of all the conventional symptoms listed as being present in a level-flight stall, the only one which may be present during turning flight is the continuous backward movement of the stick.

The yawed and stalled aircraft then starts to rotate. However, it not only rolls about the longitudinal axis due to the differences in lift from each wing, but also simultaneously rotates (yaws) about the vertical axis due to the differences in drag. The combination of these two movements gives us a new axis, the spin axis. The aircraft will continue in a self-perpetuating spin, or autorotation, about this axis until opposing forces come into play.

Common Spin Scenarios

Accidental spins tend to occur in the following scenarios, in each of these there is an element of stall and yaw leading to the spin:

Mishandled rudder

- Normal nose attitude with small angle of bank.
- Rudder used to assist the turn - i.e., into-turn or 'bottom' rudder - encourages loss of stability and hence an uncommanded wing drop.
- Natural nose drop opposed by elevator, increasing angle of attack.
- If allowed to persist, the rudder against the elevator drags energy out of the glider and the inside wing stalls.
- Pre-stall turbulence misses the tail plane – so no buffet is felt.
- The induced drag makes the glider appear to commence to turn and the uncommanded wing drop may be not detected.
- This can occur in a turn started with safe speed near the ground - but the aircraft then turns more than 360°.

Attempt to stretch the glide to a landing

- Pilot running out of height attempting to stretch the glide to a landable area.
- The pilot is tense and overloaded.
- There is a need to turn the glider (possibly to avoid obstacles).
- Pilot allows the speed to decay but does not let the nose get low and does not use much bank.
- Stress causes pilot to use excessive unconscious application of into-turn rudder.
- Glider appears to begin to turn - but this is due to an uncommanded wing drop and is it is entering a spin which will require a full spin recovery which will generally require 300 ft to complete.

Attempt to turn a stalled glider (such as after a winch launch failure or other situation)

- Glider already slow (below straight flight stall speed) or stalled but this not detected by pilot.
- Attempt to turn can result in a wing drop which may not be detected as uncommanded – i.e. the aircraft appears to enter turn as commanded.
- Glider enters a spin which will require a full spin recovery.

Thermaling too low

Many accidental spins have occurred when the pilot is trying to thermal too close to the ground. This situation catches even experienced pilots.

This is complicated by:

- Broken, variable lift at low altitudes.
- Variable wind strengths and mechanical turbulence.
- The turn increasing the wing's angle of attack.
- Initial turn down wind causes transient increase in the wing's angle of attack.
- Entering a tight core causes a further transient increase in the wing's angle of attack.

Overall Considerations

- Warning signs for a spin are not always present - often there is no pre-stall buffet.
- Into-turn rudder i.e., rudder used to assist a turn is dangerous.

By far the most common cause of entry to an unintentional spin is the first of these – yaw at the stall caused by out-of-balance flight.

Spin Direction References

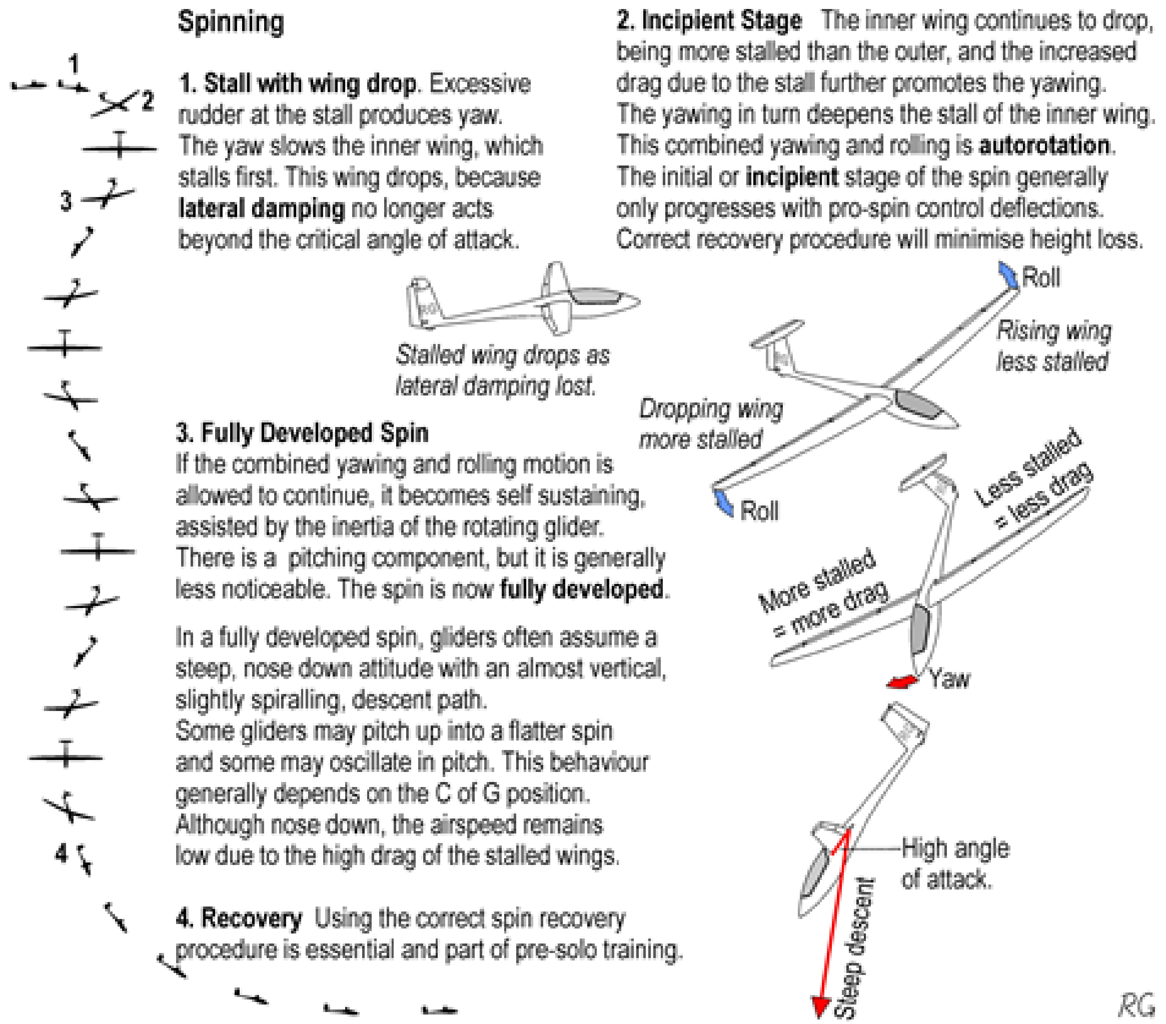
Pilots in a spinning aircraft may be confused as to which way the aircraft is actually spinning. It is essential that the spin direction is identified so that the correct recovery procedure is applied.

The pilot has access to internal and external references to assist in identifying the spin direction:

- External: look forward at the ground or horizon, which way does the earth appear to rotate, which wing is lower?
- Yaw string indicates YAW which caused the spin. It points towards the rudder required for recovery
- Internal: the compass will move as the aircraft rotates, which way does it spin?

Phases of the Spin

The following diagram shows an aircraft in the phases of a spin.



Entry Phase

The 'entry' or 'transition' phase is the short period between departure from controlled flight at the stall and the incipient phase. For a spin to develop it is necessary to have a wing lowered at this point and yaw introduced to the aircraft. The entry phase is the commencement of autorotation as the down going wing increases its angle of attack beyond the stall and generates drag – creating the rotation.

The entry phase is the easiest point to recover from the developing spin.

RECOVERY AT THIS POINT IS STRAIGHTFORWARD:

- Move the stick smoothly and progressively forward to unstall the wing.
- At the same time use rudder to counteract any yaw.

Incipient Phase

The incipient phase of the spin is the period of stalled flight between the commencement of rotation and the developed, stable or steady phase of autorotation. The final balancing of aerodynamic and inertial forces has yet to occur.

This progression may be very rapid and is sometimes described as a flick. It may last only one turn, or it may persist for up to four rotations until pitch, roll and yaw oscillations develop into relatively steady and predictable periods, during which time the rotation tends to accelerate towards the rate found in the fully developed phase.

From this point the full spin recovery procedure must be used to recover from the spin.

If the spin is not recovered by this point one of two things occurs:

- either equilibrium is achieved, and the aircraft is now in the fully developed phase of the spin (typically this takes anywhere from ½ to 4 turns), or
- following the initial roll and yaw the tilted lift vector allows the nose to drop and if longitudinal and/or directional stability sufficiently oppose the pro-spin moments the angle of attack decreases back below the stalling angle and the aircraft transitions to a spiral dive.

Fully Developed Phase

In this phase, a state of equilibrium is reached, characterised by a low and constant airspeed. Rates of descent in unballasted gliders can be as high as 800’ per rotation.

If the aircraft proceeds to the fully developed phase, aerodynamic forces created by the aircraft are balanced by gyroscopic forces due to the distributed mass of the rotating aircraft, causing a steady autorotational state. By this time the corkscrew flight path is vertical and oscillations in pitch, roll and yaw steadily repeat with each turn.

In this spin phase the spin will be self-perpetuating. If the pilot does nothing about it, the spin is likely to continue until the aircraft hits the ground. Positive anti-spin control inputs will be required to recover from the fully developed spin.

The aircraft will lose altitude rapidly and descend along a vertical path about the spin axis.

Whilst pitch attitude, wing tilt, rate of rotation and rate of descent will all be somewhat stable it is likely that these may oscillate during the spin. It is also possible for some aircraft to exhibit different rates of movement in the aircraft axes during the spin depending on the manner of spin entry

The recovery procedure for the incipient and fully developed spin phases

The universal spin recovery technique in gliding is guaranteed to work for all gliders certified to EASA Standards CS-22.

1. For powered sailplanes, close the throttle.
2. Full rudder opposite to the direction of spin applied and held.
3. Check ailerons neutral.
4. Ease the control column forward until rotation ceases.
5. Hold these positions of controls until recovery is completed (rotation stops and aircraft is no longer stalled).
6. After spin rotation stops, centralise rudder and ease out of the ensuing dive.

Some aircraft manufacturers specify variations on this sequence such as a pause between application of rudder and movement of elevator. Consult the AFM/POH for specific guidance on the aircraft you are operating.

Recovery Phase

Spinning ceases only if and when opposing forces and moments overcome the aircraft's autorotation. Recovery phase is where the pilot has initiated the spin recovery actions and the aircraft is no longer in autorotation. The aircraft can then be recovered from the ensuing dive.

Recovery action is clear-cut and universal however some points need to be considered:

1. It is easy for a pilot to become disorientated in the spin and become confused as to which way the glider is spinning. Referring to the correct internal and external references and practice removes most of this confusion.
2. The nose-down attitude in the spin may be very steep in some spins. It is by no means an instinctive reaction to move the stick forward under these circumstances.
3. During the recovery phase, the nose attitude typically steepens, and the rate of rotation may momentarily accelerate as well, giving the impression that the spin is actually getting worse. It is not, and the anti-spin control inputs must be maintained until the spin stops.
4. Spin recovery is not instantaneous. It may take up to several turns for the anti-spin control inputs to finally overcome pro-spin forces. The longer an aircraft is in a spin, the more turns it may take to recover. Spins are recoverable only when the cumulative effects of the interacting variables favour recovery and there is enough altitude.

It is therefore necessary to practice spinning to the extent that confusion is eliminated and the recovery action, like that from a stall, becomes a CONDITIONED RESPONSE.

Variations in the Spin

The development and characteristics of a spin vary between glider types, but a glider will usually rotate a few times before it settles down into a state of spinning steadily. The spin stabilises once a complicated balance is reached between the various aerodynamic and inertial forces acting on the aircraft.

Variation in spin entry has a significant impact on the ensuing motion of the aircraft. A couple of basic cases are the nose high and nose low attitude entries:

- The nose high attitude entry to the spin usually results in a rapid nose down pitch change during the autorotation phase that transitions immediately into a spiral dive as the high angle of attack is lost due to high pitch inertia.
- The nose low attitude entry to the spin may cancel the autorotation phase just as it is trying to build by preventing the wing's angle of attack from increasing to spin-sustainable levels. Here longitudinal and directional stability win out and if pro-spin controls are held an uncomfortable nose low sideslip is experienced.

The Spiral Dive

The Spiral Dive is significantly different from the spin. In a spiral dive the aircraft is still in controlled flight and the wings are not stalled. However, from the viewpoint of the pilot the spin and spiral dive can look somewhat similar.

- Effectively a spiral dive is the aircraft flying in a (generally) steep angle of bank with a nose down attitude, gathering speed as it goes. From what we saw in GPC 8 (Sustained Turns) this applies an increasing load on the aircraft as the airspeed increases.

- As described earlier some aircraft may be able to transition from a spin to a spiral dive after a number of turns due to the aircraft's nose-down attitude. A glider which is spun with the C of G in a forward position may show a tendency for the spin to transition into a spiral dive. Some gliders will not spin at all in this C of G configuration, others may proceed through the spin entry phase but show a tendency to enter a spiral dive after less than one turn of a spin.
- The danger inherent in a spiral dive (that is not present in a spin) is that the forces on an aircraft build up quite quickly and if not checked may build to the point that can affect the structural integrity of the aircraft. This is compared to an aircraft in a spin where the aircraft is not flying and the forces on the aircraft are reasonably light.
- The recovery from a spiral dive is different from that of a spin. This is because the aircraft in a spiral dive is still flying so its controls can be used in their usual sense. However, the high aerodynamic forces that build up on the aircraft mean that extreme care is required to avoid over-stressing the aircraft during the recovery.

Spiral Dive Recovery

The general recovery sequence from a spiral dive is:

1. UNLOAD – Release (unload) the forces on the aircraft by applying forward stick.
2. ROLL – Gently apply stick and rudder to roll the aircraft to a wings level configuration.
3. PULL (ease) BACK – Gently ease back on the stick to raise the nose attitude back to level flight.

These are separate actions. DO NOT combine them as pulling back on the stick whilst still banked in the spiral dive will further increase the aerodynamic forces on the airframe.

Do not apply the airbrake during a spiral dive. Doing so changes the lift forces on the wing and may cause damage to the aircraft structure.

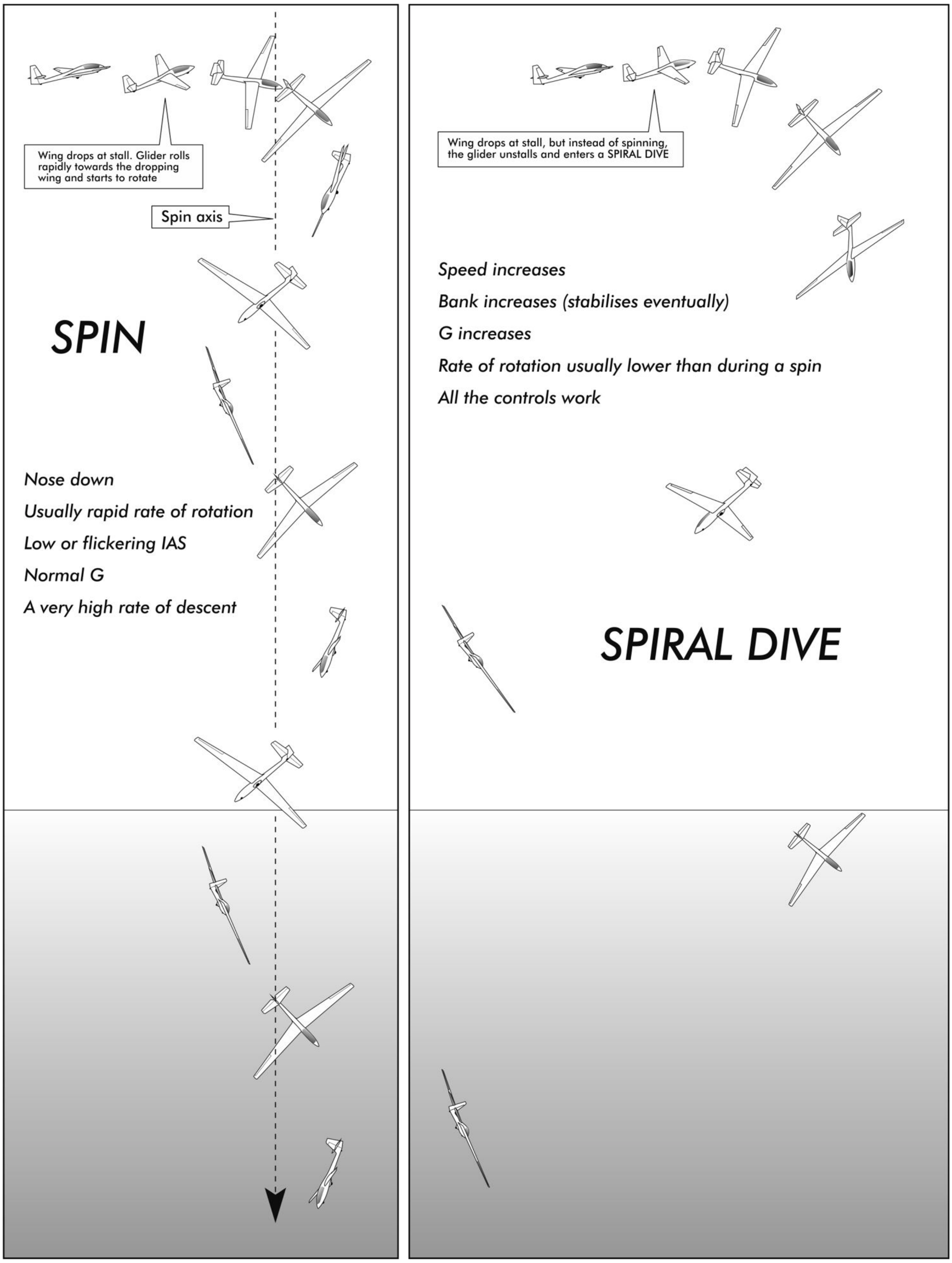
Differences between Spins and Spiral Dives

Whilst a pin and a spiral dive might look similar, the recovery actions needed for them are different. As noted before, in a spiral dive the aircraft is in controlled flight and the wings are not stalled. The table below provides additional aids on differentiating between spins and spiral dives.

AID TO DEVELOPED SPIN/SPIRAL DIVE IDENTIFICATION

Attribute	In Developed Spin	In Spiral Dive
Aircraft stalled	YES	NO
G Loading	Normal	Increasing
Load on controls	Light (unresponsive)	Effective and increasing control loads
Yaw string	Large deflection, pointing towards rudder for recovery	Generally normal flight position
ASI	Low or unreliable	Steady and increasing*
Air sounds	Stable (but may vary on rotation)	Increasing
* If a pilot enters the spiral dive from a spin and is continuing to apply pro-spin control settings the ASI may still indicate low airspeed due to pitot/static errors.		

These differences are shown in the following figure:



(Image courtesy of the BGA)

Recovery Technique Summary

This table is a guide only – the Aircraft Flight Manual must be consulted for specific actions for any given aircraft.

From Spin (Entry Phase)	***From Spin (Incipient & Fully Developed Phases)***	***From Spiral Dive***
Stick forward.	Full opposite rudder to spin rotation.	Unload wings, control column forward.
Rudder to correct yaw.	Aileron neutral.	Roll wings level gently using aileron & rudder.
	Ease control column forward until rotation ceases.	Ease out of dive with elevator.
	Rudders neutral and ease out of dive with elevator.	
Adopt gliding position, re-orientate yourself, regain situational awareness with FULL SCAN.		

Note: Yaw string pointing towards Left Rudder for recovery. ASI on zero. High rate of descent

Spin Avoidance

The easiest way to recover from an unintentional spin is to avoid it in the first place.

- Safe speed near the ground is essential – but on its own is not sufficient so ensure all turns are coordinated – especially near the ground. Never over-rudder a turn.
- Near the ground – don't turn through more 90°.
- Never stretch the glide to land.
- Under no circumstances should you be tempted to thermal too close to terrain.
- If you are in doubt about whether the aircraft may be entering a spin, move the stick forward.
- Practice your spin entry and recovery regularly so that it becomes instinctive.

Human Factors

Disorientation

Pilots understand which way is up via three sensory mechanisms – proprioceptive (seat of the pants), visual (eyes) and vestibular (inner ears).

Proprioceptive inputs provide information about joint position and muscle tension, but generally play only a small part in the total picture. Visual sensation is the most reliable, whereas vestibular inputs are very powerful but frequently misrepresent the rotational motion of flight. Therefore the eyes, through the interpretation of instruments and outside references are important to orientation. Disorientation occurs when there is a conflict between the visual and vestibular sensations – your eyes tell you one thing, but your inner ear says something else.

Within the ear, three semicircular canals are structured perpendicular to each other, so that a canal lies in each of the three planes of the human body. Information from these semicircular canals affects visual tracking.

During the initial phases of a spin, the eye is able to remain oriented. However, in a spin that continues beyond about two turns, disorientation often occurs, and it will be very difficult for the pilot to make the correct recovery inputs, unless properly trained and experienced in spinning.

After about five turns, the eye becomes out of synch with the aircraft's rotation. Vision will blur and the speed of rotation appears to increase. Now the pilot has difficulty in determining the number of turns in the spin, its direction, and the effectiveness of any actions taken to exit the spin.

Upon stopping a spin, the fluid within the semi-circular canals continues to move in the same direction as the spin rotation.

The brain must contend with a conflict between this indication of turning one way and a visual indication of turning in the opposite direction, when there may be no actual rotation at all.

Startle / Surprise Response

Startle is an uncontrollable, automatic muscle reflex, raised heart rate, blood pressure, etc., elicited by exposure to a sudden, intense event that violates a pilot's expectations.

Surprise is an unexpected event that violates a pilot's expectations and can affect the mental processes used to respond to the event.

This human response to unexpected events has traditionally been underestimated or even ignored during flight training. The reality is that untrained pilots often experience a state of surprise or a startle response to an aircraft upset event. Startle may or may not lead to surprise.

Pilots can protect themselves against a debilitating surprise reaction or startle response through scenario-based training, and in such training, instructors can incorporate realistic distractions to help provoke startle or surprise.

Pilots need to understand that their primary training cannot cover all possible contingencies that an aircraft or pilot may encounter, and therefore they should seek recurrent/additional training for their normal areas of operation, as well as to seek appropriate training that develops the aeronautical skill set beyond the requirements for initial certification. GFA Flight Reviews provides this recurrent training.

FLIGHT EXERCISES FOR THIS UNIT

- You must complete the pre-aerobatic check.

- Entry Phase Spin Symptoms & Recovery – Your trainer will demonstrate the spin entry and incipient phase of a spin with the actions necessary to recover and return to stable level flight. This will include how to recognise the spin entry and the direction of rotation.
- Incipient & Fully Developed Spin Symptoms & Recovery – Your trainer will demonstrate the spin entry and show how the spin develops through the incipient to the fully developed phase, with the actions necessary to recover and return to stable level flight. This will include how to recognise the direction of spin rotation.
- Spiral Dive Symptoms & Recovery – Your trainer will demonstrate a spiral dive and the necessary actions to recover to stable level flight. The spiral entry may be from a spin.
- Student practice – you will be provided the opportunity to practice recovery from the various spin phases working from the initial entry and incipient phases first. As you become competent with recovery from the incipient phase your trainer will allow you the opportunity to recover from the fully developed phase of the spin and following that recover from a spiral dive.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Failure to conduct adequate pre-aerobatic check.	Forgetting that spins are an aerobatic manoeuvre and require the pre-aerobatic check to be completed. Practice using the pre-aerobatic checklist.
• Failure to identify the spin entry phase.	Not sensing the stall/yaw/nose drop symptoms. Multiple exposure or even simulator demonstration will assist. Unlike in a wings-level stall, buffet symptoms may not be present.
• Failure to identify the direction of rotation:	Multiple exposure or even simulator demonstration will assist.
• Failure to use adequate (i.e., full) rudder during recovery from the fully developed phase of the spin and allowing aircraft to recover itself (or not).	Too impatient. Use full recovery techniques. If your training glider recovers quickly from the spin this makes it difficult, so focus on following the full procedure.
• Inability to differentiate between spin and spiral dive and subsequent incorrect use of controls.	Focus on G loads, ASI reading, increasing noise level. These are signs of a spiral dive.
• Excessive use of controls during recovery.	Discomfort with nose down attitude. Feel the G force you are applying to the glider and keep this limited.
• Continuing to hold rudder in after cessation of rotation or failing to centre ailerons during spin recovery.	Once the glider is unstalled, you need to apply coordinated stick and rudder.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe the characteristics of spins & spiral dives.
- Demonstrates recovery from a spin at the entry, incipient and full phases of a spin.
- Identify indicators of a spiral dive and take recovery action.

RESOURCES & REFERENCES

- CASA AC61-16 v1.0
- GPC Theory Lesson 6.
- Video – Spin & Spiral Dive Avoidance & Recovery.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Why is it important to understand if the aircraft is certified for spinning?
- What is the most common way that an unintended sin occurs?
- What are the ways to avoid accidently entering a spin?
- What are the symptoms of a spin?
- What are the symptoms of a spiral dive?
- Why are unintended spins so dangerous?
- What are the recovery actions for an aircraft at the entry phase of a spin?
- What are the recovery actions for an aircraft in the incipient and fully developed phase of a spin?
- What are 3 characteristics that are different between a spin and a spiral dive?
- What are the recovery actions for an aircraft in a spiral dive?
- What is a threat to an aircraft in a spiral dive that does not apply in a spin?
- Does a spin only develop when the aircraft has a high nose attitude?
- What does the term 'autorotation' mean?

Gliding Australia Training Manual

Pilot Guide

Unit 19

Crosswind Take-off & Landing

WHAT THIS UNIT IS ABOUT

To assess cross wind condition and describe their effects on take-off and landing operations and demonstrate the safe actions to take in the event of cross-winds on both take-off and landings.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 14 Take-off
- GPC Unit 17 Stabilised Approach and landing

COMPLEMENTARY UNITS

Nil

KEY MESSAGES

- Cross-wind conditions can adversely affect glider operations and pilots need to know when this could occur with reference to:
    - The Aircraft Flight Manual limitations.
    - Personal minima and experience.
    - Club Operations Manual limitations.
- Pilots must be able to assess the cross-wind component for a nominated runway.
- Pilots need to know how to use the aircraft's controls to counter drift in cross-wind conditions on take-off and landing.
- Describe actions to abort a cross-wind take-off safely.

PILOT GUIDE FOR THIS UNIT

- We normally take-off into wind as this provides air flow over the wing before we even move. The glider can lift off the ground earlier in the launch, and movement across the ground is slower when landing meaning a shorter ground run.
- Sometimes (often) the wind is not blowing straight along the runway, and we have a cross wind component, which impacts on the glider, making it drift laterally across the runway with the wind on take-off or landing.
- The aircraft controls are sufficient to cater for a small crosswind but may not handle a stronger crosswind. Towplanes are usually the limiting factor as they tend to have a lower crosswind capability. The Aircraft Flight Manual will provide details of the maximum crosswind component that can be accommodated (or has been demonstrated by the aircraft manufacturer). If it is too strong you need to operate from a different runway that reduces the cross-wind component or leave the aircraft in the hangar.

Crosswind Take-off

- With the main wheel on the ground, a wind from the side will push the tail of the aircraft, resulting in the nose weathercocking into wind. This can be countered by use of opposite rudder to keep the glider travelling straight, but the amount of rudder is limited and may not be sufficient if the wind is too strong.

- Wind from the right will try and lift the right wing and you may not have sufficient aileron control to hold it down, in particular at low speed. The wing tip runner will need to help by running the into wind wing and holding it lower.
- If you are unable to control the glider sufficiently during the ground run and separation, you should release immediately and land the glider, probably angling across the runway.
- If possible, delay separation from the ground until you have more speed and therefore greater control.
- Once the glider lifts from the ground the whole glider will drift downwind. In order to continue to fly along the runway you will need to 'crab' by pointing the glider in a direction upwind. So the nose of the glider will be pointing at an angle into wind and the glider will be tracking along the runway. The towrope should be aligned with the runway direction if you have this right. It is important not to let the glider settle back to the ground at this stage.
- If on aerotow, once the towplane lifts off the ground the same thing will happen to the towplane and the pilot will adopt the same angle into wind. At this time, you need to let the glider slip back into line behind the towplane and the tow pilot takes responsibility to ensure that the combination is tracking along the runway direction.
- When conducting a winch launch in a cross-wind, the pilot will still need to counter for the cross wind effects on the aircraft. The greater acceleration of the winch launch will mean that the use of rudder and aileron will probably only be required for a short period of time.
- Do not allow the cross wind to force the down wind wing tip onto the ground as this raises the potential for a serious accident if the tip catches on the ground. Be prepared to immediately release the winch cable if the downwind wing cannot be prevented from contacting the ground.
- Your gliding site may have operational limitations when launching in cross winds due to potential for cables to drift onto areas outside the airfield. Ensure you are aware of these and ensure you perform the necessary drift correction on launch as the winch driver may terminate the launch if they feel the drift of the aircraft it will create the potential for an unsafe situation then the cable is released.

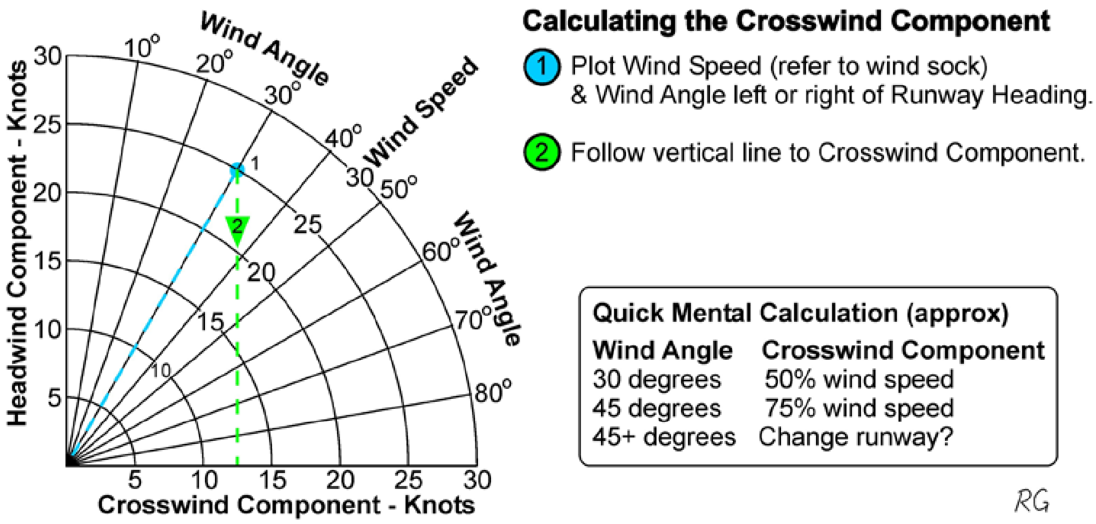
Crosswind Landing

- Crosswind landings are the reverse of this situation. To fly in the required landing direction on final will require a **Crabbing** approach or a **Wing-down** approach
- **Wing-down approach:**
    - Turn the glider directly into line with the landing path.
    - Lower the into wind wing sufficient to counter drift.
    - Maintain landing track with opposite rudder.
    - Flare, hold off and ground roll with above drift countering controls, taking care to ensure the lower (into wind) wingtip does not come close to the ground.
- **Crabbing approach:**
    - Maintain track line by adjusting heading sufficiently into wind to adjust for drift.
    - During flare and hold off, rudder the aircraft straight on to the landing track line and maintain parallel heading with rudder.

- Possibly using opposite aileron to counter the roll caused by the rudder. which takes some careful flying close to the ground
- If drift is encountered, lower into wind wing sufficiently to stop drift.

- Ground roll should be made as short as possible with full airbrake and wheel braking, maintaining directional control with rudder and finishing with into wind wing touching down at just before the glider stops.
- Be careful with canopy security when exiting the glider.

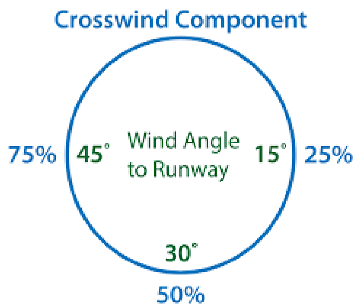
GFA Crosswind Chart



- Point 1 on the chart plots a 25 knot wind at an angle of 30 degrees to the runway.
- Following the vertical line shows a crosswind component of 12.5 knots, which is quite significant.

A simple rule of thumb to estimate the cross-wind using a clock face. If the angle of the wind from the nose is:

- 15º (quarter past the hour), crosswind component is ¼ (25%),
- 30º (half past the hour), crosswind component is ½ (50%),
- 45º (three-quarters past the hour), crosswind component is ¾ (75%).
- 60º (on the hour) or more, use 100% crosswind.



Orographic turbulence

Some runways may have trees, building or other barriers which block the wind, but often these obstacles create significant turbulence behind them.

This turbulence can create significant problems for the pilot, with both takeoff and landing. When landing, select a higher flying speed to give you more control.

On takeoff beware of starting the launch in a wind shadow and then flying into a clear area where the wind suddenly impacts on the glider, and you find yourself drifting rapidly sideways, or weather cocking towards the obstacle.

FLIGHT EXERCISES FOR THIS UNIT

Your trainer will demonstrate crosswind take-off and crosswind landing, and gradually hand over responsibility.

Notes

- Assess trend of wind strength and direction from multiple forecasting sources allowing for the worst possible case.
- Ensure that the crosswind component is within the Aircraft Flight Manual and Club Operations Manual limitations.
- Set and observe personal minima.
- Maintain at all times situational awareness, aircraft control and safety including action on losing sight of the tug.
- Be alert for orographic turbulence set off from surrounding trees and/or buildings.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- Drift with a crosswind can be surprisingly strong so you need to be prepared to act quite quickly
- A crabbing take-off or landing requires coordinated controls but appears 'wrong' when close to the ground.
- Do not let the glider touch the ground when you have an established crab. You must have the wheel pointing in the direction of landing when touching the ground.
- Correcting the crab angle too early will result in more opportunity for the aircraft to experience lateral drift across the runway in the final stage of the landing.
- When on aerotow take-off, do not let the glider drift downwind of the towplane as this will exaggerate the weather cocking tendency of the towplane which may not be controllable.

HOW DO YOU DEMONSTRATE COMPETENCE?

- State the crosswind limitations for gliders flown, referencing the Aircraft Flight Manual (AFM).
- Determine the crosswind component for a particular runway
- Describe the possible impacts of the crosswind on take-off and mitigators.
- Describe the actions to take to abort a crosswind take-off.
- Describe the difference between a crabbing and wing-down approach.
- Demonstrate safe conduct of a crosswind take-off unaided at least three times

- Demonstrate safe conduct of a crosswind landing unaided at least three times using the Crabbing approach.

RESOURCES & REFERENCES

- Australian Gliding Knowledge Pages 112-113, 134-135

SELF-CHECK QUESTIONS

- With a 25-knot wind, what is the maximum angle that the wind can come from so that you don't exceed a 10-knot crosswind limit for the glider you are flying?
- You are protected by trees at the launch point but it is apparent that there is a strong crosswind from the right. What possible impact could this produce?
- You expect strong turbulence behind the trees when landing. What action can you take to reduce the impacts of this turbulence?
- You have a medium strength crosswind on take-off. What advice would you give to the wingtip runner to help with your take-off.
- Describe the crabbing method for a crosswind take-off.
- Describe a wing-down method for a crosswind landing.

Gliding Australia Training Manual

Pilot Guide

Unit 20A

Launch Emergencies (Aerotow)

WHAT THIS UNIT IS ABOUT

To:

- describe types of aerotow launch emergency;
- demonstrate the actions to safely handle a launch failure; and
- demonstrate approaches to prevent these emergencies, and safe actions in the event of them happening on the ground and in the air

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 13 Launch and release
- GPC Unit 14A Take-off (aerotow)
- GPC Unit 16 Circuit Joining and execution
- GPC Unit 17 Stabilised approach and landing

COMPLEMENTARY UNITS

- Nil

KEY MESSAGES

- Launch emergencies are easily resolved provided thought and planning takes place.
- At all times maintain safe speed near to the ground.
- At all times maintain situational awareness, aircraft control and safety.
- Locate, identify, and operate controls correctly during all phases of practice emergencies.
- Verbalise options for launch failure on all flights, dual or solo.

PILOT GUIDE FOR THIS UNIT

There are a number of potential Aerotow launch emergencies that pilots need to be aware of, and have a plan to address them should they occur: As part of your pre-take-off check you should be considering your actions in case any of these emergencies should occur.

Signals to Abort Launch Prior to Ground Roll.

- Anyone outside can abort launch – Shouting “STOP! STOP! STOP!” and holding both hands vertically above head.
- Pilot hearing STOP call to immediately release the rope.
- Pilot wishing to abort shouts “STOP! STOP! STOP!” transmitting on the radio and simultaneously releasing the rope.
- Wing-runner, shouting “STOP! STOP! STOP!” and holding both hands vertically above head.
- If a forward signaller is present (recommended), holds both hands vertically above head.

Ground Roll Emergencies

- During the early stage of the ground run the airspeed is very low hence there is minimal airflow over the wing and control surfaces, reducing controllability.
- Large control movement are usually required but control movement must reduce as the airspeed increases.
- If the wing drops to the ground, you may be able to pick it up again with large aileron control movement, but do not persevere beyond a few seconds. Release and use airbrake and wheel brake to stop the glider.
- Conflicting traffic, check “airspace clear for launch”
- When Pilot requests an “airspace clear for launch” check, ground crew need to ensure there is no conflicting traffic, looking ahead, above and behind the launch. Check for aircraf t on approach, aircraft performing an emergency landing, and also any weather issues such as a thermal crossing the runway, or storm gusts.
- Note that launching aircraft must give way to landing traffic. If unsure, do not proceed.
- Pilot Induced Oscillation
- Incorrect Separation – ballooning

Separation

- It is important to establish the two-point take off attitude suitable for your glider. This typically requires running on the main wheel with the tail just off the ground.
- When the tail wheel lifts, the glider may also weathercock or yaw as it rolls along the ground. You correct this using the rudder pedals. See Unit 19 Crosswind Take-off and Landing
- If you hold the stick back with the tail hard on the ground, then the glider will leap into the air as it exceeds the speed required to fly which will leave you with a difficult task of getting it back under control.
- If you don’t have enough back stick, then the glider will stay on the ground for a long time and control becomes more difficult.
- With the glider balanced on the main wheel, in the 2-point attitude, the glider will just separate from the ground as it reaches flying speed.
- As the glider accelerates and the controls become more effective, you must relax the back pressure on the stick so that the glider does not continue to climb higher than required.
- The glider will lift off before the tug and you should let it climb until it’s about 3 metres or just above the tug’s fin. You must not go too high as you risk raising the tail of the towplane putting the nose/propellor very close to the ground.
- When the glider is airborne, the stick and the rudder are moved in a coordinated fashion.

PIO (Pilot Induced Oscillation)

- You should not make large elevator control inputs during the separation stage, Separation requires gradual changes in back pressure.
- Pulling the stick backward will cause it to climb fairly steeply putting you and the towplane in a difficult position.

- If you then push the stick forward you will likely force the glider in a dive and strike the ground. This bounces you into the air and the G-Forces will cause you to pull the stick back and up you go again.
- If uncontrolled, this may escalate into quite an aggressive oscillation with the glider hitting the ground very hard, potentially causing damage.
- This is called a Pilot Induced Oscillation (PIO) and must be avoided. If you just apply small pressure changes to the elevator control rather than jerky control movements you will just separate quietly and smoothly.

In flight

- Conflicting traffic, check “airspace clear for launch”. Maintain situational awareness.
- Loss of power
- Rope break
- Tug upset

Tug engine Failure whilst on Ground

- Avoid the towplane by using rudder to steer away – typically you will steer to the right, but just give way to the towplane. Use airbrake and wheel brake to stop the glider.

Tug engine failure after separation

- Maintain safe speed, and avoid the towplane. Depending on your height you may decide to delay using airbrake so that you can overfly the towplane or deviate to the right to avoid the towplane which may be blocking the runway. Once you have a clear path use a small amount of airbrake to descend to the ground, round out and land normally.

Rope Break - Airborne, Runway Remaining

- Lower the nose to adopt safe speed, Release the rope and Land straight ahead on the runway. If runway length is minimal, use a lot of airbrake and then wheel brake. If over running the runway, ground loop prior to hitting fence

Rope Break - Airborne, no Runway Remaining

- Lower nose to adopt and maintain safe speed
- Release rope
- Outland straight ahead or within 30 degrees either side of straight ahead. You should be aware of possibilities for outlanding and select the most appropriate
- If above 200 feet you may do a 180º turnback and land back on the runway, looking out for other traffic.
- If sufficient height you can perform a modified circuit to a runway depending on aircraft type, aerodrome layout and/or weather conditions

Tug Emergency

Engine Failure (e.g. fuel starvation) Tug descends without warning or signal and may disappear under nose

- Release IMMEDIATELY
- Maintain safe speed near the ground
- Land ahead if low or manoeuvre for circuit

Partial Engine Failure (e.g. mechanical, fuel vaporisation, magneto failure, carbie heat selection) or about to enter cloud

- Pilot should identify the problem and determine safest option. Don't release if you don't have a safe option
- If Tug pilot signals wave-off by **Rocking the wings**, Release IMMEDIATELY and avoid the tug – tow-pilot has a bigger problem than you do.
- Maintain safe speed near the ground.
- Land ahead if low or manoeuvre for circuit.

Low rate of climb tug pilot attributing to glider (eg dive brakes may be out)

- Tug pilot signals by rapid **Rudder Waggle**.
- Do **NOT** release.
- Check glider configuration and correct if necessary.
- If correct already communicate with tug by radio and watch for possible Wing Waggle.
- High powered tugs (e.g. PA25s) can usually maintain 250-300 fpm climb rates with a two-seater with dive brakes open, lower powered tugs may not be able to maintain height.

Release Failure (Hook-up)

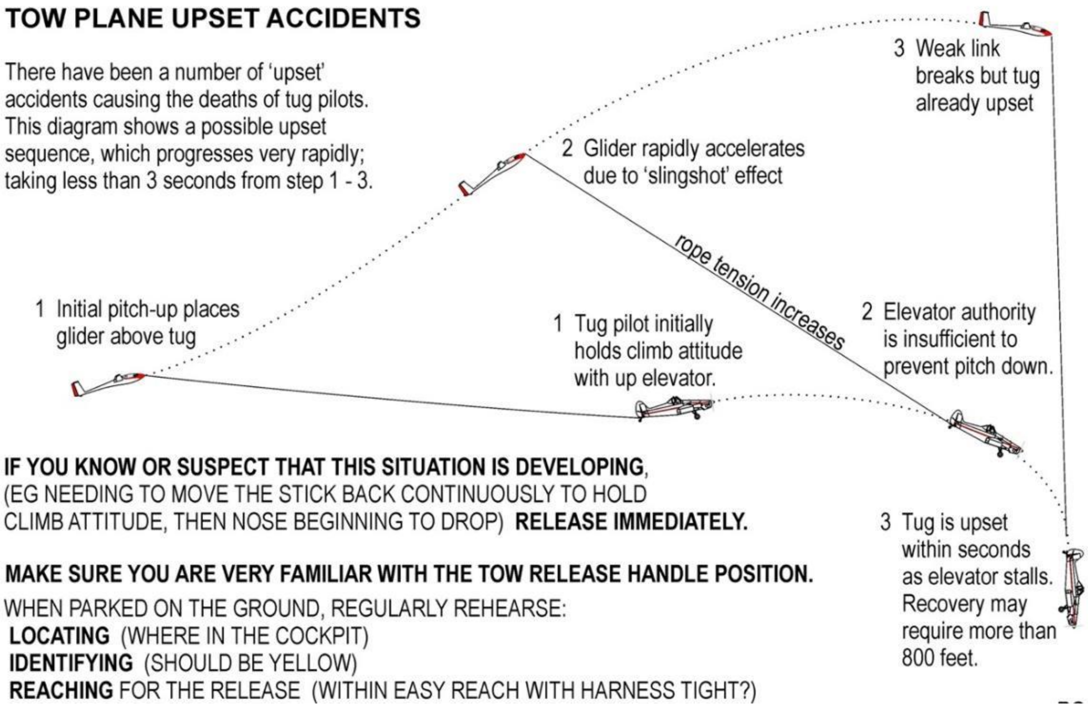
- In a real hook-up, if no radio communication received, fly to the left low tow position, try again to release.
- Maintain rope tension with yaw or/and smooth application of dive brake.
- When Tug pilot acknowledges by hand waving, glider returns to low tow astern, maintaining rope tension and keep attempting to release.
- Tug Pilot flies to suitable area close to landing area.
- Glider climbs to high tow position which signals to the tug pilot that they are ready to accept the rope.
- Tug Pilot releases the rope.
- Glider makes a high approach ensuring rope clearance with any obstacles on approach and usually landing farther up the runway
- Note the possible risk of the rope tangling in wheel/axle on landing roll.

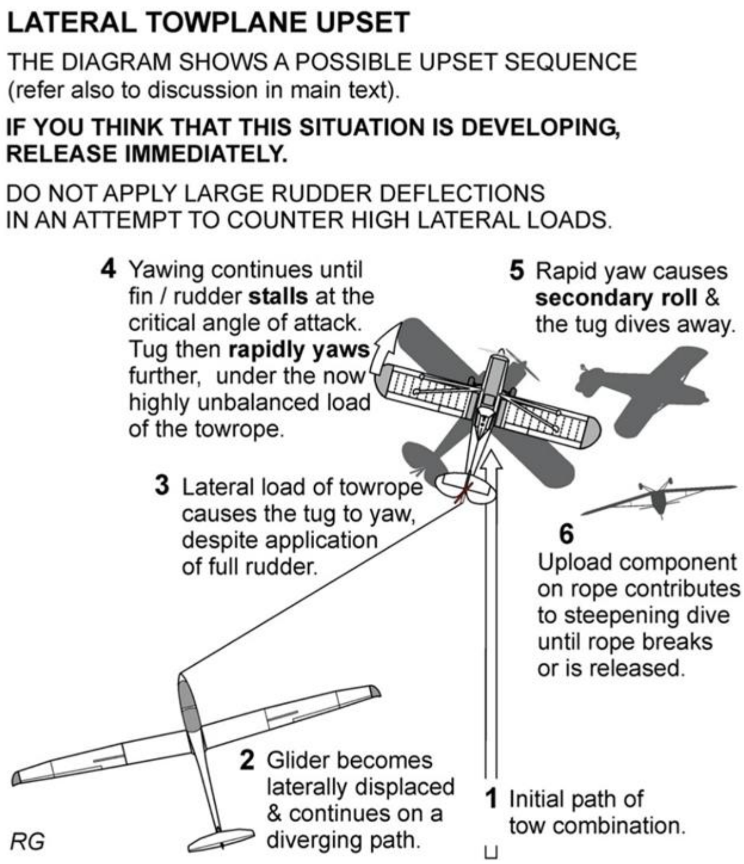
Double Release Failure

(In the unlikely event of it ever happening)

- Tug pilot communicates failure by radio (or by thumbs down hand signal)
- Glider adopts low tow position.
- Tug descends to circuit height and approach with glider maintaining low tow position and rope tightness with dive brakes. Glider controls the descent to the ground through using airbrakes.

- Glider lands first in wheeler configuration than applies full dive bake and applies wheel brake as soon as possible.
- Tug pilot should not brake allowing glider to slow the combination.
- If overtaking tug, glider steers right or ground loops right to avoid.





FLIGHT EXERCISES FOR THIS UNIT

Flying for this unit requires close coordination with the tug pilot pre-flight and in-flight.

All configurations except outlanding off low level rope break practice and double hook-up are to be demonstrated by the student and observed by the instructor to be carried out safely and correctly.

Instructor Demonstrates

- Your Instructor will demonstrate all emergencies including at least one low level rope break to a modified circuit on glider type prior to the student practicing them.

Student Practice (under supervision)

- To call options on take-off run and climb out on all flights post classroom briefing.
- Rope break on take-off run, runway remaining.
- Low level rope breaks to modified circuit or turnback depending on club safety policy.
- Hook-up procedures.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- Be aware of potential problems and be prepared to take action.
- Your primary responsibility is to fly the glider and maintain a safe speed.

- The simple solution is generally the best
- Maintain situational awareness at all times, aircraft control and safety including action on losing sight of the tug;
- Ensure you identify and operate correctly controls and equipment during all phases of operation during practice emergencies.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describes possible launch emergencies and their prevention.
- Maintain directional control and take appropriate action with a Wing drop
- Aware of causes of PIO and takes appropriate action
- Describes causes of Tug upsets and acts to prevent these.
- Responds to tow plane signals quickly and assertively.
- Identifies suitable landing areas off the airfield for emergency use
- Brief and call out options on climb out on all flights;
- Takes appropriate action with simulated launch failure, including landing on airfield, 180° turn, and explains options re outlanding.
- Describe and respond correctly to release failure and double release failure

RESOURCES & REFERENCES

- Australian Gliding Knowledge pp 104-109

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Describe potential launch failures on Ground roll, early climb and full climb
- How can you avoid a tug upset?
- What action would you take if the towplane rocks its wings
- Why shouldn't you release if the towplane waggles its rudder?
- If the towrope breaks at approx. 350 feet, what options do you have?
- Describe outlanding options for each runway if you experience a low level cable break.
- What actions do you take if your release does not work?

Gliding Australia Training Manual

Pilot Guide

Unit 20 S
Launch Emergencies – Self Launching

WHAT THIS UNIT IS ABOUT

To describe types of launch emergency and demonstrate approaches to prevent these emergencies, and safe actions in the event of them happening on the ground and in the air.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 13S Launch and release (Self Launch)
- GPC Unit 14S Take-off (Self Launch)
- GPC Unit 16 Circuit Joining and execution
- GPC Unit 17 Stabilised approach and landing

COMPLEMENTARY UNITS

Review Pilot Guide GPC Unit 20A Launch Emergencies (Aerotow) for relevant glider flying emergencies related to Ground Roll, PIO, Airspace etc.

KEY MESSAGES

- Launch emergencies are easily resolved provided thought and planning takes place.
- At all times maintain safe speed near to the ground.
- At all times maintain situational awareness, aircraft control and safety.
- Locate, identify, and operate controls correctly during all phases of practice emergencies.
- Verbalise options for launch failure on all flights, dual or solo.

PILOT GUIDE FOR THIS UNIT

There are a number of potential launch emergencies that pilots need to be aware of, and have a plan to address them should they occur: As part of your pre-take-off check you should be considering your actions in case any of these emergencies should occur.

Signals to Abort Launch Prior to Ground Roll.

- Anyone outside can abort launch:
  - Shouting “STOP! STOP! STOP!” and holds both hands vertically above head.
  - A radio call of “(Callsign) STOP! STOP! STOP!”
- O for Options in ABCDEF CHAOTIC pre-flight check list identifies alternative actions at all stages of launch if failures occur.
  - In practice, the various stages should be called out on all flights as the launch occurs (i.e. abort point airborne – continue, runway, runway, straight ahead, paddock there, paddock there, safe height modified circuit.)

Engine problem on ground roll or not airborne by abort point:

- Close throttle;

- Maintain directional control;
- Apply full dive and wheel brake(s).

Engine problem airborne, runway remaining:

- Lower nose to adopt safe speed;
- Close throttle;
- Land straight ahead on runway;
- If over running the runway, ground loop prior to hitting fence.

Engine problem airborne, no runway remaining

- Lower nose to adopt and maintain safe speed;
- If time permits, conduct CFMOST check:
    - Carburettor Heat (on if fitted);
    - Fuel (On and correct tank, fuel boost pump is on);
    - Mixture (Choke Off; Full Rich as required);
    - Oil Temperature and Pressure checked;
    - If Temperature high and Pressure low, consider possibility of fire;
    - Switches: (Magnetos switched on or both);
    - Throttle & linkage (checked).
- Close throttle.
- If time permits: Fuel and Switches off.
- Outland straight ahead or within 30 degrees either side of straight ahead;
- If above safe height either 180 degree turnback or modified circuit to a runway depending on aircraft type, aerodrome layout and/or weather conditions.
- Remember priorities: 1. Aviate 2. Navigate 3. Communicate.

Low rate of climb

- check if the dive brakes may be out.

Fire in flight:

- Adopt glide attitude;
- Throttle Back;
- Fuel and Switches off.
- Land immediately.

FLIGHT EXERCISES FOR THIS UNIT

Specific demonstration and practice required

- All configurations except Fire in flight and Outlanding off low level engine failure practice are to be demonstrated by the student and observed by the instructor to be carried out safely and correctly.

Instructor demonstrates:

- Your Instructor will demonstrate all emergencies including at least one low level engine failure to a modified circuit on glider type.

Student practice (under supervision):

- Call options on take-off run and climb out on all flights;
- The Instructor may simulate Engine failure on take-off run, runway remaining;
- The Instructor may simulate Low level engine failure to modified circuit or turnback.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- Set and don't exceed personal minima;
- MAINTAIN SAFE SPEED NEAR THE GROUND;
- Maintain Situational Awareness;
- Don't underestimate height loss in turnback procedures.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe: possible launch emergencies that may occur with ground run, initial climb (to 500 feet AGL) and during full climb above 500 feet;
- Describe actions to reduce the chances of launch emergencies
- Prevent loss of directional control;
- Identify and take appropriate action with loss of power on take-off.
- Take appropriate action with a wing drop, possibly due to cross wind;
- Take appropriate action with engine failure during ground roll
- Demonstrate appropriate actions to simulated engine failure above 500 ft AGL.

RESOURCES & REFERENCES

- Powered Sailplane Manual: GFA Ops 0009 Aug 2015
- Australian Gliding Knowledge

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Under what circumstances would you abort a Self Launch Take-off?

- What issues should you consider when completing the Outside check of your Pre-takeoff check
- If you experience an engine failure at 400 Feet, what options do you have at your airfield?

Gliding Australia Training Manual

Pilot Guide

GLIDING AUSTRALIA

Unit 20W

Launch Emergencies (Winch)

WHAT THIS UNIT IS ABOUT

To:

- Understand the actions to take to safely handle a winch launch failure.
- Recognise the threats and errors that can occur during a winch launch failure.
- Demonstrate the ability to handle a winch launch emergency at all stages of the launch.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC 13W – Launch & Release (Winch)
- GPC 14W – Take-off (Winch)
- GPC 16 – Circuit Joining & Execution

COMPLEMENTARY UNITS

- Nil

KEY MESSAGES

- Launch failures are easily managed by the pilot. Accidents that occur after a launch failure are generally caused by mismanagement of the aircraft after the launch failure, not through the failure itself.
- A launch failure can occur at any time from the point of cable hook-on to release. The launch may also be abandoned by the pilot (for example if the airspeed is trending towards the upper winch limit).
- Launch problems do not always manifest themselves as a sudden loss of power – gradual failures can and do occur and require the pilot to recognize that a launch failure is occurring and take appropriate action.
- Pilots must ensure that they never allow the aircraft's airspeed to drop below the minimum winch speed during the launch.
- When a launch failure occurs, no bank must be applied until the aircraft's airspeed is returned to and maintained at or above safe speed near the ground.
- Whilst a launch failure requires specific recovery processes, it is not difficult to recover and providing the aircraft has not entered the Non Manoeuvring Area it will either be able to land ahead or conduct a modified circuit back to the airfield.

PILOT GUIDE FOR THIS UNIT

- The winch launch can fail at any point for any number of reasons – these could be due to the equipment or the actions of people involved (including the pilot!). All pilots need to know how to deal with these failures so that they can continue the flight safely.

What is a Launch Failure?

- Launch failure is the situation where a glider is unable to continue with the launch or where it would be unsafe to continue the launch. This includes being unable to maintain speed above the absolute minimum winch airspeed of 1.3VS when in a climb attitude
- Launch failure must be expected at any time during launching operations. Provided that correct procedure is followed, launch failures present no greater difficulty than any other training sequence.
- Launch failures occur from one or more of the following conditions:
  1. Mechanical failure or power loss at the winch or autotow.
  2. Faulty judgement of speed by the winch or auto-tow driver.
  3. Cable or weak-link failures.
  4. Cable release maladjustment or failure.
  5. Accidental operation of the release.
  6. Faulty procedure by the pilot (e.g. glider over-running the launch cable) or ground crew (e.g. failing to hold wingtip).
- You were introduced to the launch failure briefing in GPC 14W.
- One of the major contributions towards safe flying is that you can anticipate the potential failure situations and not be surprised or startled into doing the wrong thing. Before take-off there must be full awareness of as many factors as possible that will govern the probable actions following a launch failure:
  - The wind direction and strength.
  - In the case of crosswinds, the preferred direction to turn if a failure occurs at height, taking into account aerodrome layout, etc.
  - Possible overshoot areas or emergency landing areas.
  - The point at which to abandon a slow launch to avoid being placed in the non-maneuvering area.
  - All of these elements need to be considered by you in the Options check item of the pre-take-off check.

Launch Failure on the Ground

- If you find your aircraft overruns the winch cable, or a wingtip drops to the ground, or you hear a STOP STOP STOP signal from the ground crew or radio, or any other situation occurs that could jeopardise the flight immediately terminate the launch by:
  - Pulling the cable release handle twice.
  - Apply full airbrake.
  - Move the stick full forward.
  - Steer the aircraft away from the cable using rudder.
- Under no circumstances should you allow the aircraft to fly. It is far better to be conservative and terminate a launch before it starts than to allow the aircraft to fly into a far worse situation.

Launch Failure in Flight

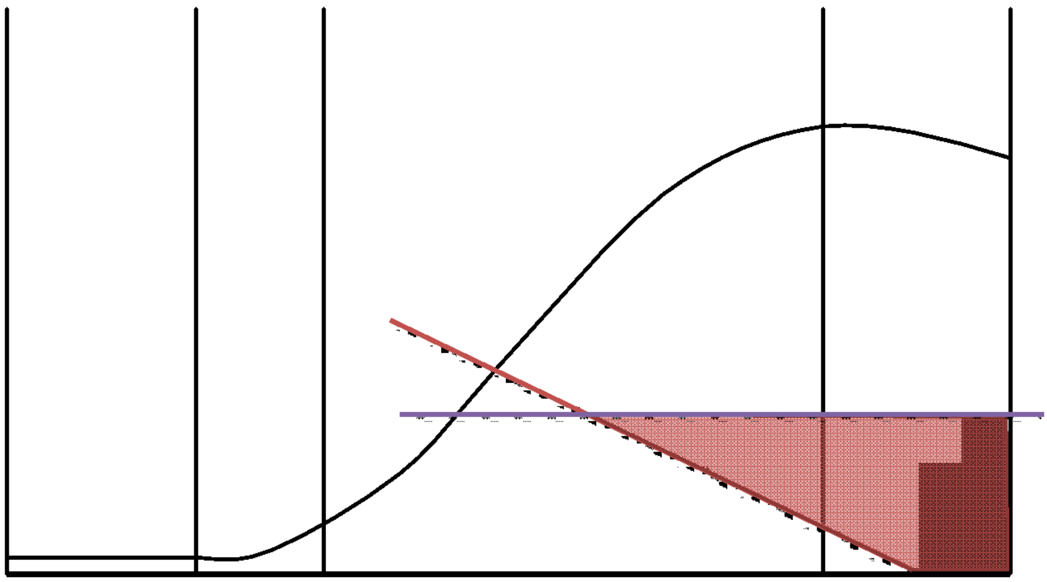
- The first step in managing a launch failure in flight is to recognise that the launch has failed!
- Not all launch failures are cable/rope breaks with an associated jolt or noise.
- Some launches fail 'softly' due to a build up of problems or issues with the winch motor.
- Remember the definition of the launch failure is the inability to maintain the minimum winch speed on the launch during the climb, regardless of the reason.
- After a launch failure in flight you must maintain control of the aircraft and return it to a safe landing by performing the following actions:
    - Action 1. Regain and maintain the safe speed near the ground (l.5VS).
    - Action 2. Operate the cable release mechanism twice.
    - Action 3. Land ahead unless there is insufficient space to land safely.
- The training aims to make your performance of Actions 1 and 2 instinctive and automatic. In contrast, Action 3 is taken after calm assessment of the situation and after the airspeed has reached the safe speed above ground (1.5 VS).
- In launch failures at low level (say <200' AGL) the climb angle should not be very steep and the lowering of the nose is not an extreme manoeuvre. The speed should not decay very much during the "pushover" from the climb attitude to the approach attitude and there is no great inertial problem to overcome, as the glider does not have to climb to the apex of a steep "hill" then come down the other side to build up speed.
- This is the very reason the glider is not allowed to climb steeply during the early stages of the launch.
- The full climb stage of the launch however is characterised by a very high climb rate, typically in excess of 2,000 ft/min (20 knots).
- Height is obviously gained very rapidly, and it is quite safe to climb steeply during this phase, provided that the speed is safely within the working band.
- If a cable-break occurs during this phase, the bad news is that you must take prompt and positive action to ensure that the glider's nose attitude is changed from the steep climb attitude to the "approach to land" attitude necessary for re-establishing a safe speed.
- This change in nose attitude must be commenced immediately the launch failure is recognised. Prompt and positive action is not the same thing as panic-stricken.
- There are two additional factors to be considered. These are jointly the most important of all and persistently responsible for causing winch-launch accidents year after year. These factors are inertia and time.
- If a glider is held in a climb attitude after a launch failure it will stall within a few seconds. To prevent a stall the attitude of the glider must be quickly changed by lowering the nose from the climb attitude to one that achieves safe speed near the ground (1.5 VS).
- During the change in attitude there will be a noticeable delay of several (minimum of 5) seconds before speed builds up to 1.5VS and stabilises, even when the nose is pointing downwards. If a turning manoeuvre is attempted before the speed stabilises there is every possibility that the glider will enter a spin. (refer GPC Unit 18).
- If the airbrakes are opened before sufficient speed has been obtained, it is likely that the glider will either stall or sink extremely rapidly. If the glider is close to the ground, either of these is likely to result in serious damage and injury.

Land Ahead or Modified Circuit?

- A launch failure can occur at any moment of any launch. Having completed Actions 1 and 2 the normal alternatives are for (a) a landing straight ahead or (b) a modified circuit.
- You should ALWAYS plan to land ahead unless you are satisfied that there is insufficient space to land ahead safely, considering the conditions and the performance of the glider.
- The circuit is 'modified' in the sense that is likely to be conducted at a lower height and closer to the runway than a conventional circuit.
- It is important to understand that when carrying out a circuit from a launch failure you must never feel under an obligation to land at the normal touch-down point and that a modified circuit with a down-field landing is quite acceptable.
- This is certainly much better than getting very low (thus closing off the last escape route) in an attempt to land back at the usual take-off point.
- Your Instructor will discuss with you the landing options at various stages of the launch. Instructors can assess your grasp of the landing situation by asking you during the launch what you would do in the event of a launch failure.

Non-Manoeuvring Area (NMA)

- The non-manoeuvring area is the area of sky on a winch/auto launch in which, if a launch failure occurred, the glider is too high to land ahead in the remaining strip length and too low to carry out a circuit. See the red shaded area in the diagram below.
- A guaranteed way to end up in the non-manoeuvring area is to be launched by a low-powered winch or autotow vehicle on a short strip. If the strip happens to be surrounded by unlandable terrain, wall-to-wall trees for example, the scene is set for a nasty accident.
- The obvious answer to such a situation is not to let it occur. Any indication that poor acceleration on take-off might lead a glider into the non-manoeuvring area, especially on marginal strips, must cause a pilot to abandon the launch to avoid getting into trouble. Stay out of the non-manoeuvring area.



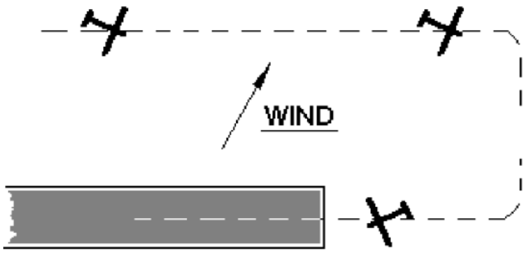
Non-Manoeuvring Area (NMA) overlaid on the normal winch launch profile

- You will note that there are no heights mentioned in the description of the non-manoeuvring area. There are many variables to consider for example, glider performance (sink rate and glide angle), strip length and shape, wind velocity and effectiveness of airbrakes/spoilers. You must decide in each situation whether a landing ahead is possible or not in the conditions of the day and in the particular aircraft being flown. Such decisions can only be made if the exercise has been practised a number of times during pre-solo and post-solo training.

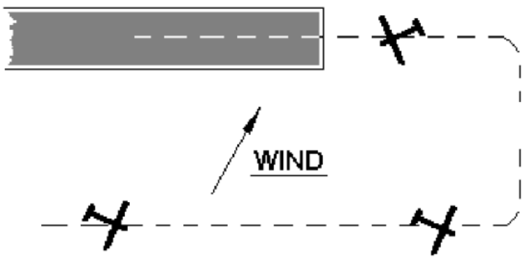
Effect of Crosswind

- When a launch failure occurs and there is a significantly strong cross-wind in a situation where you cannot land ahead and you have decided you need to conduct a modified circuit, you should turn in the downwind direction. Do not allow the glider to drift away from the strip. This is the preferred option in the absence of any local constraints such as obstacles or terrain at and around the airfield.

Modified Circuit when a turn downwind is made after the launch failure. You have clear vision of the landing area improving judgement



Modified Circuit when a turn upwind is made after the launch failure. Poor visibility of the landing area throughout the circuit.



- The turn to downwind will be through an arc of approx. 225 degrees (see first diagram). As the aircraft is flying with the wind it will require less height to move away from the runway centreline and out to a position where the modified circuit can be flown. The glider will fly the downwind leg along a track parallel to the strip, with the nose of the aircraft angled towards the airstrip to correct for drift and providing greater visibility. The base leg will also be flown against the wind giving more time to adjust.
- The landing is conducted into wind if possible, or crosswind in the original take-off direction. Note that these are preferred situations, but they may need to be modified if circumstances dictate.
- If the glider initially turns into wind (second diagram), it will consume more time (and height) to move away from the runway centreline to a downwind position and the glider is forced to point away from the strip on the downwind leg, making the task much more difficult due to a tailwind on the base leg.

What Happens if the Cable will not Release (Hook-Up)

- Thanks to the virtually foolproof hook design and greatly improved maintenance of the cable release mechanism, release failure is extremely unlikely. If it should occur, fly straight ahead after pulling the release to allow the automatic back release mechanism to operate.
- If the back release mechanism does not operate, you have exhausted all the options which are under your control and you are now must focus on flying the aircraft whilst the winch or car driver will jettison or cut the cable at their end. The glider must then be flown in continuous descending circles within the aerodrome boundary and drifting downwind, if possible avoiding overflying of people. You will need to cease turning and straighten out at a safe height and land ahead over the cable which will have laid on the ground. It is highly likely that during this process the cable will release by itself but this may not be obvious to you in the cockpit.

FLIGHT EXERCISES FOR THIS UNIT

- The instructor will demonstrate the rate of airspeed decay in the full climb configuration – this will be done after the launch at height to show how long it takes to recover to a safe speed configuration.
- During each launch you should be calling your options to when to land ahead or complete a circuit.
- During your training you will experience a number of simulated launch failures at variety of heights, to develop:

  (a) Your conditioned response of acquiring and maintaining a safe speed near the ground (l.5Vs).

  (b) Your flexible response of correct use of the height available after the failure, in accordance with all the relevant factors.
- The aim of the instruction is to ensure that when the pressure of a real failure is present, you will inevitably draw on your training, which will provide you with the ability to handle the aircraft correctly.
- Your instructor will give you the opportunity to practice recovery from launch failures using both a land-ahead action and conducting a modified circuit.
- Winch cable hook ups are not practiced as flight exercises.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Solution**
• Inability to detect a gradual failure of the launch.	Monitor airspeed as part of the launch work cycle to ensure that any degrading of speed is noted early.
• Failure to move control column forward fast enough to ensure airspeed is promptly regained to 1.5 VS.	Follow your instructor's advice and note how rapidly the control column is used when the instructor demonstrates the sequence.

• Trying to commence a circuit without ensuring that safe Speed has been attained.	You must confirm that you have achieved 1.5Vs through reference to the ASI before turning.
• Using airbrakes in order to land straight ahead without ensuring that safe Speed has been attained	You must confirm that you have achieved 1.5Vs through reference to the ASI before using the airbrakes.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe the actions to take in a winch launch failure at all launch stages.
- Demonstrate recovery from a winch launch failure at different stages of the launch.
- Explain the threats and errors that apply to recovery from winch launch failures.

RESOURCES & REFERENCES

- GFA Winch Manual (OPS 0007).

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- At what stage of the launch can a launch failure occur?
- What are the things you should do if a launch failure occurs on the ground?
- What are the immediate actions you should do if a launch failure occurs in the air?
- What is the NMA?
- What circumstances could occur to place an aircraft in the NMA?
- Why is the Options check of the pre-take-off check important for launch failures?
- How does a significant crosswind influence the recovery from a launch failure?
- What is the procedure in the extremely rare event of a cable hook up?

Gliding Australia Training Manual

Pilot Guide

Unit 21

Radio Use and Endorsement

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge required to operate aircraft radio equipment during flight in the local area; and ensure that use of the radio conforms to CASA and GFA requirements including relevant terminology.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- This unit should be delivered before GFA Unit 15 Break-off and Circuit Planning and subsequent units.
- Note: There is no need to complete this unit if you hold a CASA private pilot licence (or higher) or a recreational pilot licence with a flight radio endorsement.

COMPLEMENTARY UNITS

- This Unit is a pre-requisite for first solo and will be delivered closely with GPC Unit 23 Basic Rules of the Air as the two units are interlinked.

KEY MESSAGES

- The primacy of AVIATE-NAVIGATE-COMMUNICATE priorities.
- The responsibility of flight crew to see and avoid.
- The advantages of alerted see and avoid.
- Radios are used to resolve conflict and alert aircraft traffic.
- Use of standard procedures and phraseologies are essential for effective radio communication.

PILOT GUIDE FOR THIS UNIT

Radio Procedures General

- The major collision hazard for gliders is other gliders, in thermals, thermal streets and at turn points. Sensible use of the gliding frequencies to supplement "see and avoid" can minimise this risk.
- The risk of collision with powered aircraft has proven to be highly localised to regions of concentrated traffic. The risk of collision with powered aircraft en-route (i.e. away from points of concentration) is very small. However, this means that the TOTAL risk of collision with powered aircraft, although small, is nevertheless present and concentrated around places like active aerodromes and commonly used traffic lanes.
- It is essential that all glider pilots are aware of these points or areas of concentration and be prepared to use the radio on the appropriate Air Traffic Services frequency to assist in reducing the risk to an acceptable level. "See and avoid" on its own may not be reliable enough for collision avoidance in these areas.
- Many clubs have arranged with aerodrome co-users, local regional airlines or charter operators and have agreed radio or other procedures to suit all operations.

- The presence of a glider in an area into which a medium-sized aircraft may be descending at more than 200 knots is a clear case where "un-alerted" see and avoid is not sufficient and needs to be supplemented by use of radio.

Responsible use of the Radio.

- Pilots operating VHF radiotelephone equipment must hold a Flight Radiotelephone Operators License (FROL) or GFA Radiotelephone logbook endorsement, (refer CAO 95.4 Section 6.6). The training and qualification must be completed and the logbook endorsed prior to first solo.
- This requirement also applies when using one of the designated glider frequencies 122.5, 122.7 and 122.9, or the gliding competition frequency 122.025.
- Use of the above gliding frequencies is normally confined to purely gliding - related matters, such as routine messages during cross-country flights, special purposes during gliding competitions or for search and rescue purposes. However, some non-towered aerodromes where gliding is undertaken also use a gliding frequency as the local CTAF. Therefore, it is essential to maintain the highest standard and discipline when using the radio in the CTAF.
- When on gliding frequencies not used as a CTAF, the use of the radio is entirely optional and unrestricted. However, there are certain courtesies in radio use which make things better and easier for all concerned. Compulsive talkers on the radio seem to be a fact of life and it is sometimes difficult to get a word in edgeways when one of these people is in full song.
- When considering the effect this has on other people, think about this: a VHF radio operates on the principle of "line of sight". Ground to ground communications is usually poor and rarely exceeds 10km. However, with one set on the ground and another in the air, or two in the air, the picture changes dramatically, as follows:-
    - 1,000ft – 70Km
    - 3,000ft - 120km
    - 5,000ft - 160km
    - 8,000ft - 200km
- It will be seen that it is very easy to block the airwaves over a very large area. If someone is trying to transmit, say, a report that an outlanding is imminent and cannot get the message across, the frustration can be imagined.
- Even more importantly, a vital message concerning an accident (such as a mid - air collision observed from another glider) may be blocked. This could be a matter of life or death for the victims of such an occurrence and a radio call to summon up an ambulance could make the difference.
- Therefore, the first thing that must be learned in using a radio in a glider is the basic principle of talking only when necessary. Exactly how to do it will be covered later.
- Used properly, a radio in a glider is a very distinct asset. Used indiscriminately, it is a pest.
- One further thought while we are considering unnecessary use of radio. Most gliders have no means of replenishing their electrical supply in flight. A few have solar panels fitted, but such installations are still quite rare. Batteries therefore get flatter and flatter as the flight goes on. A lot of transmitting will flatten the battery far more quickly than just listening, by a factor of about 10 to 1. In addition, excessive transmitting flattens everybody else's batteries within radio range, because the current drawn by the radio increases as messages come in, the squelch lifts and the receiver amplifies the signal to drive the speaker.

Use of VHF Frequencies in the Aeronautical Communications Band.

- A pass in the online theory examination is required which is accessed through the Online Exams and Courses option in the Member Area of Go Membership. Your demonstrated radio usage and procedures will be assessed by your Level 1 or higher rated instructors, who will test your ability to communicate, annunciate and articulate using the radio (where English is a second language, refer also to MOSP 2, Section 15.3).
- The practical examination will be carried out by.

Candidates who successfully pass the theory exam and practical assessment will have their logbooks endorsed as follows:-

> ***"This is to certify that (name)................ has demonstrated competence to operate R/T equipment onboard aircraft in the English language.".***

The logbook endorsement should carry the instructor's name, instructor level, signature, club and date.

- The informality which is characteristic of glider-to-glider communication on the glider frequencies is not appropriate when operating on any other aeronautical frequency. There are procedures to be followed; otherwise chaos and possibly danger may result. Knowledge of correct radio procedures and terminology is required. This must be accompanied by the discipline to listen out and reply promptly and concisely when necessary, broadcast when appropriate, and pass only that information which is strictly necessary.
- Thinking pilots will realise that the background and discipline described above could be used with advantage by glider pilots on GFA's own frequencies.

Procedures and Terminology

Procedures.

Your instructor will show you how to operate your particular radio in your glider. This information will include operation of a VHF radio to:

- Change frequencies,
- Set volume & squelch levels,
- Press to transmit and use the microphone.

Once the radio is switched on and set up as required, a few basic procedures apply to its use. These can be listed as follows:-

- Listen out carefully before transmitting. Nobody wins if two transmissions go out together; all that happens is that a squealing noise upsets everyone within radio range.
- Hold the microphone two to five centimetres from the mouth when speaking. If you hold it too close, the transmission will be distorted and unclear, too far away and you simply won't be heard.
- Press the transmit button BEFORE speaking (rather than AS you speak) and do not release it until AFTER speaking. Otherwise parts of your transmission will be lost.
- If the microphone does not have a proper mounting, be sure you stow it in such a way as to avoid inadvertent pressing of the transmit button. The same principle applies to hand-held radios used in flight.
- Think about what you want to say before transmitting, to avoid "umm-ing and ah-ing" on the air.

- Always address the station being called first, followed by your own callsign and the message. For example: "Leeton Ground, Hotel Whisky, abeam Ardlethan at 5,000, ops normal".
- When calling a non-gliding station, for example an Air Traffic Controller or a powered aircraft, prefix your callsign with the word "glider". It helps the other party to visualise your situation and likely intentions, in particular alerting them to the fact that you have no power-plant and may of necessity behave less predictably than a powered aircraft when in the circuit area.
- It is illegal to broadcast messages that:
    - Contain obscene or profane words or language.
    - Are of a personal or private nature.
    - Use the callsign of another station improperly.
    - Are false or intended to deceive.
    - Are superfluous and do not pertain to operational requirements.

Terminology

The international Air Traffic language is English. To avoid confusion caused by distortion, weak signals or limited understanding of the language, a system of standardised words and terminology has been created. This consists of a phonetic alphabet, numbers which are spoken in a particular way and some words which have very specific meanings and uses.

The phonetic alphabet is as follows:-

A	ALPHA	AL fah	N	NOVEMBER	no VEM ber
B	BRAVO	BRAH voh	O	OSCAR	OSS cah
C	CHARLIE	CHAR lee	P	PAPA	pah PAH
D	DELTA	DELL tah	Q	QUEBEC	keh BECK
E	ECHO	ECK ho	R	ROMEO	ROW me oh
F	FOXTROT	FOKS trot	S	SIERRA	see AIR rah
G	GOLF	GOLF	T	TANGO	TANG go
H	HOTEL	hoh TELL	U	UNIFORM	YOU nee form
I	INDIA	IN dee A	V	VICTOR	VIK tah
J	JULIETT	JEW lee ETT	W	WHISKY	WISS key
K	KILO	KEY loh	X	X-RAY	ECKS ray
L	LIMA	LEE mah	Y	YANKEE	YANG key
M	MIKE	MIKE	Z	ZULU	ZOO loo

Numbers are spoken as follows:-

0	ZE-RO	5	FIFE	DECIMAL	DAY SEE MAL
1	WUN	6	SIX	HUNDRED	HUN dred
2	TOO	7	SEV en	THOUSAND	TOU SAND
3	TREE	8	AIT		
4	FOW er	9	NIN er		

Standard words and phrases should be used as follows:-

Affirm	Yes, or permission granted, or that is correct.
Negative	No, or permission denied or that is not correct.
Correction	An error has been made, correct message follows.
Acknowledge	Confirm that you have received and understood my message.
Roger	Message received and understood.
Wilco	Message received, understood and will be complied with.
Go ahead	Transmit your message.
Verify	Check that the transmission is correct.
Say again	Self-explanatory.
I say again	Self-explanatory.
Speak slower	Self-explanatory.
Stand by	Self-explanatory.
That is correct	Self-explanatory.
How do you read?	Used to gauge effectiveness or serviceability of radio and should not be used in normal transmissions. Answered by "Reading you strength...." One: Your transmissions are unreadable. Two: Your transmissions are readable now and then. Three: Your transmissions are readable with difficulty. Fower: Your transmissions are readable. Fife: Your transmissions are perfectly readable. "Loud and clear" is often used instead of this expression.
Break	Used to terminate one transmission and start another (to another station) without releasing the transmit button.
Height broadcast.	When operating below 10,000 feet and broadcasting height or altitude over the radio, use normal terminology, e.g. "three thousand, five hundred" (not "three five zero zero"). If above 10,000ft and flying at, for example, 13,500ft on 1013.2HPa, you would broadcast this as "Flight Level One

	Three Fife" and 26,000ft would be broadcast as "Flight Level Two Six Zero".

Units of Measurement

Units of measurement to be used in airways operations and air-ground communications are as follows:

Measurement	Units
Distances used in navigation (generally in excess of 2NM)	nautical miles and tenths
Short distances	metres
Altitudes, elevations and heights	Feet
Horizontal speed, including wind speed	Knots
Vertical speed	Feet per minute
Wind direction for runway operations	Degrees Magnetic
Wind direction except for runway operations	Degrees True
Visibility, including runway visual range	kilometres or metres
Altimeter setting	hectopascals
Temperature	degrees celsius
Weight (Mass) Metric	tonnes or kilograms
Time	hours and minutes
Time System	Coordinated Universal Time (UTC)

**Miles must be read as meaning nautical miles unless otherwise stated. The word "nautical" may be omitted from air-ground communications.*

In-Flight Emergencies

There are special words for use in the event of having an emergency in flight. Use of these words will guarantee you sufficient air time to get your message across. Because they are allocated for the exclusive use of pilots in some kind of distress, it goes without saying that they should not be used lightly.

The key words and their uses are as follows:-

MAYDAY (3 Times)

- Derived from the French "m'aidez" (help me), this is used when the pilot experiences a serious in-flight emergency.
- A tug pilot would use Mayday, Mayday, Mayday, to announce, for example, an in- flight fire or some equally serious problem.

- An example of a glider pilot's use of Mayday would be in the event of a mid-air collision, either to announce that the aircraft is about to be abandoned or an attempt made to land it.
- Note on the above points. Naturally a pilot would not hang around to go through the protocol of making a radio call if the severity of the emergency demanded, for example, immediate abandonment of the aircraft. Preserve life as a first priority and only make the call if you have time.
- Pilots must exercise discretion in the use of the Mayday call. Frivolous use of the word ultimately discredits it and nobody takes any notice. On the other hand, don't ever be afraid to use it if you are really in trouble.
- The Mayday call may be made on the frequency in use at the time the emergency occurs, or it may be made on the international distress VHF frequency (see next section)

PAN PAN (Three Times)

- This word means, loosely, "breakdown" and is used for an in-flight emergency less serious than one which demands instant attention by the use of Mayday.
- A tug-pilot would use ‘Pan Pan’, ‘Pan Pan’, ‘Pan Pan’, for example, if he notices that the aircraft is indicating a rising oil temperature and a falling oil pressure. As such symptoms may indicate an imminent engine failure; this situation would justify waving off the glider and making a Pan call to announce the aircraft's situation.
- A glider pilot might use ‘Pan Pan’ in the case of a bird-strike, where damage had been caused but the glider is still controllable.
- The purpose of the ‘Pan Pan’ call is to alert anyone who is listening that a problem has been encountered, but there is no immediate danger. It is usually made on the frequency being used at the time, and rarely on the distress frequency, although this should not by any means be ruled out. If things get worse, don't hesitate to change the ‘Pan Pan’ call to a Mayday call.
- Rather than try to describe here each possible emergency that might be encountered in flight, pilots are encouraged to use their imagination in thinking about the kinds of emergencies which might crop up.

Stop Transmitting – Distress Traffic (Callsign)

- This radio call is used if your broadcast is interfering with radio communication between stations dealing with a Mayday or Pan situation. If it is directed to you, you must stop transmitting unless you are in distress yourself.
- e.g. “Glider ABC Melbourne Centre Stop Transmitting – Distress Traffic Qantas 521.”

International Distress Frequency

- By international agreement, certain frequencies have been set aside for use by pilots in distress. In the VHF band, the international distress frequency is 121.5 MHz.
- A glider pilot in an emergency situation, as described earlier in this chapter, should not hesitate to use 121.5 MHz to make an emergency call if it is appropriate. The frequency is constantly monitored by most large commercial aircraft and the satellite systems dedicated to search and rescue purposes.
- The warning about frivolous use of the word "Mayday" also applies to the use of 121.5 MHz. Under no circumstances should the frequency be used for anything other than emergency broadcasts. On the other hand, if an emergency crops up, it is there to be used and a pilot should do so without fear.

When to Use the Radio.

- Note: If your gliding club is operating inside controlled airspace your instructor will brief you on the radio calls required in that situation.
- If outside controlled airspace all pilots must monitor and communicate on the CTAF frequency (including those assigned MULTICOM 126.7) whenever they are operating at or in the vicinity of a non-towered aerodrome. An aircraft is defined as operating at the aerodrome whenever it is within the active areas of the aerodrome - when the aircraft is located within the aerodrome runway, or taxiway markers. In the vicinity of an aerodrome is defined as within a horizontal distance of 10 nm of the aerodrome reference point and at a height above the aerodrome reference point that could result in conflict with operations at the aerodrome.
- The height may vary considerably in consideration of local traffic and other circumstances at particular aerodromes. However, all aircraft are expected to be operating on the CTAF frequency whenever at or below 3,000ft as a minimum above the aerodrome reference point and higher when appropriate.
- The following table sets out the recommended broadcasts, but pilots may use discretion in determining the number and type of broadcasts they make. For example, when operating from a private or remote airstrip, a single broadcast declaring an intention to take-off and track in particular direction may be all that is required where there is no response to the initial transmission.

Circumstance Item (non-towered Pilot's radio broadcasts aerodromes)		
1	The pilot intends to take-off.	Immediately before, or during, taxiing.
2	The pilot intends to enter a runway.	Immediately before entering a runway.
3	The pilot is inbound.	10 NM or earlier from the aerodrome, commensurate with aircraft performance and pilot workload, with an estimated time of arrival (ETA) for the aerodrome
4	The pilot is ready to join the circuit.	Immediately before joining the circuit.

- In addition to making positional broadcasts, pilots should listen to other broadcasts to increase situational awareness. This ‘alerted see-and-avoid’ strategy results in an eight-fold increase in the likelihood of seeing another aircraft.
- Whenever pilots determine that there is a potential for traffic conflict, they should make radio broadcasts as necessary to avoid the risk of a collision or an Airprox event. Pilots should not be hesitant to call and clarify another aircraft’s position and intentions if there is any uncertainty.
- It is essential that pilots maintain a diligent lookout because other traffic may not be able to communicate by radio (e.g. the other pilot may be tuned to the wrong frequency, selected the wrong radio, have a microphone failure, or have the volume turned down).

Unserviceable radios:

- An aircraft must not take-off from a non-towered aerodrome with an unserviceable radio. However, if the radio becomes unserviceable during flight the pilot may continue the flight and land at the aerodrome or another non-towered aerodrome if it is appropriate to do so. Refer (CAR 166E and CAAP 166-1).

FLIGHT EXERCISES FOR THIS UNIT

Once you have received this lesson the instructor will be asking you to make the appropriate calls. Initially the instructor will help you with these but as your experience grows you will be expected to make these calls unaided.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

Depending on your background you may have problems initially with the aviation standard phraseology and where to make the calls.

HOW DO YOU DEMONSTRATE COMPETENCE?

You should be able to:

- Communicate, annunciate and articulate using standard phraseologies on a VHF radio.
- Demonstrate operation of a VHF radio controls to:
    - select and change frequencies,
    - set volume & squelch levels,
    - press to transmit and
    - use microphone.
- Achieve a pass on a theory Radio Telephone Operator endorsement examination which is accessed through Go Membership/Online Exams and Courses/. You will need to log in with your GFA Member Number.

RESOURCES & REFERENCES

- GFA MoSP 2 Operations
- CASA AIP ENR 10.1.17 Radio Calls
- CASA CAAP 166 Operations in the vicinity of non-controlled aerodromes
- GFA "Airways and Radio Procedures for Glider Pilots" Manual

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

Q1. What range of your VHF radio would you expect if you transmitted a call at 5000'?

Q2. Can you go solo without a logbook endorsement of radio procedures?

Q3. What is the unit of measurement for wind speed?

Gliding Australia Training Manual

Pilot Guide

Unit 22

Use of Situational Awareness Aids

WHAT THIS UNIT IS ABOUT

To describe the operation of a range of electronic aids to situational awareness and their use in supporting effective lookout; and to describe the limitations of these aids.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 9 – Lookout Scan Procedures
- GPC Unit 21 – Radio Use and Endorsement

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 39 – Advanced Soaring Instruments and Flight Computers.

KEY MESSAGES

- Modern electronics and radio communications have delivered a variety of devices that can assist the pilot in obtaining and maintaining situational awareness.
- These devices are not perfect and have multiple failure modes. This means they are an adjunct to, not a replacement of, the main situational awareness processes. Always maintain lookout as the primary means of maintaining situational awareness.
- Pilots need to understand how these devices operate, how they are configured and used, how to interpret the information they provide.
- Pilots also must understand their limitations and how to know that they are configured and operating correctly.
- These devices must not be allowed to distract from the prime duties to lookout, see and avoid.

PILOT GUIDE FOR THIS UNIT

- There are different types of equipment providing aids to Situational Awareness. Each comes with different displays and configurations. The manual appropriate to the device used in the aircraft must be consulted for the correct setup, usage and diagnostic procedures.
- The following types of devices can improve your situational awareness providing they are working configured correctly.
    - Aeronautical Radio (VHF)
    - FLARM
    - Transponders (XPNDR)
    - Moving Map displays (discussed in GPC 39).

There are limitations of these devices which are:

- Range of communications.
- Need for electrical power.

- Continuous drain on aircraft battery.
- Readability of displays / clarity of audio output.
- Ability to display complex data on a limited area.
- Need for configuration and calibration.
- There is also a need for regular updates for some devices

- Let's look at the advantages and limitations of these devices.

Radio

- Almost all gliders in Australia are fitted with a radio even though a radio is not mandatory. Radio is however, very useful.
- The essential thing to remember about the use of a radio is the old adage, "aviate, navigate, communicate." What that means, especially to low hours pilots, is that their highest priority is to fly the aircraft and keep a good lookout for others rather than becoming distracted by trying to make a correct radio call.
- The biggest use of radio is when returning to the strip and circuit area to tell other aircraft where you are. The radio is also very useful when gliders are flying together so that their respective positions can be provided. This promotes a targeted scan and improves safety. The downside of this is that we can fall into the trap where you think you have all the positions of the gliders in the area, so our scan is only for these aircraft. We then find there are one or two gliders operating without radio or not using your frequency.
- Stating the obvious the radio will only be effective if you are on the right frequency. If you are operating in the circuit area, then you should be on that CTAF/Tower frequency. If you are going cross country in G class airspace, then you should be on a nominated glider frequency. Various gliding sites use a common frequency for pilots from that area, so you need to be aware of which frequency will be best to used depending on where you are flying.

Power supply in gliders

- There's no doubt that technology such as GPS has revolutionised many aspects of gliding, and most of it is good. However, getting these devices to work in a sunlit cockpit requires a lot of energy from batteries or solar panels.
- With all glide computers there is a problem of power supply. The more powerful the computer and the bigger the display, the greater the power drain, especially where a system is fitted like a transponder or a device such as ADS-B which broadcasts and receives the position of civil aviation aircraft.
- What happens when the electricity runs out? You might not lose all your instruments but things like radios which need a lot of power to transmit will stop working properly and you may not know that you are not transmitting as the battery voltage sags.
- One of the best ways of providing more power to run these extra instruments is solar panels built into the glider's fuselage. This may be only possible with new gliders, but a couple of small solar panels can mean your battery voltage rarely drops, even during the longest flights.
- Newer battery technology can be used to provide more power but the extent to which this is possible is limited by a few factors including whether the battery is available in a size which will fit a glider, whether a particular battery technology is certified to be used in a glider and whether the battery or its charging system are fire-proof enough that you would want to carry them in a glider cockpit.

- If your power supplies fail there are two situational awareness aids that are always available that require no electricity and are free to use: the sun and the compass.

Flarm and ADS-B

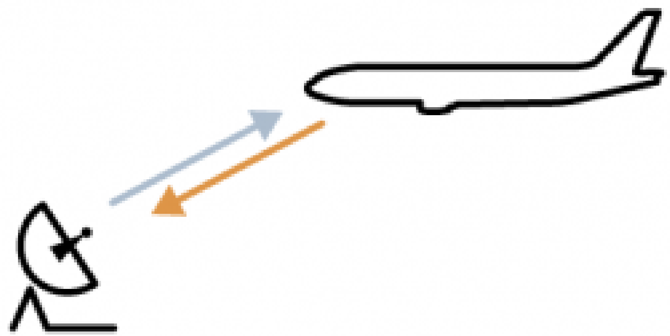
- **FLARM** (Flight Alarm)– uses an alarm to alert pilot to review display and determine closest and immediate threats.
- Two computer/GPS based instruments are available to increase situational awareness in gliders, Flarm and ADS-B.

Typical Flarm display

- Flarm is an instrument invented in Switzerland in 2003 to give glider pilots an audio-visual alert of other Flarm equipped aircraft and predict potential collisions. It analyses the flarm GPS signal of other gliders and identifies when the aircraft are converging and therefore have potential for collision risk. The light indicates the presence of another glider close by and if collision is predicted it will also sound an alarm.
- Most Flarms have an integrated data logger which can be used to record flight tracks for badge claims, competitions and flight analysis. The Flarm also includes a world-wide terrain database which can be used to predict potential collisions with ground features from antennae to mountains.
- **ADS-B** is a more recent technology which is used by a much wider range of general aviation, sport and transport aircraft. It's available as receive only (ADS-B in) and receive and transmit (ADS-B out). Full ADS-B installations can be expensive and use a lot of power.
- ADS-B in is being increasingly fitted to gliders to provide optimal situation awareness of the traffic around you. Instruments such as PowerFlarm have both improved FLARM and ADS-B capability.
- Flarms are mandatory in most competitions and in many day to day club operations and it's likely that ADS-B will follow the same route.
- Both technologies fix the speed and position of the aircraft the device is installed in using a built-in GPS and solid-state altimeter. The instrument's computer predicts the aircraft's future track and broadcasts this signal. The instrument also receives signals from other equipped aircraft within a range of 3 km or more and uses this information to predict potential collisions.
- These devices can be connected to voice modules and also display weather information, the rate of climb and call sign of other aircraft giving pilots a more descriptive warning of potential hazards.

- Flarm units use little power and are reasonably priced. ADS-B is somewhat more expensive and uses more power but these parameters are being improved and we should expect to see gliders with ADSB in the near future..
- Since Flarm devices are mostly fitted only to gliders, it's a great technology for glider-only airspace where that exists. ADS-B can be fitted to a much wider range of aircraft and it has a much greater potential for making airspace safer. ADS-B is mandatory in Australia for aircraft flying under IFR (Instrument Flight Rules) but is not mandatory for VFR (Visual Flight Rules) which represents the majority of general aviation and sports flying.

Transponders:



- Some gliders are fitted with transponders. The definition being; a transponder (XPDR) is a receiver/transmitter which will generate a reply signal upon proper interrogation; the interrogation and reply being on different frequencies. (ICAO)
- A 4-digit code is displayed on the unit in the glider which can be selected to any number requested by Air Traffic Control (ATC). For gliders flying VFR this would normally be 1200.
- Its main purpose is to let ATC know where you are for traffic purposes and is a requirement normally to enter controlled airspace. For the glider pilot there is little information gained in regards to situational awareness from this device.
- The transponder also has a relatively high- power demand on your battery.

Moving Map Displays

- Glide computers fitted with moving map displays have even more capabilities. They can be loaded with hundreds of waypoints and details of aerodromes and outlanding strips. Aerodromes can have a picture attached with details of runway length, direction, altitude and local frequencies etc.
- The recent history of your flight can be shown as a "snail trail" coloured to display lift and sink on track and as an aid to centring thermals and finding lost ones. A display to show the strongest and weakest parts of a thermal around the circle.
- Airspace can be shown with displays and warnings of possible airspace violations. Where a terrain database is loaded, the glide computer can give you information about possible collisions with ridges, mountains and towers.
- When interfaced with common gliding software such as SeeYou, the glide computer can be used for task planning and modification in flight. A complete set of task statistics can be displayed in flight to optimise your flight.
- If you are flying cross-country and running out of height, it can display information and bearings to a number of nearby strips.

- Maps can be zoomed in or out to show details or whole tasks. Map pages showing task points or distance and bearing to alternative waypoints or your home strip can be switched instantly. Screens or pages can be customised in many ways to suit your preferences and display the information you want to see.
- Glide computers with data loggers are not expensive and can add enormously to the fun of gliding, both in the air and on the ground after the flight.
- Good airmanship requires that you should have an accurate idea of the facts and you should not rely solely on instruments like GPS and glide computers. They should be an aid to flying and navigation and not your only tool.
- You should never use electronic instruments to the detriment of the basic airmanship skills of aviate, navigate, communicate. GPS should not be used as a primary means of navigation, especially not for avoiding controlled airspace. Visual pinpointing and official charts remain the primary legal means of cross- country navigation.

Computer software for glider pilots

- There's a small range of computer software intended for glider pilots. The programs range from simple for uploading tracks waypoints to and from GPS devices to more powerful software like SeeYou.
- SeeYou is a flight planning and analysis program. It allows you to plan tasks over terrain maps using a library of waypoints and upload this to a GPS or glide computer. After the landing, you can download your flight track and analyse it.
- Flights can be re-flown on the computer so you can analyse your thermalling performance and decision making. If you've been flying a comp or in a group, flights can be re-flown in sync.
- You can see the statistics for your flight including the time spent circling, time spent in cruise, L/D etc. Some hand held GPS units can run programs like SeeYou for use in the glider. SeeYou is commonly used in competitions for planning tasks and coordinating scores.
- Software is not just for experts though. When you're learning, tools like SeeYou can be very useful to analyse flights and thermalling performance to improve your cross-country skills.

Personal Electronic Devices.

- There are also many personal electronic aids that can be displayed on your phone or IPAD such as LX Nav, Win Pilot, Avplan and OzRunways which provide an enormous amount of information to the aviator.
- Another standalone device is "Oudie" which provides the same information as a fitted NAV computer described above.

- You will spend more time with this and other NAV units in GPC 39.

Important Notes:

- As all these devices can be very distracting, you should ensure that they are programmed and set up before you go flying.
- You should know how to power cycle the device and how to determine that it is operating correctly.
- You should know how to configure and determine the calibration and update status of the device.
- All these aids can make gliding very enjoyable and provide confidence in our navigation but as mentioned throughout your glider training aircraft still run into each other so:
- Set up your navigation aids correctly before take-off and spend the majority of your time looking out as the Vario, Radio and FLARM will provide audio warnings without having to get your head inside.

FLIGHT EXERCISES FOR THIS UNIT

- Your instructor will show you how to operate your gliders electronic aids and how to check and configure the device.
- Inflight you can demonstrate receiving information either by radio, FLARM or other aids to determine location and the direction of traffic.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

Problem	Solution
• Some devices can be complex to set up and use, which can distract you from your core flying skills.	Use the basic information available rather than trying to use all capabilities.

HOW DO YOU DEMONSTRATE COMPETENCE?

- When you can unassisted set up and operate the aids in your glider and demonstrate awareness of other aircraft using these aids.

RESOURCES & REFERENCES

- Australian Gliding Knowledge Pages 80-82, 229-231
- Operation manuals for the various devices

SELF-CHECK QUESTIONS

- How does FLARM increase your situational awareness?
- What is the approximate range of FLARM?
- What is the purpose of the Transponder?

Gliding Australia Training Manual

Pilot Guide

Unit 23

Rules of the Air

WHAT THIS UNIT IS ABOUT

To introduce the basic Rules of the Air and operating procedures enabling the pilot to fly solo safely within the local area.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Units 1 - 22 which will include Unit 21 Radio Use & Endorsement.

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

Nil

KEY MESSAGES

The student must be able to:

- apply the “Rules of the Air” practically in the circuit and in local flying.
- apply the limitations of the Visual Meteorological Conditions for a local flight.
- describe the altitude and any area limitations of the local operating airspace.

PILOT GUIDE FOR THIS UNIT

Applicable Rules of the Air.

Refer to ***GFA Airways and Radio Procedures for Glider Pilots***.

The following “rules” must be remembered so that you can operate safely with other aircraft.

- A sailplane shall not operate lower than:
  - 1,000 feet over a built-up area, except in the course of taking off or landing at an aerodrome or gliding site, nor
  - 500 feet above the ground, except when taking off or landing as above, being retrieved following an outlanding, when completing an approved low-level finish procedure, or when engaged in ridge or hill soaring.
- A sailplane which is required to give way to another aircraft shall do so by passing behind it, or if passing in front or above or below that aircraft, shall keep well clear.
- When two aircraft are on converging headings at approximately the same height, the aircraft which has the other on its right shall give way, except that:
  - Powered aircraft shall give way to airships, sailplanes and balloons;
  - Airships shall give way to sailplanes and balloons;
  - Sailplanes shall give way to balloons; and
  - Powered aircraft shall give way to aircraft that are seen to be towing sailplanes.

- Where two aircraft are approaching head-on or approximately so and there is a danger of collision, each shall alter its heading to the right.
- An aircraft being overtaken has right of way over the overtaking aircraft, which shall not overtake by climbing or diving to pass over or under the other aircraft. An aircraft shall overtake another aircraft by passing to its right.
- An aircraft in flight or on the ground shall give way to an aircraft landing or on final approach to land. Where two or more sailplanes are approaching to land, the lowest sailplane has the right of way but shall not use this rule to cut in front of or overtake another sailplane on final approach. A powered aircraft shall give way to a sailplane which is approaching to land.
- Where two sailplanes are at approximately the same height and both are approaching to land, the higher-performance sailplane shall give way to the lower-performance sailplane.
- An aircraft which is about to take off shall not do so until there is no apparent risk of collision with another aircraft.
- The minimum vertical or horizontal separation between gliders in a thermal is 200ft.
- The first glider in a thermal establishes the direction of turn.
- A joining glider must turn in the same direction.

Airspace Classification and Airways Procedures

Responsibility of Flight Crew to see and Avoid Aircraft.

The Civil Aviation Regulations require the flight crew of an aircraft to maintain vigilance so as to see, and avoid, other aircraft.

For this reason, there are ‘Visual Flight Rules” so that the above regulations can be maintained.

Visual Flight Rules

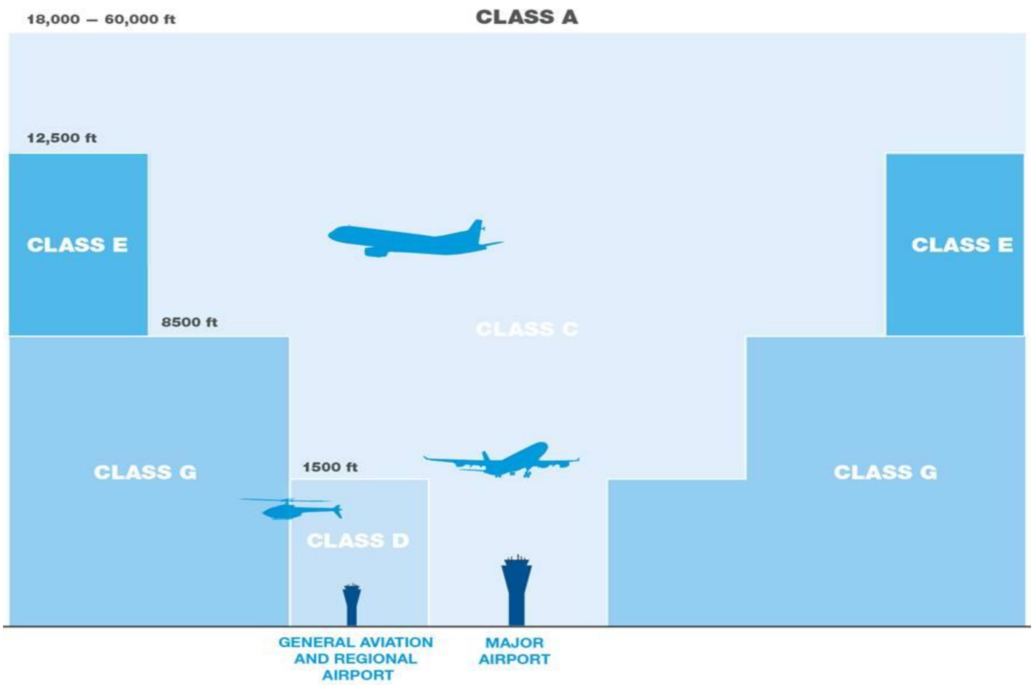
Gliders are only permitted to fly in Visual Meteorological Conditions (VMC). The table below shows the requirement for VMC for gliders in uncontrolled airspace.

Height	Required flight visibility	Horizontal and vertical distance from Cloud	Additional conditions
At or above 10,000ft AMSL	8Km	1.5 Km horizontal 1,000 ft vertical	
Below 10,000 ft AMSL	5Km	1.5 Km Horizontal 1,000ft Vertical	
At or below 3,000ft AMSL or 1,000ft AGL, whichever is the higher	5Km	Clear of cloud and in sight of the ground or water.	Carriage and use of radio is required when operating to these conditions for communication on the CTAF when required within the vicinity of a non-controlled aerodrome.

Airspace Classification

To control aircraft of all different types and capacity in a safe manner the Civil Aviation Safety Authority have divided sections of Australian airspace into different classifications.

The Classes are A, C, D, E and G.



- A, C and D are controlled and require specific clearances to enter.
- E and G for Gliders are uncontrolled although certain requirements are to be met when gliders are operating in E airspace.

Class A & C Airspace

- Class A controlled airspace is above Flight Level (FL) 180 within radar coverage and above FL245 outside radar coverage). Class A and underlying C airspace extends downwards in "steps" reaching ground level in the immediate vicinity of major airports which handle large public transport aircraft. Although VFR aircraft (including gliders) are permitted to operate in Class C airspace, VHF radio is mandatory and all aircraft must have an individual clearance from Air Traffic Control to enter the airspace.
- Class C airspace is depicted on En-Route Charts, Low (ERCs(L)), Visual Navigation Charts (VNCs) and Visual Terminal Charts (VTCs). These charts are available from Airservices Australia.
- There are also providers that provide all this info on portable electronic devices such as OzRunways.

Class D Airspace

- This is controlled airspace which surrounds some airports with a control tower where the traffic density does not justify the installation of radar: e.g. Camden, Moorabbin.
- Such airspace relies on specified procedures for traffic alerting and separation, and equipment requirements are less stringent that for Class C. VFR traffic (e.g. gliders) may receive traffic information on other aircraft but separation is the pilot's responsibility. For gliders, VHF radio and Air Traffic Control clearance are required. Pilot radio operating qualifications are the same as for Classes A and C. Class D airspace is depicted on ERCs(L), VNCs and VTCs.

Class E Airspace

- This is controlled airspace which generally occupies the space between Class G (uncontrolled) airspace and Class C, D and A airspace in certain parts of Australia. Class E airspace commences at 12,500 feet over Australia but can be as low as 8,500 feet.
- Class E airspace is depicted on ERCs (L), VNCs and VTCs. In Class E airspace, IFR and VFR flights are permitted. IFR flights are provided with an ATC service, are separated from other IFR flights, and receive traffic information on VFR flights as far as is practicable. VFR flights receive a Surveillance Information Service (SIS) on request.
- VFR flights entering and operating in Class E airspace should:

  (a) avoid published IFR routes, where possible;

  (b) monitor the appropriate Class E frequency and announce if in potential conflict; and take appropriate action to avoid potential conflict.

NOTE: CASA and GFA have agreed some formal processes that allow glider pilots to use a discreet frequency while providing greater situational awareness to other airspace users as follows:

- When flying in groups, glider pilots can nominate one aircraft to monitor air traffic control and pass on traffic information to other gliders using a discrete glider frequency.
- Special arrangements can also be made for gliding competitions or events, with authorisation to be provided through a NOTAM issued by Airservices Australia.
- For single glider operations in Class E airspace operations not in accordance with a published NOTAM, glider pilots will maintain a listening watch on the appropriate ATC frequency.

Class G Airspace

- This is uncontrolled airspace and is all that airspace which is not covered by any of the previous categories.
- Any glider operating in Class G airspace which has a radio is encouraged, but not required, to monitor the appropriate VHF frequency (rather than a glider frequency) when above 5,000 feet AMSL.
- A Radar Information Service (RIS) is provided for transponder-equipped aircraft in the vicinity of some capital city airports. This is unlikely to be of interest to gliders but may be helpful to some tugs. The areas served by RIS are depicted on ERC(L), VNC and VTC charts.

Operations at Non-Towered Aerodromes

This is covered in Civil aviation advisory Publication number 166-1

- Non-towered aerodromes are those at which air traffic control is not operating. This can be any of the following:
  - an aerodrome that is always in Class G airspace;
  - an aerodrome with a control tower where no air traffic control (ATC) service is currently provided; or
  - an aerodrome which would normally have ATC services provided but such services are presently unavailable.
- **Mandatory requirements**: All aircraft operating at, or in the vicinity of any certified, registered and military non-towered aerodrome, as identified and published in ERSA and any other aerodrome designated by CASA on a case by case basis, as published in ERSA or NOTAM, must be operated with a serviceable VHF radio. The radio must be fitted with the common traffic advisory frequency (CTAF) designated for use at the aerodrome as published in ERSA.

- The pilot must be qualified and endorsed to operate the radio and must maintain a listening watch and make radio calls whenever it is reasonably necessary to do so to avoid a collision, or risk of a collision with another aircraft.
- These calls must include:
    - The name of the aerodrome
    - The aircraft's type and call sign; and
    - The position and intentions

Prohibited, Restricted and Danger Areas (PRD)

Prohibited Area

- Flight within a Prohibited Area is not permitted under any circumstances.

Restricted Area

- Flight within a Restricted Area (e.g. military flying training area or gun-firing range) is normally only permitted outside the hours of activation of the area. In special circumstances, operations may be permitted within the hours of activation on the basis that the aircraft must operate within the terms of the clearance given by the controlling authority in charge of the area and the flight path will comply with controlled airspace procedures. However, some Restricted Areas do not allow flight at any time though the areas (e.g. Australian Defence Force munitions factories.)

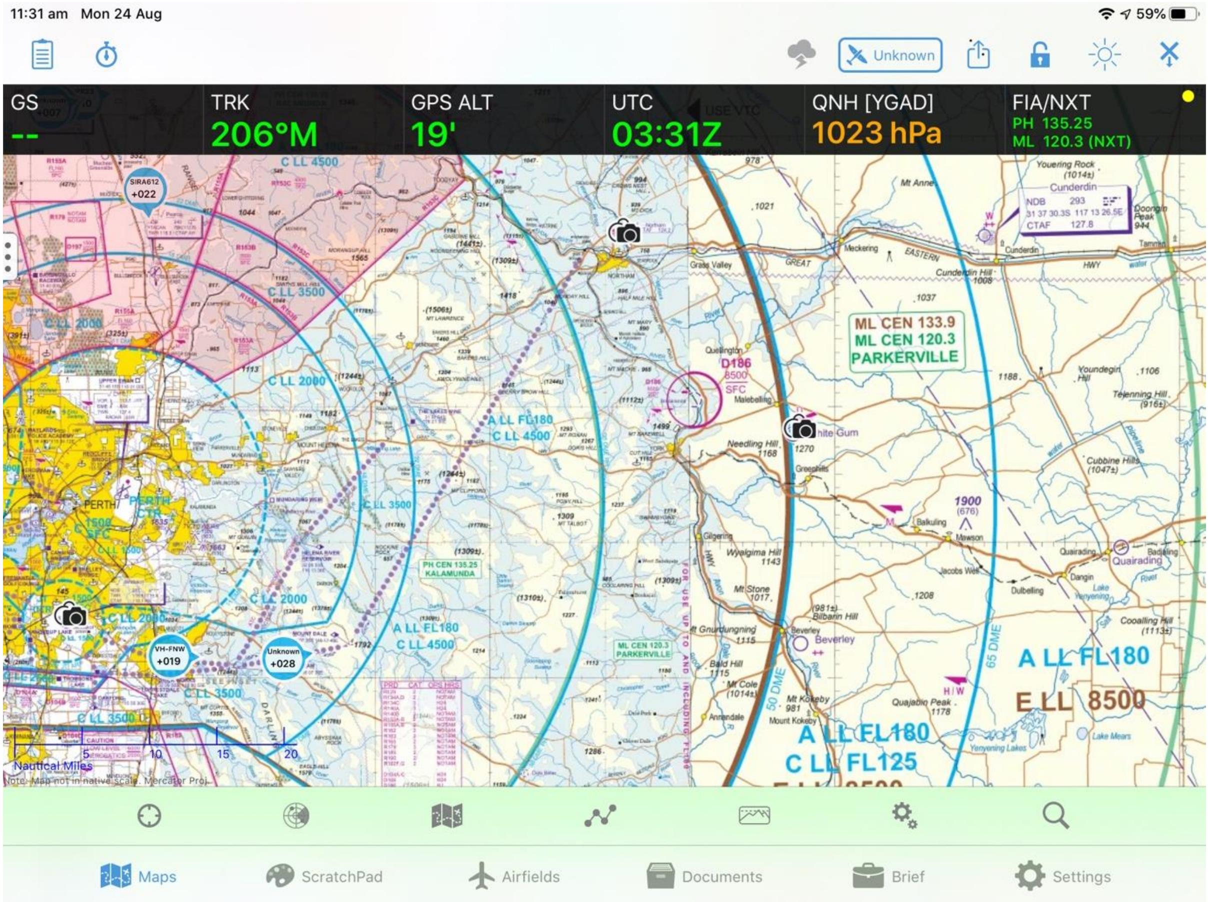
Danger Area

- Flight in a Danger Area (e.g. civil flying training area, light aircraft lane of entry or Mining site where blasting takes place) implies acceptance of a higher degree of Aviation risk and does not require a clearance.
- Danger, Restricted and Prohibited Areas are marked on ERC(L), VNCs and VTCs and details are published in ERSA.

Charts.

The picture below shows a VTC chart with A, C ,E and G airspace.

It also shows a Danger area. (Red circle D186). This is shown from Ground level (SFC) to 8500.



- As it’s taken from an electronic software it’s also showing real time active restricted airspace. This is shown as red shading (to the north of Perth). If we are just looking at the VTC chart we would have to look at the NOTAMS and check whether the restricted airspace is active.
- NOTE: Your instructor will show you how to log into NAIPS to obtain this information.
- NOTAMS (Notice to Airman) are available 24hrs from Airservices Australia https://www.airservicesaustralia.com/naips/Account/Logon
- G airspace is not shown as it is always below either C or E airspace.
- In this case you can see on the right- hand side of the map E LL 8500, so G airspace is from the ground to 8500.
- The same applies closer to Perth C airspace (left of chart) where you see C LL 4500, G airspace is below this altitude.

Documentation

- As well as the normal WAC charts for visual navigation, up-to-date airspace, aerodrome and radio frequency information is important. Airservices Australia provides a publications service which can supply all the necessary documentation.
- As a minimum, it is strongly recommended that all pilots and gliding clubs obtain the En-Route Supplement Australia (ERSA) with its associated amendment service. The ERSA should be readily available to all club cross-country pilots. In the ERSA will be found details of aerodromes, their categories, and details of those which meet the standard for ALA (Aircraft

Landing Area), including diagrams of each aerodrome layout and the local radio frequencies in use.

- Either the club or individual pilots should obtain En-Route Chart Low-level (ERC(L)) and Visual Terminal Chart (VTC) packages appropriate to the intended area of operation, as well as Visual Navigation Charts (VNCs) where available.
- These charts depict controlled airspace and en-route radio frequencies; they also come with an optional amendment service. If they are purchased by the club, the charts should be available to all cross- country pilots for flight-planning purposes. On any flight likely to be in the vicinity of controlled airspace the pilot should carry any charts necessary to navigate without violating the control zone.

Note:

- The AA Publications Centre is at:

Alan Woods Building

25 Constitution Avenue

Canberra, Australia 2601

Postal Address: Locked Bag 8500 Canberra, ACT, 2601. Australia-wide free call 1300 306630.

Fax number: (02) 6268 5111.

Email: mailto:publications.unit@airservicesaustralia.com

- Contact the Centre for information on "packages" of charts applicable to the area in which you fly and the price of the packages you need.
- Alternatively, all charts, ERSA and the VFG can be purchased on-line through the Airservices Australia web site at: www.airservicesaustralia.com/store/default.asp
- An excellent publication, strongly recommended for all glider pilots, is the Visual Flight Rules Guide, usually known as the VFG, published by CASA and available online at: http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90008

FLIGHT EXERCISES FOR THIS UNIT

At this stage in your flight training, you would have observed many of these rules and observations. Your instructor will continue to indicate and apply these rules to ensure you have sufficient knowledge when you arrive at the solo stage.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

You need to instinctively apply the rules of the air, which will require you to learn and apply them whenever you fly.

HOW DO YOU DEMONSTRATE COMPETENCE?

- In your flight exercises your instructor will observe your application and knowledge of these rules and performance standards which need to be achieved by your first solo.

RESOURCES & REFERENCES

- GFA Airways and Radio Procedures for Glider Pilots.
- Civil Aviation Advisory Publication number CAAP 166-1

Gliding Australia Training Manual

Pilot Guide

Unit 24

Human Factors and Pilot Limitations

Unit 24 - Human Factors and Pilot Limitations

WHAT THIS UNIT IS ABOUT

To develop the Skills and Knowledge to:

- Describe the non-technical skills and knowledge that underpin all GPC units and aviation activity;
- Assess the impact of Human Factors on operations of aircraft and;
- Develop personal limitations on operating aircraft …

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- Nil

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 25 Threat and Error Management

KEY MESSAGES

- All pilots are affected by human factors issues that can become threats to safe aviation.
- All pilots must learn to recognise and mitigate these issues as part of their TEM actions.
- HF issues are both physical, cognitive and interpersonal.

PILOT GUIDE FOR THIS UNIT

You are encouraged to view the PowerPoint presentation covering Human Factors.

You are encouraged to download and review the Human Factors manual from the GFA web page

Medical fitness to fly

Medical fitness to fly is not just a doctor's assessment, it is beholden on every pilot to self-assess their fitness to fly before and during each flight. The following mnemonic is an aid to that self-assessment:

IMSAFE

Illness

- Have I any illness that can affect my performance in flight?
- e.g. Colds may block sinuses leading to eardrum pain and damage
- do I feel unwell?

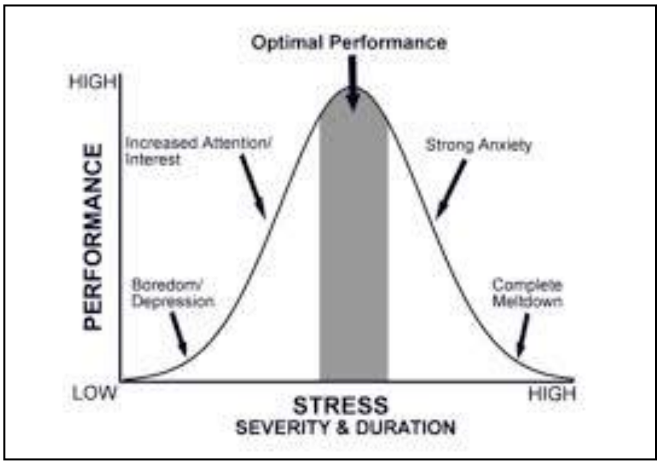
Medication / Drugs

- Am I taking any prescribed or over the counter meds or drugs that can affect my performance in flight? e.g. Pain killers, codeine, anti-histamine, beta-blockers
- CASA Drug and alcohol testing

- GFA Alcohol, Drug & Smoking Policy

Stress

- Underload
- Optimum (Eustress)
- Overload (Distress)
- Where personal problems fit.



Alcohol

- Legal limitation
- 8 hours between bottle and throttle may not be enough for a binge

Fatigue

- Adequate rest and sleep
- Long flights/ days

Eating

- Healthy and regular diet
- Hydration
- Glucose control throughout flights.

HAZATTS (Hazardous Attitudes) [FAA]

There are many personality types, some of which can cause difficulty for a pilot. If you demonstrate any of these characteristics, you are encouraged to think through the alternatives suggested.

- Anti-authority ("Don't tell me!") - Don't like anyone telling them what to do. Resentful of rules & regulations.
    - Antidote: Follow the rules, they're usually right (and written in blood!)
- Impulsive ("Do something - do it now!") - Need to do something, anything, quickly. Don't stop to think about better alternatives.
    - Antidote: Not so fast... think first.

- Invulnerable ("It won't happen to me.") - Accidents happen to other people, not to me. Therefore, I can take chances.
    - Antidote: Sometimes it will happen to you.
- Macho ("I can do it.") - Always trying to prove themselves better than others. Take risks and try to impress others.
    - Antidote: Taking chances is foolish.
- Resignation ("What's the use?") - I really can't make a difference. It's going to happen anyway, why bother? Leave it to others.
    - Antidote: I'm not helpless, I can make a difference. Never give up.

Aviation Decision Model [FAA]

DECIDE

- Detect – the fact that a change has occurred
- Estimate – the need to react to or counter the change
- Choose – a desirable outcome for the flight or situation
- Identify – actions to control the change successfully
- Do – take the necessary actions
- Evaluate – the effects of the action to react to or counter the initial change

Additional Human limitations

Discuss the following items with reference to GFA Human Factors for Gliding

Eyesight

- Limits
- Spectacles usage
- Sun glasses

Ears

- Vertigo
- Eardrums
- Sinus blockage

"G" forces

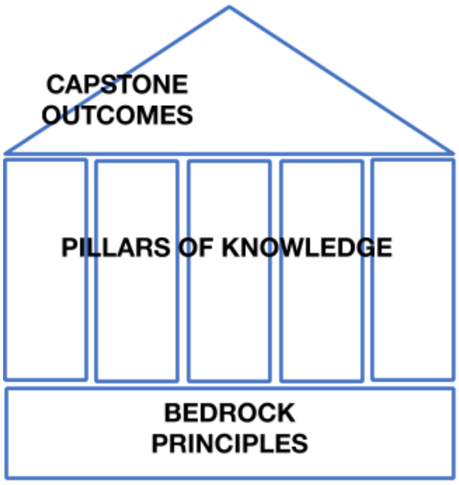
- "G" increase in turns/aerobatics
- "G" induced Loss of Consciousness (GLOC)
- Sub-gravity (i.e. 0-1 G) testing

Oxygen

- Hypoxia with altitude
- Legal requirements

Airmanship (an easy proword)

- AIR (Heat, cold, noise, wind, weather, fit for task)
- MAN (fitness to fly, trained, recency, proficiency, type endorsed)
- SHIP (airworthy, prepared, fit for task)



CAPSTONE OUTCOMES:	Situational awareness
	Judgement
PILLARS:	Self
	Aircraft
	Team
	Environment
	Risk
BEDROCK PRINCIPLES	Discipline
	Skills
	Proficiency

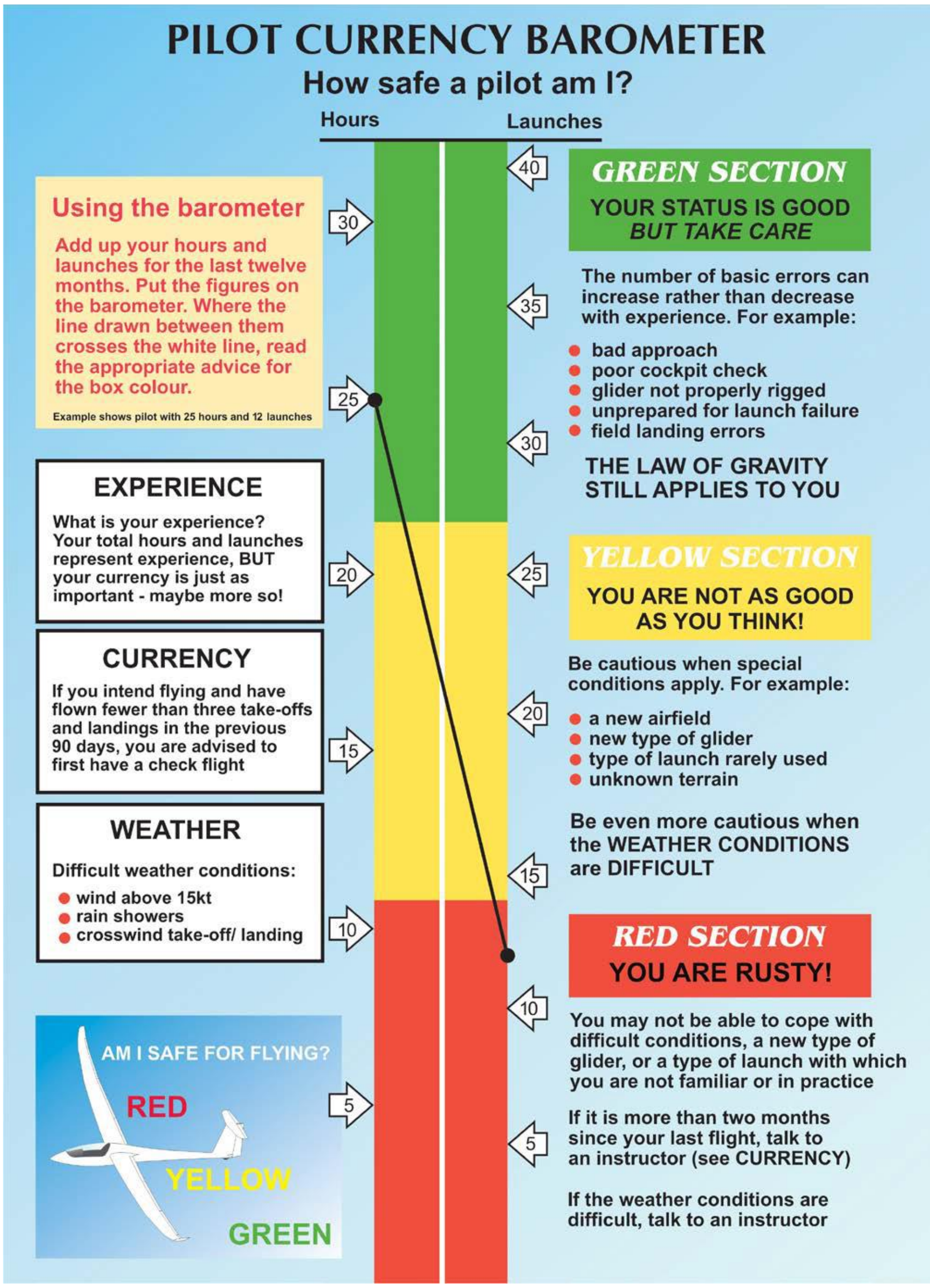
Situational awareness

- What has happened recently?
- What is happening now?
- Projecting to: What might happen in the future?

Judgement

- Using skills, knowledge, experience and intelligence to analyse a situation and decide a course of action.

Pilot Currency



FLIGHT EXERCISES FOR THIS UNIT

- This unit develops non-technical skills and knowledge that underpins all GPC units and aviation activity.
- These competencies will be assessed on evaluation of all flights in the GPC syllabus.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- More than 75% of incidents/accidents are attributed to human factors
- Errors arising out of human factors must be detected, estimate the alternatives, choose the best course of action, do it, then evaluate the action
- Such errors must not be allowed to result in undesired aircraft states (UAS)
- Each pilot is responsible to identify factors that can impact of their performance, and act accordingly.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate taking action to identify various Human Factor issues utilising the tools described in this unit.

RESOURCES & REFERENCES

- GFA Human Factors for Gliding : GFA October 2013
- Aviation Decision Making: FAA Advisory Circular 60-22 1991.
- Flight Discipline: Tony Kern February 1998.
- Introduction to the Generic Pilot Proficiency Program: Mark W Riley: Aviation Safety Foundation Australasia (ASFA) 2007.
- Occurrence Summaries on the GFA website under Documents/Forms / Operations
- Risky Business: WA Department of Local Government, Sport and Cultural Industries, Website 2020.
- Safe Work Australia website glossary 2020
- Safety Management Kit: Booklet 3: Safety Risk Management: CASA December 2014
- SKYbrary website Eurocontrol: 2020

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What percentage of accidents are attributed to Human Factors?
- What are the five Hazatts and what are the antidotes for each?
- What are the three stages of Situational Awareness?
- What does the pneumonic “IMSAFE” stand for?
- What can you do to rectify if your ears “block” on a fast descent?
- Above what height must you use oxygen?
- What does the pneumonic “DECIDE” stand for?
- What is meant by “Eustress”?
- Why is underload stress as dangerous in aviation as overload stress?

- Why should you not fly when you have a cold?
- What is the minimum time between consumption of alcohol and flying.
- Why is adequate hydration important?
- How is “Judgement” defined?
- What is an “UAS”? Give three examples of an UAS.

Gliding Australia Training Manual

Pilot Guide

GLIDING
AUSTRALIA

Unit 25

Threat and Error Management

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge required to:

- recognise and minimise the impact of threats; and
- manage any subsequent errors in an aircraft in order to prevent these leading to an undesired aircraft state.

This unit develops non-technical skills and knowledge that underpins all GPC units and aviation activity.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- Nil

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

GPC Unit 24 Human Factors and Pilot limitations

KEY MESSAGES

- Threats come at you, while errors come from you.
- Our aim is for Pristine Flights - any variation to a straightforward pristine flight is a threat.
- Threats can lead to errors;
- Errors can lead to Undesired Aircraft States (UAS);
- An UAS can lead to an aircraft incident or accident;
- Pilots must use TEM strategies to mitigate against Threats and Errors.

PILOT GUIDE FOR THIS UNIT

Definitions

Pristine Flight

- Flight carried out entirely in a normal manner from pre-flight initiation to post-flight completion.

Threats

- Any variation to a straightforward pristine flight is a threat.
- Every threat increases the likelihood of an error being committed.
- Every threat requires a positive strategy to manage it and prevent errors.

Errors

- **Slips**
  - Observable externally
  - Inadvertent Fall to a lower level
- **Lapses**
  - Observable internally only
  - e.g. Lapse of memory
- **Mistakes**
  - Rule or knowledge-based error
- **Violations**
  - Deliberate avoidance of rules/Standard Operating Procedures (SOPs)
  - e.g. Minimum distance from other aircraft, thermalling rules, checks.

Uncorrected errors can lead to an:

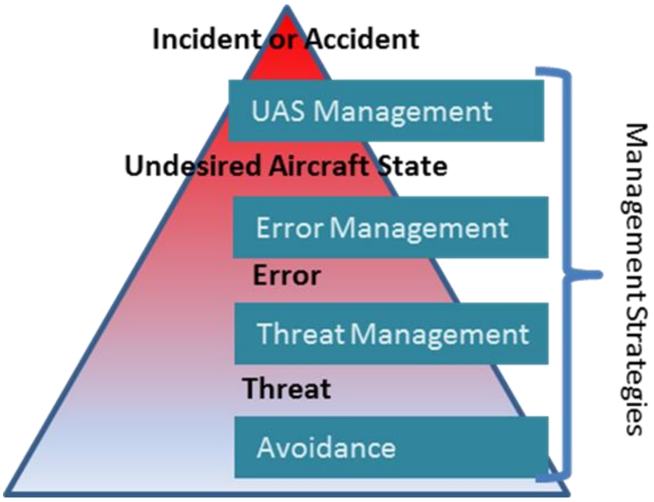
- **Undesired Aircraft State (UAS)**
  - Pilot induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety,
  - e.g. wheels up, stall, spin, Airprox (near miss), in-flight break-up, fuel exhaustion.
  - A UAS can lead to an aircraft incident or accident, which could have been prevented if the original threat or the resulting error had been handled better.

Threats come at you, while errors come from you

- Every glider flight, whether local, cross-country or competition, involves some threats, and all pilots must ensure they recognise these and have a strategy to manage the threats and prevent errors, and/or have a process to catch errors that may have occurred.
- Remember we ALL make some errors on every flight,
  - the important thing is to ensure they are not critical ones, or that they are captured before they lead to an UAS.

Useful Strategies:

- The following are just a few examples of TEM strategies that should become automatic to be a skilled and safe pilot:



- Prepare for flight:
  - Daily self-assessment (IMSAFE)
  - What's the weather?
  - What are the NOTAMed Threats?
  - What task should be achievable?
  - What other threats are there? (e.g. Airspace, Bush fire risk, Landable terrain)
- Take advice from other pilots, especially experienced glider pilots.
- Use SOPs / Procedures/ Checks diligently.
- Maintain sterile environments when necessary.
- Don't succumb to time or other pressures (get-home-itis, more people to fly, aircraft unserviceability).
- Plan the flight, fly the plan.
- Always fly the glider first – and always be thinking ahead of the aircraft - anticipating not reacting.
- Maintain effective nutrition, hydration and waste management.
- Recognise the potential for fatigue and if fatigued be more careful and conscientious.
- After interruptions, say "Where was I?"
- Always carry out a Situation Awareness review after a period of high workload.
- Set limits and stick to them
  - particularly with respect to landing decision making
  - transitioning from "Soaring" Pilot to "Landing" Pilot.
- Don't "see what you expect to see" – look for threats and errors.
- Listen to "that little voice" that questions what you are doing.
- Always evaluate after flight:
  - What threats were mitigated?

  - What errors were exhibited but managed?
  - What was learned?
  - What can be improved on in future flights?
- Check your personal ATTITUDE
  - safety above all else;
  - it is after all a sport and should never become a life-or-death situation.
- Acknowledging your vulnerability to errors is actually a sign of strength.
- In flying, you never stop learning.
- Every flight, whether you have 50 hours, 500 hours, or 15,000 hours, presents you with the threats that must be recognised and managed.
- On every single flight you need to ask:
  - What are my threats today?
  - How will I manage and mitigate these?

It is safer to be on the ground wishing you were in the air than in the air wishing you were on the ground.

Have fun out there – but be safe!

FLIGHT EXERCISES FOR THIS UNIT

Instructor to:

- Demonstrate how to prepare a day's briefing using TEM strategies,
- Identify during flight operations when TEM is used.

Student to:

- Demonstrate how to prepare a day's briefing using TEM strategies,
- Identify during flight operations when TEM is used.

Post Flight:

- Debrief to identify all threats – which were expected, which were not.
- Did these lead to errors and how were these handled?
- Did any errors progress to a UAS?

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- Interpreting Notam and Meteorological information and terms
    - Lack of Experience to be able to fully recognise threats

HOW DO YOU DEMONSTRATE COMPETENCE?

- Define:
    - Pristine flights,
    - Threats,
    - Errors and
    - Undesired Aircraft States (UAS)
- Prepare a briefing for flight using TEM strategies:
    - Daily self-assessment (IMSAFE);
    - Assessment of the weather;
    - Identifies if there are any NOTAMed Threats;
    - Assesses what tasks are achievable;
    - Identifies any other threats (eg Airspace, bush fire risk, landable terrain, known traffic etc.)
- Demonstrate awareness of threats and errors that can occur during Pre-boarding and pre-flight Checks.
- Demonstrate monitoring and positive strategies to identify and manage in-flight threats and aircraft handling, procedural. communication or committed errors before an UAS occurs;
- Diligently demonstrate the use of Standard Operating Practices (SOPs) / Procedures / Checks;
- Does not succumb to time or other perceived pressure;
- Describe how biological functions create threats and their mitigation through effective nutrition, hydration and waste management strategies;
- Describe how to recognise and mitigate fatigue;
- Demonstrate conducting a Situation Awareness review after a period of high workload or interruption;
- Demonstrate personal limits
    - particularly with respect to transition from Soaring Pilot to Landing Pilot or ;
    - in cross wind conditions or:
    - when feeling fatigued.
- Perform a post-flight evaluation and describe:
    - What threats were mitigated?

- What errors were exhibited but managed?
- What was learned?
- What can be improved on in future flights?

RESOURCES & REFERENCES

- Knowledge Centre: Bureau of Meteorology Website.
- Gliding – Threat and Error Management: Arthur Gatland; Soaring: June, August, October 2010.
- Human Error; James Reason; Cambridge University Press: 1990.
- Human Factors for Pilots; Package; CASA: 2012
- Threat and Error Management in Flight Operations: SKYbrary webpage: Flight Safety Foundation.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What is the definition of a pristine flight?
- What is the difference between a threat and an error?
- What is a SOP?
- What is an UAS? Give three examples of an UAS.
- What are the four levels of management in TEM?
- What are five common threats to every flight?
- How could each of the threats in the above question be managed?
- What are the four categories of error?
- List the items you should cover in a post flight TEM evaluation.

Answers to Pilot Guide Questions:

GPC 1

GPC 2

GPC 3

GPC 4

GPC 5

GPC 6

GPC 7

GPC 8

GPC 9

GPC 10

GPC 11

GPC 12

GPC 13

GPC 14

GPC 15

GPC 16

GPC 17

GPC 18

GPC 19

GPC 20

GPC 21

GPC 22

GPC 23

GPC 24

GPC 25