Gliding Australia Training Manual

Pilot Guide

Section B

Units 27 – 44 (GPC)

Gliding Australia Training Manual

Pilot Guide

GLIDING AUSTRALIA

Unit 27

Advanced Aerotowing

WHAT THIS UNIT IS ABOUT

To develop and demonstrate the skills and knowledge required to conduct Advanced Aerotow techniques

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 13 Launch and Release Aerotow
- GPC Unit 14 Takeoff Aerotow
- GPC Unit 19 Crosswind take-off and landing
- Unit 20 Launch emergencies

COMPLEMENTARY UNITS

- Nil

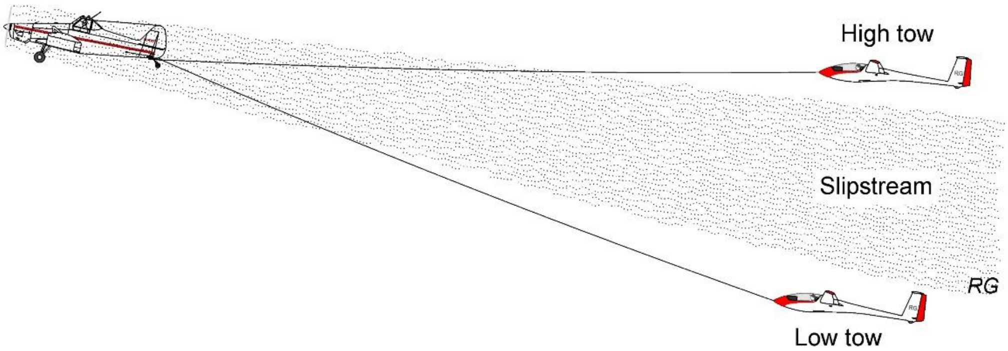
KEY MESSAGES

- Pilots are expected to fly safely in both high and low tow.
- Transitioning between these two positions requires care.
- Boxing the Slipstream is a very useful exercise in confidence building and co-ordination, enabling you to better recover from unexpected positions.

PILOT GUIDE FOR THIS UNIT

Transition between Low-Tow and High-Tow

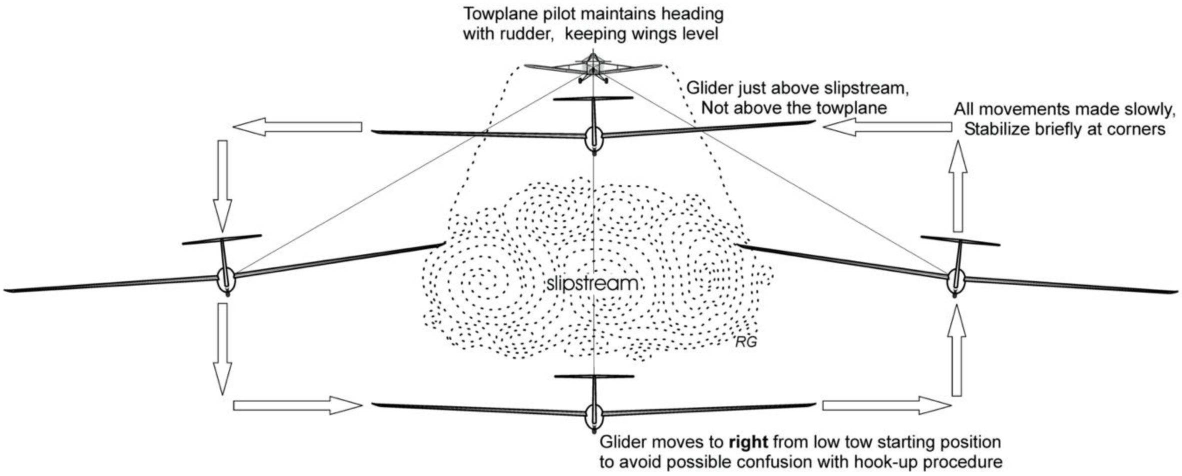
- During this training you will be taught both high and low tow, and the correct way to transition between the two. In Australia we generally use low tow position but there are times when High tow is a better option:
- Long distance ferry flights are best done in high tow due to decreased drag on the towplane.
- When flying over obstacles high-tow provides a slightly better clearance.
- If your glider is using a belly release rather than a nose release there may be some advantage in using high tow.
- Transition from low-tow to high-tow requires care in particular as you fly through the slipstream.
- It is important that you make constant progress by maintaining some back pressure on the stick. It is easy to remove the back pressure and the glider gets stuck in the turbulent air. Maintain the pressure so that the glider moves upwards and out of the slipstream.
- Similarly, you don’t want to transition too quickly as you may lose sight of the towplane if you go too high which can create a danger for the towpilot.
- Once clear of the slipstream you are in the correct high tow position



- Transition from high-tow to low-tow is slightly easier in that you maintain vision of the towplane.
- It is important that you make constant progress by maintaining some forward pressure on the stick.
- Once clear of the slipstream you are in the correct low tow position.

Boxing the Slipstream

- The aim is to fly the glider around the slipstream so you should avoid the turbulent air.
- We fly to the **right first** so as not to confuse with hook up procedure. See Unit 20 Launch Emergencies.
- Smooth movement of the controls is required, and there is no need to rush.
- Use rudder and aileron to bank the glider and move to each side so that the glider's nose is slightly outside of the towplane's wingtip. Hold just enough bank to stabilise in each corner of the box as forces from the tow rope will attempt to pull the glider back to centre. (Note slight bank in the diagram). After stabilising, move on the next 'leg'.
- When traversing from the top right to top left corner, initially reduce the amount of right bank to drift into the centre and don't reverse to left bank until almost behind the towplane. Maintain the towplane's wheels on the horizon from the top right to top left corners.
- If the glider moves too quickly into the centre, a bow may develop in the rope. As soon as a bow starts to form, increase the pressure on the towrope by increasing the bank slightly away from the towplane and slow the rate of movement into the centre. If the bow in the rope tightens too quickly, be ready to release the towrope just before the rope pulls tight to avoid a tug upset or broken weak link.



Cruising on Tow – High-Tow and Low-Tow

- On long retrieves or positioning tows, low tow is easier to maintain, especially in turbulent conditions.
- In smooth conditions, high tow has the advantage of the glider pilot being able to see more of the ground ahead for situation awareness. Also if the glider has a belly release, it lessens the rope rubbing on the nose.
- In level flight, with the tug/glider combination not climbing, e.g. cross-country ferry flights, the feel of the glider is quite different, as follows -
  - The trim of the glider is considerably affected - the trim control will almost certainly need to be reset.
  - Slack will develop in the rope very easily. Airbrakes may be cracked and used to help keep the rope tight, or the glider can be flown in the tug slipstream - this creates quite a lot of extra drag.
- When releasing from tow in level flight, there must be no delay in making the right turn, otherwise the rope may get quite close to the glider. This is true whether releasing from the high tow or the low tow position.
- The slipstream may be in a slightly different position compared to where it usually is. However, as usual, low-tow is still just below the slipstream and high-tow just above.

Descending on tow

- This may be required when descending below airspace steps or lowering cloud base.
- Descending on tow is more likely to result in a slack rope, in particular if the tow pilot reduces power too quickly. Use of airbrake is likely to be required to maintain tension on the rope. Yawing the glider can also add some drag to maintain rope tension.
- Radio communication with the tow pilot is typically required.

Lookout

- Emphasise to look ahead at the towplane but also search for possible conflicting traffic. The glider pilot will typically have better visibility than from the towplane. Scan ahead, above and to each side on a regular cycle.
- If you see possible conflict you should use the radio to advise the tow-pilot.

FLIGHT EXERCISES FOR THIS UNIT

- You will be introduced to flying in high tow and then transitioning from low tow to high tow and then back to low tow.
- Once you have mastered this, yowil then be shown boxing the wake and given the opportunity to try this. You will generally pick up this skill in a couple of flights, but it can be more difficult with a powerful tug.
- You will be introduced to cruising straight and level and then descending on tow.
- You will be shown how to avoid getting a bow in the rope, and what to do when this occurs.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS

- The pace to move through the slipstream without "getting stuck"
- Levelling out above the slipstream.
- Identifying normal relative position of the towplane when in High Tow.
- Poor control when in high tow and with boxing the slipstream can result in a tug upset. When you lose sight of the towplane below the nose of the glider you must release.
- Getting out of station is quite possible in each of these maneuvers so a good level of aircraft control is required prior to starting these exercises.
- Descent on tow may result in the glider catching up to the towplane due to its lower drag. Use slip or airbrakes. Be prepared to release if necessary.
- Rapid use of airbrakes can break the tow rope. "Crack" the brakes slowly.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Transition from low tow to high tow then back to low tow.
- Demonstrates correct pace to avoid getting caught in the slipstream and to avoid kiting manoeuvres.
- Demonstrates correct pace to complete boxing the slipstream manoeuvre.
- Airspeed is maintained throughout.
- Maintain level flight on tow in both high and low tow position.
- Demonstrates descent on tow, with use of airbrake where required.
- Airspeed is monitored and adjusted and Bows in the tow rope are corrected.

- Appropriate lookout is demonstrated.

RESOURCES & REFERENCES

- Nil

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- Describe the correct High-tow position
- List two hazards when moving from low-tow to high-tow
- Describe the process to Box the Slipstream
- Why are you more likely to get a bow in the rope when cruising or descending on tow compared to a normal launch?

Gliding Australia Training Manual

Pilot Guide

Unit 28

Sideslipping

Unit 28 - Sideslipping

WHAT THIS UNIT IS ABOUT

To develop your ability to confidently utilise the Sideslip to increase your descent rate.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 10 Use of ancillary controls.
- GPC Unit·12 Slow flight and Stalling.
- GPC Unit 17 Stabilised approach and landing.

COMPLEMENTARY UNITS

- GPC Unit 19 Cross wind landings

KEY MESSAGES

- Maintaining a sideslip to a low level just prior to round out is NOT recommended unless you are very experienced, current at sideslipping and competent.
- Aircraft with effective airbrakes will rarely require the use of sideslip.
- Sideslip manoeuvres in some gliders in conjunction with particular control settings (such as airbrakes) can result in uncommanded pitch down manoeuvres due to tailplane blanking. Always check the Aircraft Flight Manual / Pilot Operating Handbook prior regarding the use of sideslips with other controls before flight.

PILOT GUIDE FOR THIS UNIT

- The purpose of a sideslip is to steepen the approach path and increase the rate of descent without increasing speed. For sailplanes without airbrakes or spoilers, the sideslip is the only method of approach path control. Such machines are rare nowadays.
- Some early-generation fibreglass gliders have fairly weak airbrakes and, combined with their very flat glide-angles at the normal approach speed, accurate glidepath control can be difficult. In such sailplanes the sideslip can be a useful aid to supplement the airbrakes, especially in out-landings.
- It is recommended that the manoeuvre be practiced at height using a line reference and then used on approach when some skill has been achieved.
- Sideslipping results in a loss of significant lift generated by the wings as the relative airflow flows across the wing at an angle, hence the glider descends at a higher rate. The sideslip can therefore be used to provide a steeper descent path.

Entering a sideslip

- To enter a sideslip from straight and level flight:
  - Note the nose attitude for a safe speed.
  - Apply aileron to produce the desired amount of bank – the bank angle determines the descent rate in the sideslip and
  - apply opposite rudder to prevent turning and maintain a constant track.

- Note that this results in uncoordinated flight as indicated by the yaw string.
- There is a limit to the amount of sideslip, dependant on the effectiveness of aileron and rudder.
- Identify the track of the glider and ensure the required track is maintained by adjusting the amount of aileron and rudder used.
- The glider's attitude is controlled by use of the elevator as normal.
- The speed in a sideslipping approach should be exactly the same as in a conventional approach. Unfortunately, the nose-mounted pitots fitted to most modern gliders have very large errors in a sideslip and the airspeed indicator is useless in the manoeuvre. It cannot be relied on and therefore should not be used.
- You can maintain an accurate speed in a slipping approach by keeping the nose in the same attitude as for a conventional approach. Because of the dynamics of a sideslip, this will require a slight backpressure on the stick.
- The greater the sideslip angle, the greater the nose-up attitude required and the greater will be the backward stick movement. But as already mentioned, gliders have strong spiral instability and are unable to sustain a sideslip at more than about 10 degrees of bank, so a slip with a pronounced nose-up attitude will not be necessary. This limitation ensures that a high rate of descent in a sideslip cannot be sustained in a glider.

Recovering from a sideslip

- It is important that prior to recovering from the sideslip that the nose attitude is returned to the original position. Note that the ASI does not work effectively in a sideslip so it cannot be used to monitor air speed.
- Sideslip is removed by first confirming a safe nose attitude and then rolling wings level with aileron and simultaneously removing the rudder input. Maintain a constant attitude by relaxing the backpressure on the stick.
- In the sideslip the glider does not track in the direction the nose is pointing, but at an angle to the same side of the nose as the lower wing. This must be allowed for when planning to straighten up onto a specific heading.

Sideslip for landing

- Most gliders have excellent airbrakes so sideslip is not usually required.
- Sideslip can increase the descent rate which can help if a steep approach over high obstacles is required.
- If a very high rate of descent is experienced, recovery must be commenced in time to arrest the rate of descent to a level that is appropriate for landing (ideally by 300' AGL).
- In the sideslip the forward wing tip is much closer to the ground, so you need to recover at a higher height than a normal round out.
- In a crosswind landing using sideslip, the lower wing is angled into the wind. This reduces the size of the angle required to correct the slip compared with the alternate approach (upper wing into wind).
- Ensure all drift is corrected prior to touch down otherwise wheel damage is possible/likely.

Failure to establish the correct nose attitude

- If the attitude is nose high on recovery you risk an immediate stall, an uncommanded nose drop and resulting collision with the ground.

- If the nose attitude is lower than normal on recovery you will have a much higher airspeed than expected/required, so you risk needing to adjust airbrakes at low altitude and an extended landing distance - which may defeat the reason for doing the sideslip in the first place.

Slipping Turn

- The sideslipping turn may be demonstrated from the sideslip by either increasing the bank or reducing the rudder, so that the glider turns towards the lower wing. Your instructor may demonstrate that a normal turn may be turned into a slipping turn.
- In a slipping turn, as distinct from a straight sideslip, it will be necessary to adopt a higher nose attitude than in a normal turn. This is because the rate of descent in a slipping turn can be very high, much higher than in a straight sideslip and some of the downward velocity resolves itself into an increased forward speed. Hence the high nose attitude. It is obvious that the practice which is necessary to determine exactly how high the nose should be raised must be gained at altitude before it is tried on an approach.
- It must be realised that in a well-developed sideslip it takes some time and loss of height to reduce the rate of descent as recovery is made. This is even more so in the case of a slipping turn.
- Full allowance must be made for any likely wind gradient and recovery must always be made at a reasonable height otherwise it is easy to misjudge and put a wing tip into the ground.
- Sideslipping with spoilers or airbrakes out will usually cause a buffeting on the elevator. Some glider types suffer a strong nose-down pitch when sideslipped with the airbrakes extended. This pitching motion may not be correctable unless the airbrakes are retracted. Your instructor will ascertain whether such a manoeuvre is permissible on the type (see type handling notes) and explore the extent of the buffeting and/or any unusual or undesirable behaviour over the sideslip and speed range before giving instruction.

FLIGHT EXERCISES FOR THIS UNIT

- Your instructor will demonstrate a sideslip at height, pointing out control movement to establish.
- You will note the heading and track and nose attitude prior to commencing the sideslip and then observe the amount of slip and adjustment of the rudder to stop the turn.
- You will also see a demonstration of the limit of slip and the nose attitude raised to a point higher than a normal stall. It will be pointed out that the airspeed indications will be very inaccurate.
- The recovery will be demonstrated noticing the airspeed when back in balanced flight.
- Then it will be your turn to practice.
- Once you have flown a sideslip at height you will be then shown how to use it when landing.

When sideslip may be of benefit

- On approach, flare and landing when visibility ahead is restricted by any combination of sun, rain and canopy haze. A slight sideslip (often with airbrake used normally) of as little as 5-10 degrees can be used to markedly improve forward visibility.

- In a descent when landing in a strong crosswind. In this situation, if the pilot holds the into-wind wing down, the slip into the wind assists with the rate of descent and helps offset the drift caused by the cross wind.
- To prevent a glider being sucked into a cloud using sideslip to enhance the sink rate if used in addition to full air brakes.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS
• The unusual "feel" of the manoeuvre and the nose attitude. • Balancing aileron and rudder to achieve the desired effect.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate the steps required to enter and exit a sideslip.
- Maintaining a constant track across ground whilst in the sideslip.
- Recovery from sideslip at the same speed as the entry.
- A controlled sideslip on final approach (subject to local restrictions).
- A sideslip to the left and right and return to normal coordinated flight.

RESOURCES & REFERENCES

- Australian Gliding Knowledge Pages 140-141

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- When would sideslipping be beneficial?
- If sideslipping in a turn, would the nose be higher or lower.
- Is the airspeed accurate during a sideslip.

Gliding Australia Training Manual

Pilot Guide

Unit 29

Steep Turns

Unit 29 - Steep Turns

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge to perform steep turns in a glider (60° of bank).

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 8 - Sustained turns, all controls
- GPC Unit 26 - Competence for first solo

COMPLEMENTARY UNITS

Nil.

KEY MESSAGES

- Ability to maintain nose attitude during turn is critical.
- Lookout is more difficult under 2G or more loading.
- Steep turns can result in stalls or spiral dives if not conducted correctly.
- High G loading for prolonged periods may lead to blood loss to the upper body with resulting grey-out or black-out of flight crew.

PILOT GUIDE FOR THIS UNIT

- This unit will give you the ability to safely manoeuvre at bank angles that will assist you to thermal well, and to teach you how to recognise and recover from a spiral dive.
- A steep turn is no different to any turn of a lesser angle of bank save in degree as all control functions are the same.
- In previous lessons you have learnt that the stall speed increases with bank angle and the associated "G" loading.
- Hence as you can see from the table below, we need to commence the steep turn and maintain a speed comfortably above the stall speed for your bank angle.
- 60 degree stall speed is approximately 1.4 times your normal straight and level stall speed.

ANGLE OF BANK	'G' LOADING	TYPICAL STALLING SPEED (Knots)
0 degrees	1	33
10 degrees	1.02	33
20 degrees	1.06	34
30 degrees	1.15	35
40 degrees	1.2	38

50 degrees	1.56	41
60 degrees	2.0	46
70 degrees	2.92	56
80 degrees	5.75	79

- Your instructor will demonstrate a steep turn from a medium turn, after selecting a suitable nose attitude for the required speed. Typically, 70 knots but will be confirmed with the Aircraft Flight Manual.
- You will notice that as the bank Increases to the required angle (60 degrees) the nose position will be maintained with the elevator.
- You will note that considerable up elevator will be needed to maintain the nose position in a steep turn.
- You instructor will explain that the High G loading and noise level may mask pre-stall warnings, so extra care is needed.
- Care must be taken to maintain the attitude. If the nose is allowed to drop the speed will build up very rapidly and the glider could enter a spiral dive. If this occurs then the recovering action is to reduce the backpressure on the stick and reduce the angle of bank with the ailerons.
- It's also important that you maintain an effective lookout while turning at this rate! The G Loading makes moving your head more difficult, but you must make the effort.

FLIGHT EXERCISES FOR THIS UNIT

Your flight instructor will:

- Demonstrate a steep turn.
- Point out the speed and angle of bank, and higher G Loading.
- Explain the need for use of back elevator to maintain attitude.
- Demonstrate a recovery to level flight.
- Demonstrate the recovery actions from a spiral dive.
- You will then practice steep turns.

Notes

- If you are competent at 45° bank turns, you should find this relatively easy. Practice turns at increasing angles of bank before trying proper steep turn.
- Application of coordinated aileron and rudder should be smooth and progressive. Larger aileron movement requires commensurate larger rudder pedal movement. Steeper turns will require more back-stick pressure to maintain nose attitude.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- Maintaining the nose attitude at 60 degrees.
- Maintaining an effective lookout.

HOW DO YOU DEMONSTRATE COMPETENCE?

- You demonstrate the ability to enter a steep turn (60 degrees), maintain and recover to level flight.

RESOURCES & REFERENCES

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

- What is the “G loading in a 60-degree bank.
- What is the normal stall speed of your glider? So what would you expect the stall speed to be at 60 degrees bank?
- How do you recover from a spiral dive.

Gliding Australia Training Manual

Pilot Guide

Unit 30

Thermal Centring Techniques

WHAT THIS UNIT IS ABOUT

To develop your skills and ingrained habits in centring thermals effectively.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 11 Introduction to Soaring
- GPC Unit 26 Assessment of competence for first solo

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 31 Thermal Entry

KEY MESSAGES

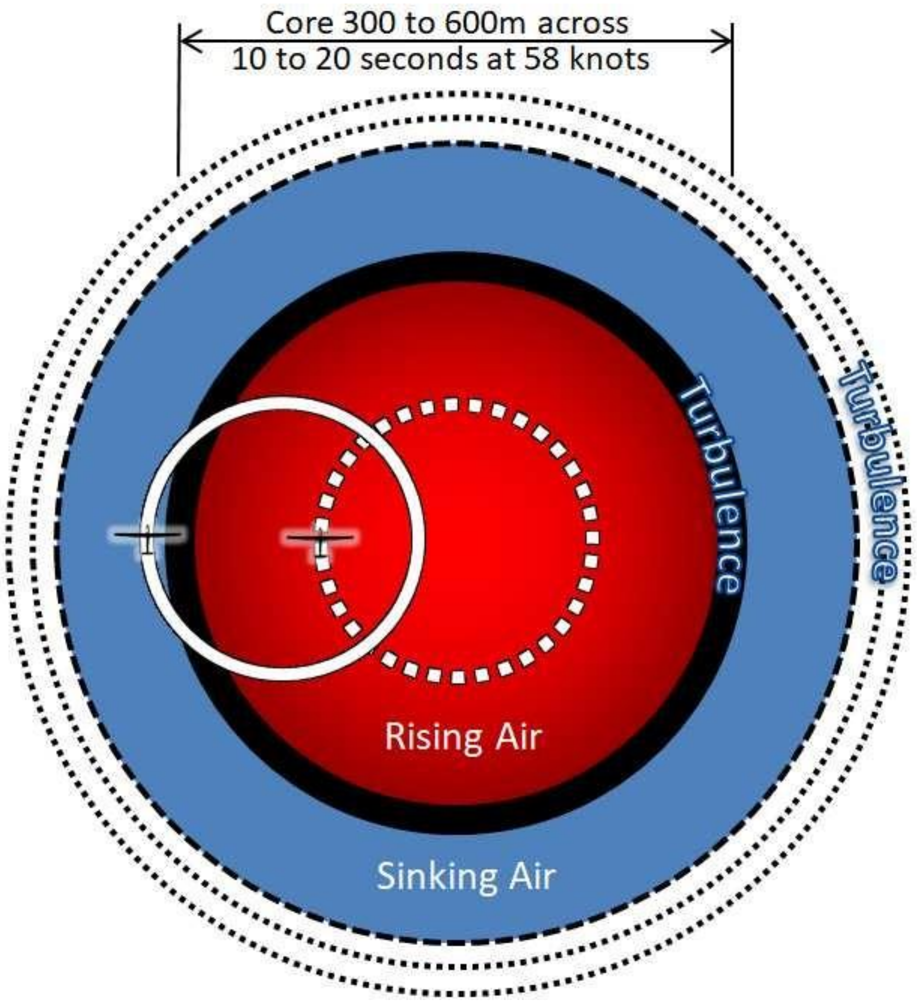
- Typical thermals in Australia are large and can take 10 to 20 seconds, or more, to fly across
- Maintain coordinated control of the glider with consistent bank and attitude (actual angle not critical)
- It is important to develop a mental picture of the rising air and location of the core
- There are two key techniques for centring a thermal – using feel and using the vario
- Feel of vertical accelerations is instantaneous – you can use feel to determine the difference between a gust and a surge
- The vario always lags because it takes time to accelerate the glider upwards or downwards, typically a glider turns through 45-60 degrees in this time – you need to compensate for this when using the vario to centre
- You need to be able to use the feel technique and the vario technique

PILOT GUIDE FOR THIS UNIT

A typical thermal is ideally circular in section with the rate of rising air higher towards the middle than the outside. The diagram below depicts a thermal with the central red area showing lifting air (with stronger lift at the central core), and the blue annulus showing sinking air. The area of shear between the sinking air and lifting air is turbulent (shown in black). There is also a less severe area of turbulence outside the sink caused by shear between the sinking air and the still air – when flying through this area it can feel like driving over cobblestones.

Thermals are large at the altitudes that we thermal: typically in Australia of the order of 300m to 600m across and potentially much larger under large cumulus. This equates to around 10 to 20 seconds to fly across the rising air at a slow cruise.

To climb effectively, you need to fly the glider in a circle around the middle of the thermal (the core). You'll need to maintain a <u>constant nose attitude and angle of bank</u> – if you don't do this you won't fly in a circle, will not be able to feel the air, and may lose the thermal altogether. The diameter of the circle depends on your speed and your angle of bank. An angle of about <u>40 degrees</u> generally works best – too shallow and you won't fit in the thermal and if too steep it is harder to control and increases the glider sink rate. Ideal thermalling speed varies greatly with the glider, the conditions, and the wing loading. Most likely you should fly around 50 to 55 knots in a modern glider (without water ballast) but the key is to <u>fly just fast enough to maintain good control</u> at the 40 degree angle of bank.



It is important to develop a mental picture of the rising air and the location of the core by feeling the surges and monitoring the instruments. Centring is the process of moving the circle a little in the direction of the core – no more than one adjustment per complete circle.

Two standard thermal centring techniques are described below. As you become more experienced you will no doubt develop variants to these techniques that work best for you under various conditions.

It is very important to complete a targeted scan before manoeuvring in a thermal. You should also do a periodic full scan to check for other gliders in the thermal and transiting aircraft.

1. **Feel Technique (ignoring the Vario)**

   Thermalling by feel is by far the best technique and other techniques are secondary. In the ideal situation, you will feel upward accelerations or surges at any time you fly into faster rising air, and downward accelerations at any time you fly into lesser rising air (or sinking air). This is the same acceleration you feel when an elevator starts and stops.

To centre using feel: When a sustained upward acceleration is felt, bank should be reduced to about half for 2-3 seconds before resuming the original angle of bank. On the next turn repeat if necessary.

On the diagram below the green area marked SURGE is where you should feel the upward acceleration. Correction (reduced bank) should start at the point where the glider is shown. The dotted line shows the path with reduced bank for 2-3 seconds and then the corrected circle that is hopefully better centred on the core. You'll need to regularly repeat this process, particularly if the thermal is rough or your nose attitude and angle of bank are not constant.

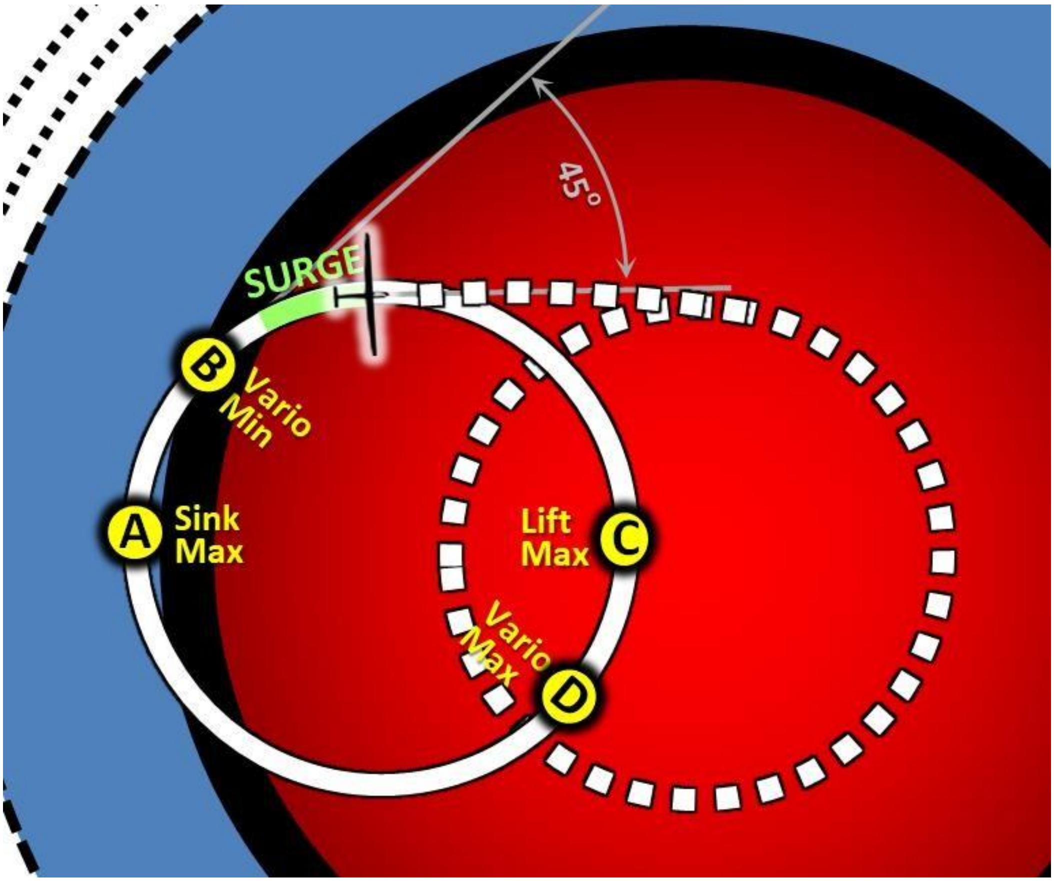
2. Vario Technique

You may not be able to feel acceleration because the thermal is very wide, the strength is low, the glider has little natural feel, you are too tense (relax!), or for a number of other reasons. For this reason a secondary technique uses vario indications with compensation for vario lag. Vario lag is mostly due to the inertia of the glider (it takes time for the air to accelerate the glider before the vario can indicate the change). It will be different for each glider/weight/vario combination and generally equates to around a 45 to 60 degree portion of a typical thermalling turn.

To centre using the vario: Identify the minimum vario indication in the turn (preferably using audio). 45 degrees (1/8 turn) after this point bank should be reduced to about half for 2-3 seconds before resuming the original angle of bank. On the next turn repeat if necessary.

On the diagram below Point A is the point of the circle with the most sinking air (or least lifting air if the circle is a little closer to the core). Point B is where the vario indicates the minimum (after the lag). At this point identify a ground feature a further 45 degrees into the turn, then continue the turn to that heading, reduce bank for 2-3 seconds, and then resume the original angle of bank. As with the feel technique, you'll need to regularly repeat this process. Ideally this technique should result in correction at the point where the glider is shown – the same point as for the feel technique.

Unit 30 - Thermal Centring Techniques



Practice at every opportunity. Nobody ever perfects thermalling!

Notes

- Speed and bank angle changes will change the turn radius and centre; unless these are constant when centred, the centre of the thermal will be quickly lost.
- With both techniques, the vario indication is used to confirm that the thermal has been centred. If a positive vario indication remains reasonably constant throughout a turn, then the thermal has been centred.
- Do not change the direction of the turn while thermalling, even if you think there are no other gliders in the thermal or nearby.
- Skidding turns when thermalling may result a spin without warning. Your yaw string should always be a little on the outside of the turn – in this state the glider is unlikely to spin (and it's also most efficient).
- Beware of vario installations that have leaks or produce variable lag. Vario installations can be checked by an airworthiness inspector.

FLIGHT EXERCISES FOR THIS UNIT

Feel Technique

It is important to develop your sense of feel to be able to feel the surges in a thermal. You'll be asked to indicate when you feel a surge – try to concentrate on your seat-of-the-pants feel and do not pay attention to the vario. Your trainer will demonstrate centring by feel and then you'll have plenty of opportunity to practice. You'll feel the surges better if you turn the vario sound off and cover, or don't look at, the vario.

Vario Technique

The vario technique will be demonstrated and you'll have an opportunity to practice. Remember that lookout is extremely important – maintain your periodic and targeted scans with a brief glance at the vario at appropriate times.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Not maintaining constant nose attitude	1. Flying using airspeed indicator instead of nose attitude relative to the horizon 2. Not trimmed correctly
• Not maintaining constant angle of bank	Not using visual references for angle of bank. Use visual references such as instrument screws and glare shields.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate good lookout at all times when thermalling
- Demonstrate good glider control – maintaining consistent bank and attitude and coordinated use of controls
- Describe the lag limitation of the vario and how to compensate for it when centring
- Describe the feel and vario techniques for centring
- Predict where the core is relative to the glider
- Demonstrate centring with positive climb rate for at least two turns and in both directions

RESOURCES & REFERENCES

- G Dale. 'The Soaring Engine - Volume 1' 2015, Chapter: Thermal soaring – The size and shape of a thermal; How to centre the thermal

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Roughly how long does it take to fly across a typical thermal?
2. Why is it important to thermal with a consistent attitude and bank?
3. What speed and angle of bank is appropriate?

4. Ideally, is the point of correction and the action the same when using the feel and the vario technique?
5. Why is a skidding thermalling turn dangerous?
6. Is it OK to change the direction of your turn within a thermal?

Gliding Australia Training Manual

Pilot Guide

GLIDING
AUSTRALIA

Unit 31

Thermal Entry

WHAT THIS UNIT IS ABOUT

This unit will develop your knowledge and skills for safe thermal entry and the first thermalling turn.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 30 Thermal Centring Techniques

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 32 Soaring with Other Gliders

KEY MESSAGES

- Initial turn direction is less important than making the turn – it can be corrected if wrong
- Minimise changes in attitude during entry to maximise feel
- Lookout with respect to thermal entry and ongoing scan
- The vario indication is not particularly useful for thermal entry due to lag and gust sensitivity. In particular the vario indicates rising are with a lag and horizontal gusts instantaneously, so it's very important to learn to enter thermals by feel
- Steps for thermal entry
- Patience

PILOT GUIDE FOR THIS UNIT

Thermal entry is the process of transitioning from cruising flight to thermalling (including the first turn). Ideally the thermal is perfectly centred after entry, but more likely you will need to re-centre as discussed under GPC Unit 30 – Thermal Centring Techniques.

It is important to have a good understanding of the horizontal structure of a typical thermal and identify where you are relative to that structure as you fly through it.

It's also important to understand the limitations of the vario. Total energy variometers respond to changes in total energy derived from altitude and speed. From GPC 30 Thermal Centring Techniques, you should be aware of the lag limitation of varios but they are also sensitive to gusts. The turbulence around thermals causes horizontal gusts that may increase or decrease the total energy – this happens instantaneously and may completely mask vertical indications on a vario. So the vario indicates the good rising air with lag but useless gusts instantaneously making it a poor instrument for judging thermal entry. You will barely feel the horizontal gusts but you will feel vertical accelerations instantaneously – that's why it is very important to learn to enter thermals (and centre thermals) by feel.

When approaching a thermal, there is a good chance others are as well and from any direction. A FULL and TARGETED lookout scan is essential to ensure situational awareness and to predict where each glider is likely to be when the thermal is joined well before actually entering the thermal.

Three key decisions must be made:

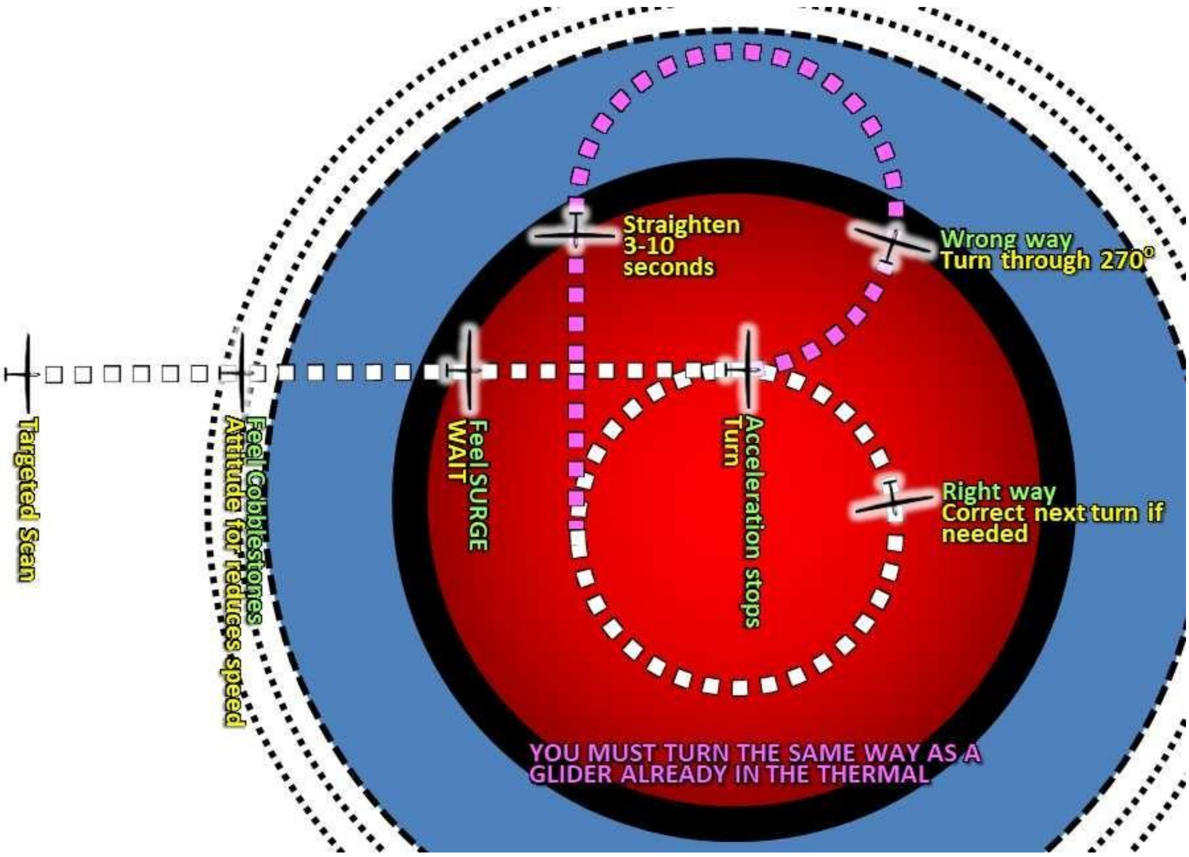
1. Deciding if you will turn;
2. When to turn; an
3. Which way to turn.

Deciding if you will turn is covered in detail in GPC 40 – Cruising, speed to fly, height bands and thermal selection. When to turn is covered below. Which way to turn is far less important than turning at the right time (assuming that there isn't another thermalling glider defining the direction).

Experienced pilots turn the 'wrong' way almost half the time – don't expect to do better!

If joining a thermal with other gliders, the turn must be in the same direction as the other gliders regardless of what height the other gliders are at, and if at similar height the glider should be positioned opposite. The direction of turn of other thermalling gliders can take a while to establish when approaching. Once the direction of turn is clear, aim to arrive outside of the turn being used by other glider(s). They need to be concentrating on climbing and not avoiding you! See also GPC 32 – Soaring with Other Gliders.

The diagram below shows a single glider with an exemplar approach to a thermal, described in the steps below.



1. Complete your FULL and TARGETED scan and identify other inbound or thermalling gliders.

2. As you approach a thermal you may fly through turbulence that feels like driving over cobblestones. At this point or when you know you are close to the thermal using visual cues (other gliders or cumulus cloud) raise the nose to reduce speed and keep that constant attitude as you enter the thermal. Entry speed for optimal feel and manoeuvrability should be 10-20 knots below cruise speed. Re-trim for your new cruise speed.

3. It is normal to fly through an area of sinking air (but this isn't always the case) followed by turbulence just before the rising air. As you fly into the rising air you should feel a surge (vertical acceleration) – do NOT turn when you feel this or you will turn before the core.

4. Before turning you must complete a thorough TARGETED SCAN. This takes time so anticipate and do this before you expect to turn.

5. Wait until you feel a sustained surge for at least five seconds or have a sustained vario indication for at least five seconds. Another cue is that at the peak of the lifting air the feel of the vertical acceleration will cease – that is the time to turn. If this doesn't happen or you just get short gusts then resume cruising.

6. If you've turned the 'right' way you should feel a wonderful surge as you fly into the stronger lifting air near the core. This is shown on the diagram in white.

7. If you've turned the 'wrong' way you'll get that horrible sinking feeling. Continue the turn through ¾ of a turn (270o) relative to your original heading and then straighten out. This is shown on the diagram in pink. Depending on how far away from the core you were when you turned you will need to fly straight for between 3 and at most 10 seconds to move the circle significantly across the thermal. If you feel a sustained surge for at least three seconds then resume your turn, or if you don't feel a surge then resume the turn after 10 seconds.

8. Re-trim to thermalling speed.

On the next turn re-centre the turn as necessary.

Notes

- Do not enter a thermal if there is any collision possibility with other gliders. Do not assume that other pilots have seen you.
- Cues for which way to turn such as a wing lifting are not reliable. Other factors are more important and are covered in the post-GPC advanced training syllabus.
- Practice thermal entry at every opportunity, you'll never stop learning.

FLIGHT EXERCISES FOR THIS UNIT

Your instructor/coach will demonstrate a number of thermal entries and the correction if the turn is away from the core. You'll discover that your instructor/coach will turn the 'wrong' way about half the time – this is normal. Keep that in mind when you fly and try not to get frustrated!

You'll then get an opportunity to practice thermal entry. Try to feel what the air is doing – you'll have best success at this if you keep your movements on the controls smooth (particularly the elevator).

Keep a constant nose attitude as much as possible. Remember to maintain a good lookout and wait for a sustained surge (or vario indication) before turning.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• **Turning in a gust**	Not waiting for a sustained surge of at least 5 seconds
• **Turning too late**	Taking too long to decide which way to turn – pick a direction before reaching the thermal
• **Turning too early**	Not waiting for at least 5 seconds or until the surge subsides before turning

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate good lookout
- Identify the difference between a thermal and a gust
- Demonstrate appropriate nose attitude during thermal entry
- Wait for the peak before turning
- Identify if the turn is away from the core and correct appropriately

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. When should you reduce speed in the thermal entry sequence?
2. Is it acceptable to 'pull up' as you enter the core?
3. Can you turn the opposite direction to another glider if it is at a very different height?
4. How do you know when to turn?
5. If you've turned away from the core, what angle should you turn through before flying straight and how do you know when to resume the turn?

Gliding Australia Training Manual

Pilot Guide

Unit 32

Soaring with Other Gliders

WHAT THIS UNIT IS ABOUT

To learn how to safely and cooperatively fly with other gliders. This requires awareness, separation and predictability.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 31 Thermal Entry

KEY MESSAGES

- **Lookout** is essential for awareness of other aircraft and predicting behaviour.
- Separation is maintained by thinking ahead and predicting what other aircraft might do.
- If you are in another pilot's blind spot, you are responsible for giving way.
- Adopt gentle, predictable manoeuvring techniques, join in with other gliders cruising or circling patterns and don't surprise anyone or burst any bubbles!

PILOT GUIDE FOR THIS UNIT

Soaring with other gliders is an exciting and rewarding experience. You will learn a lot from watching other pilots and of course they'll mark the thermals for you. The associated risks need to be managed carefully since you will spend extended periods cruising and thermalling with other gliders.

Be aware that judging distance and closing speed to other aircraft is difficult, particularly if you are inexperienced or lack currency. Plan ahead and increase margins so that judgement errors do not result in lack of separation.

Lack of separation is likely to result from poor lookout when cruising (watch for gliders in front manoeuvring and converging headings), when entering thermals, whilst thermalling, and leaving. When entering thermals always join gliders already in the thermal from the outside of their circle and such that 60m separation is maintained. Be vigilant with a regular full scan and targeted scans before manoeuvring.

Anticipate double-blind situations1 and prevent the situation arising. It's too late once in the situation since separation is not visible. In the cruise, don't allow a glider to remain directly under your nose – manoeuvre to one side to keep the front glider visible. While thermalling never turn inside another glider. When leaving a thermal conduct a targeted scan in the direction of exit as well as under the outboard wing.

Your flying should be predictable at all times so that other pilots can maintain separation through anticipating your actions and likely flight path. Gliders that are ahead in the cruise will expect gliders following to give way if they turn – leave enough space to do this safely. If you are in the lead you should not manoeuvre suddenly and unexpectedly, and should not rely on following gliders seeing you and giving way appropriately.

[1] *Double blind situations are where pilots of each aircraft cannot see each other due to being in each other's blind arc. Refer to Pilot Guides 'Lookout Introduction' and 'Lookout Scan Procedures'.*

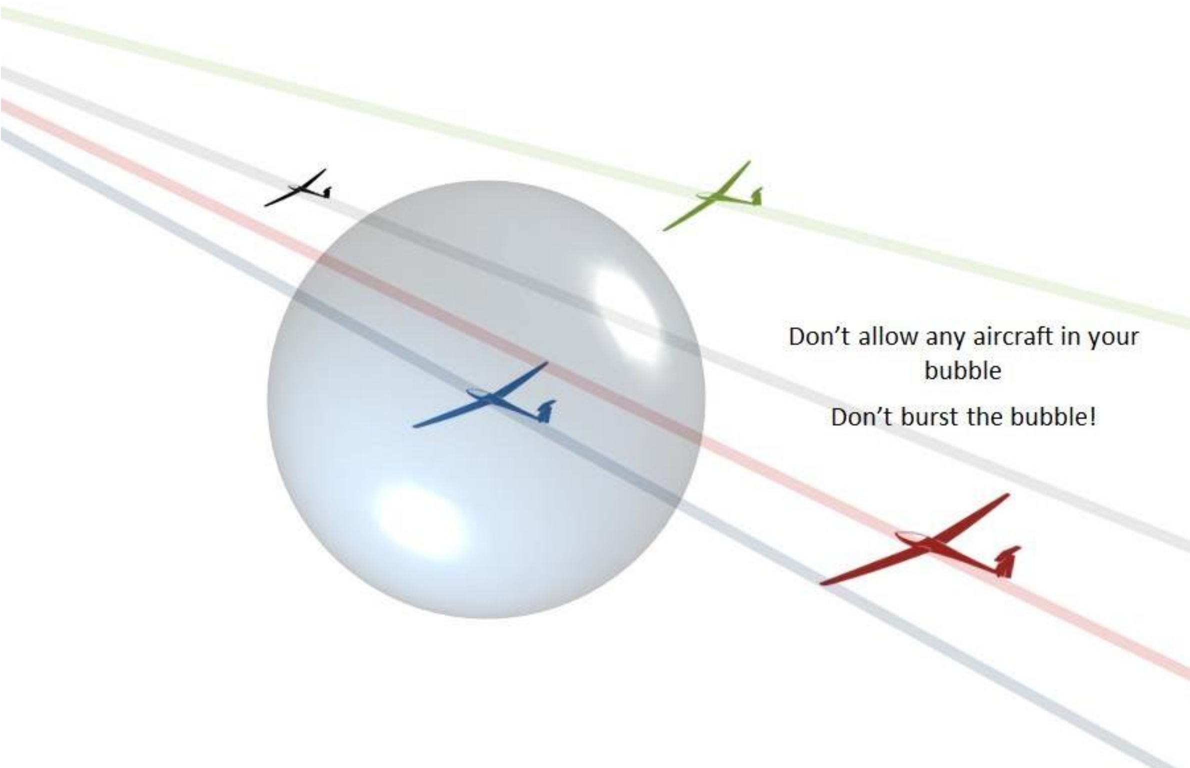
The key to safety when soaring with other gliders is **Awareness**, **Separation** and **Predictability**.

1. Awareness

- Keep a constant lookout when cruising and thermalling to locate other aircraft and predict:
- what the other aircraft might do; and
- where conflict may occur due to converging headings or converging heights.

2. Separation

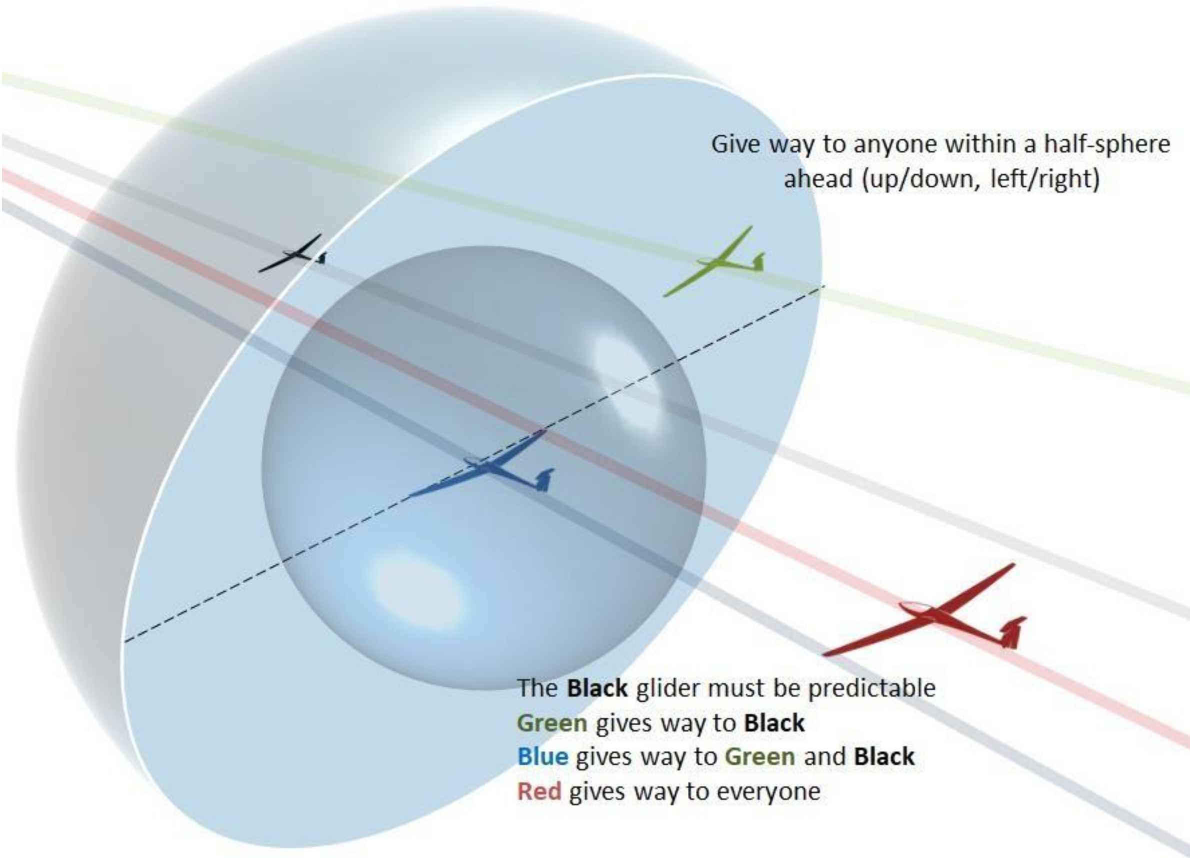
Imagine a 60m (200 feet) radius "bubble" around each glider. No aircraft should ever be inside your bubble. The diagram below illustrates the concept with four gliders in the cruise (cruising to the left).



Use the principle of **Separation Priority** when cruising:

- Give way to anyone within a half sphere ahead (up/down, left/right)
- You must give way to these gliders no matter how the gliders in front, or to the side, manoeuvre.
- When overtaking make the other pilot aware – use the radio (in most cases you will have identified the other glider).
- Do not enter double-blind situations. Eg aircraft under the nose or over the tail – you can't see each other.

The diagram below illustrates the principle for four gliders in a cruise. The 60m bubble and half sphere is shown for the Blue glider only but of course all gliders have their own bubble for separation. The outer half sphere is of arbitrary radius but roughly shows an area up/down and left/right where the Blue glider would need to give way to other gliders if they manoeuvre.



3. Predictability

It is important that all pilots behave in the same way when approaching, entering, and leaving thermals, and when making centring corrections. If you are predictable and other pilots are predictable then actions can be anticipated with safer outcomes. The points below introduce elements of predictable behaviour related to thermalling.

When approaching a thermal:

- Conduct a thorough FULL scan and TARGETED scan as discussed in GPC Unit 31 Thermal Entry.
- Locate gliders in the thermal and identify their direction of turn. You must match the direction of turn (even with very large differences in height).
- Plan ahead for your arrival – which gliders will you be joining in with?
- When the tail of a glider in the thermal is pointing directly at you, pick a heading a little outside that point, and maintain that heading (don't follow the glider).
- Slow down gradually before arriving to synchronize with the other gliders' speed.
- **Don't pull up in the core.**

When entering a thermal:

- You must give way to gliders already in the thermal.
- Join with zero potential conflict – fly around the outside of the other gliders' circle (with at least 60m separation) until an opening is available or they climb above.
- Figures 1 and 2 below illustrate an incorrect (and unsafe) thermal joining sequence and an appropriate joining sequence.

Figure 1 - Incorrect thermal joining sequence

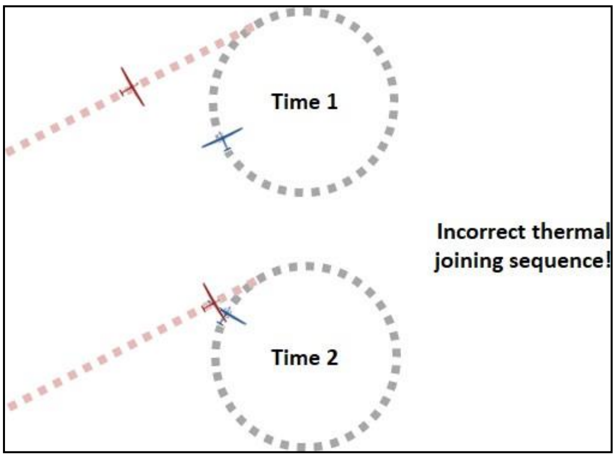
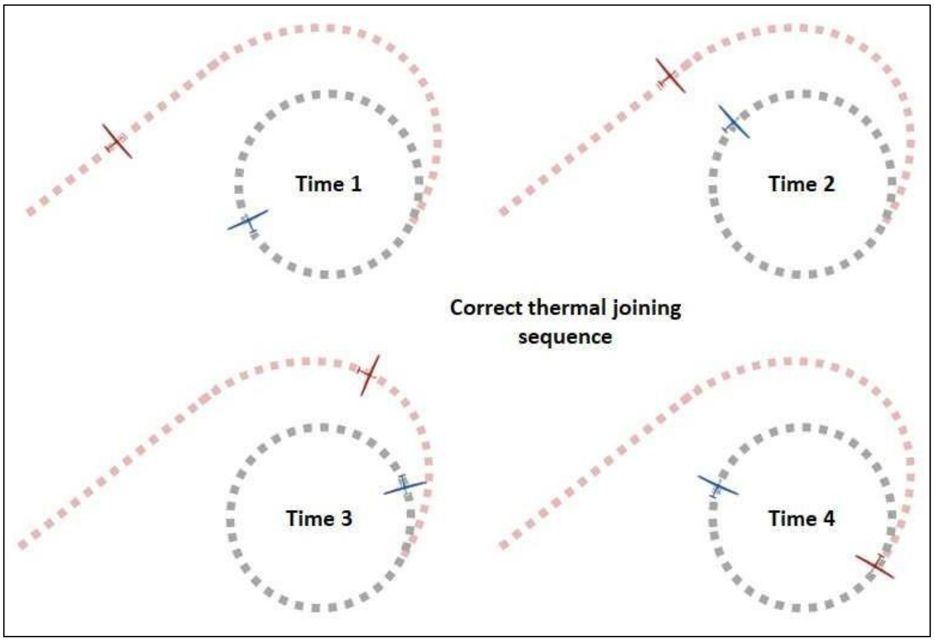


Figure 2 - Correct thermal joining sequences



When thermalling:

- Never point at another glider.
- Don't turn inside other gliders – keep the nose of your glider outside the line of the tail of any glider in front.
- Watch out for all gliders, not just the closest glider. If available, monitor your Flarm.
- Go with the flow – match other gliders bank angle and speed. Accept that climb rate is likely to be lower than thermalling on your own.
- Make small centring corrections when safe to do so.
- Note that one pilot with a small bank angle disrupts the thermal for the others who are forced to follow.

When leaving a thermal:

- Exit with a gentle roll-out after checking for potential conflict. Possible points of conflict are a glider behind and a little on the outside of your turn (check under your outside wing that it's clear) and below (check below your inside wing).
- Gradually increase speed as you leave.
- If you roll to wings level (zero bank), others will assume you are leaving so don't turn back into the thermal.

FLIGHT EXERCISES FOR THIS UNIT

Flying for this unit requires reasonable thermal conditions with at least two other gliders available together to cruise and thermal with. If this is not possible then flight exercises will be delayed to another day or potentially be conducted at another site.

Near other gliders: Cruising, thermal joining, thermalling and leaving thermals will be demonstrated to you. Keep a very good lookout and try to anticipate conflict situations.

You'll then have an opportunity to try it for yourself.

Notes

- Judgement of the distance to gliders and the closing rate or relative speed between gliders will take time to develop.
- You may find this exercise challenging because you need to concentrate on what's happening outside the glider while maintaining accurate control of the glider – this gets better with practice.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Not recognising potential conflicts	• Poor lookout and/or spatial awareness (develop good lookout habits) • Lack of understanding of potential conflict situations (discuss with your trainer)
• Not maintaining separation	• Misjudging closing speeds and geometry (you'll get better at this with practice) • Incorrectly predicting behaviours of others (you'll get better at this with practice) • Flying unpredictably (if you don't fly predictably then other pilots may misjudge what you are doing – follow the guidelines in this unit)
• Poorer aircraft handling when near other gliders	• Distraction and overload (you'll get better at this with practice)
• Joining a thermal by aiming at the middle on approach	• Heading directly towards a glider in a thermal (when the tail of a glider in the thermal is pointing directly at you, pick a heading a little outside that point, and maintain that heading)
• Not maintaining position opposite another glider in a thermal	• Heading at the glider ahead in the turn instead of outside the tail

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate consistent lookout locating other gliders
- Recognise potential conflicts such as converging headings or converging height changes and double-blind situations
- Predict intentions of other pilots
- Describe the concept of a separation bubble and how “separation priority” works
- Demonstrate appropriate separation from other gliders
- Demonstrate predictable behaviour

RESOURCES & REFERENCES

- Gliding Federation of Australia. ‘Lookout for Glider Pilots’, OSB 02/12

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What are the three key principles for safely soaring with other gliders?
2. What is the minimum separation from other aircraft at all times?
3. Why is it important to fly predictably?
4. Why is it not safe to turn inside another glider when thermalling?
5. Why should you not turn back into a thermal after rolling wings-level?

Gliding Australia Training Manual

Pilot Guide

Unit 33

Thermal Source and Structure

WHAT THIS UNIT IS ABOUT

To develop your knowledge and skills related to thermal sources, thermal structure, and thermal lifecycle.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 31 Thermal Entry

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 38 Meteorology and flight planning
- GPC Unit 40 Cruising, speed to fly, height bands and thermal selection

KEY MESSAGES

- Thermals are rising buoyant air from a thermal source.
- The ground is a thermal source when it is heated by the sun. Darker and hotter surfaces generate better thermals.
- Thermals have a lifecycle and may have a bubble structure.
- There may not be a thermal at the 'perfect' location relative to sources and triggers since you need to be at the right point of the cycle (the bubble may be below or above).
- Thermalling at low level increases the risk of a spin – maintain safe speed near the ground and have a clear break-off point at a safe height for a circuit and landing

PILOT GUIDE FOR THIS UNIT

Understanding what a thermal is, potential sources of a thermal, thermal triggers, and the vertical structure of thermals is important for maximising the chance of finding a thermal, and for making decisions on thermal selection.

Thermals are rising air caused by buoyancy of the air relative to the surrounding air. This buoyancy is normally due to differential (higher) surface temperature generating hotter less dense air but can also be due to increased humidity since humid air is also less dense.

The sun heats the ground, not the air, and will heat darker and drier areas more than lighter moister areas – rock, townships and dark areas are good early in the day; green grassy areas, forests and swamps are not. However once they have warmed up, moist areas produce good thermals late in the day. It may help to think of walking barefoot on the ground – the warmer areas underfoot are likely to produce thermals.

The ground heats a pool of air which is then more buoyant than the surrounding air but is held near the ground by surface tension. It will need a trigger to break away from the ground – triggers are features such as machinery, lines of trees, and upwind edge of lakes. Once triggered the pool of air will ascend until the pool of buoyant air is exhausted – this may be a few minutes or tens of minutes. The area then needs to heat to regenerate the buoyant air and the cycle repeats.

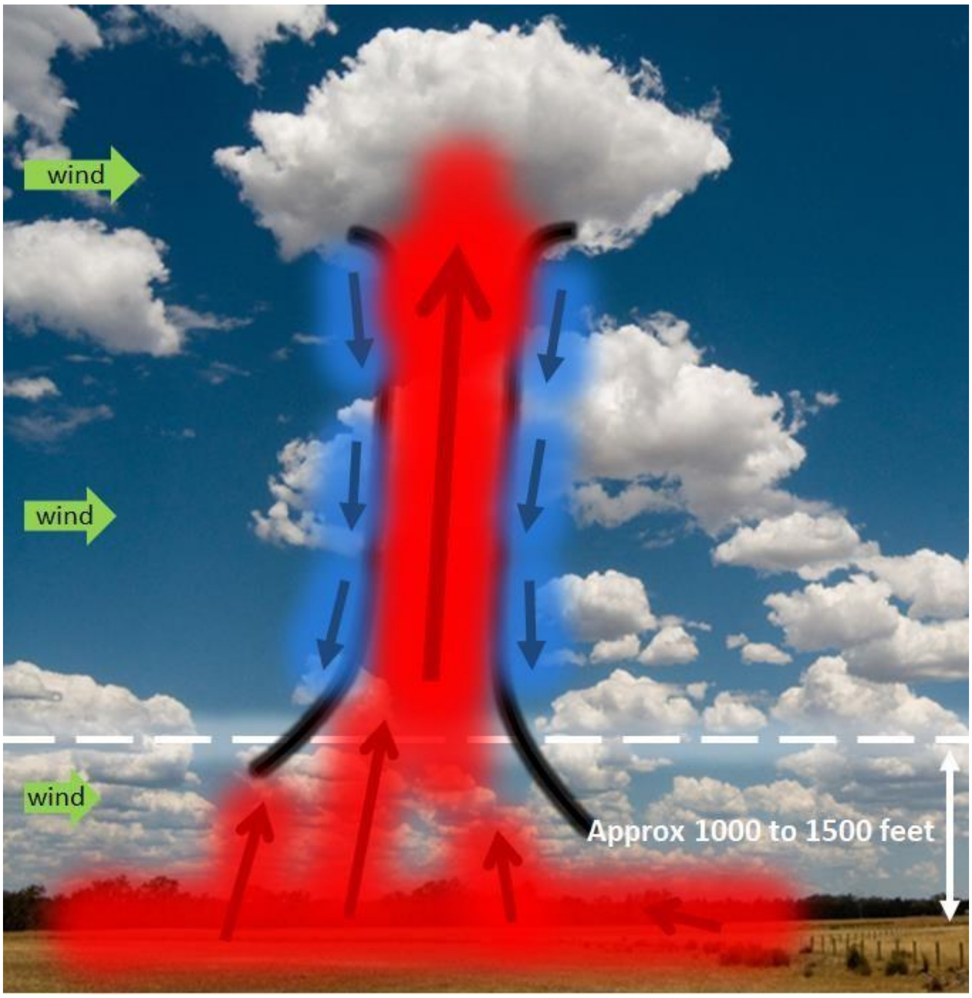
The source area feeding a thermal is large (1 square kilometre or more) but the triggers can be small.

Thermals may be columns of air that rise continuously from the ground for a period of time or may be a bubble that continues to rise but is no longer fed by the thermal source.

Further detail on the impact of wind will be discussed in the advance training syllabus.

The diagram below illustrates a column thermal. The red area shows warmer air, which rises due to buoyancy. There's a pool of warmer air near the ground that typically breaks away in multiple narrow and turbulent cores before eventually coalescing into a single core. In this example the core rises into a cumulus cloud (where the water vapour in the air forms water droplets) until eventually the air temperature in the thermal is roughly the same as the surrounding air. At that point the air stops rising and spreads out. Around the outside of the thermal is a ring of sinking air, depicted in blue.

Higher convection (the height of thermals) normally generates stronger thermals, with a longer cycle fed by a larger pool of buoyant air – this means that the thermals will also be further apart. A rough rule of thumb is that thermals will be the same number of kilometres apart as the convection height in thousands of feet.



FLIGHT EXERCISES FOR THIS UNIT

You will have an opportunity to sample many possible thermal sources and triggers while navigating on a short cross country flight. You'll find the discussion on the terrain that you fly over useful. Think about the air blowing across the ground in the wind. What areas will be good thermal sources and what features will it flow over that are likely to trigger a thermal?

Don't be frustrated if the thermals aren't there when you get to a good location. You may have made a good choice but arrived too late or early for the thermal to be there – remember thermals typically cycle and often have bubble behaviour.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
• Confusing sources with triggers	• Thermal source areas are large • Triggers are small • Only a small amount of experience with which to judge – take the time to watch and learn.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe:
  - The difference between thermal sources and triggers
  - The vertical thermal structure
  - How thermals cycle and variations with terrain and time of day
- Identify potential thermal sources and triggers taking into consideration sun, wind, terrain, vegetation, time of day, cloud cover
- Demonstrate navigation to relevant thermal sources and triggers in a search for thermals

RESOURCES & REFERENCES

- G Dale, 'The Soaring Engine – Volume 1', Chapter: Thermal soaring – Thermal formation; When thermals start to rise & Appendix

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Does the sun heat the air?
2. What is the difference between a thermal source and thermal trigger?
3. Would a road make a good thermal source?
4. Why might a thermal not be there when you arrive in the 'perfect' spot for a thermal?

Gliding Australia Training Manual

Pilot Guide

Unit 34

Outlanding Planning Demonstration & Execution

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge required to plan, prepare and perform a landing in an unknown field. This may include a landing at the conclusion of a cross country flight and in an emergency situation (launch failure, low in circuit, etc) close to the airfield.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 15 - Break-off & Circuit Planning
- GPC Unit 16 – Circuit Joining and Execution
- GPC Unit 17 - Stabilised Approach and Landing

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 35 - Flight preparation, glider, trailer and pilot.

KEY MESSAGES

- Outlanding requires concentration and planning and adherence to standard procedures. It should not be done in haste so an early decision to land is critical.
- Set personal minima for the decision to land and for flying the circuit and stick to these.
- You need to monitor and estimate height above ground without reference to instruments
- Identifying obstacles, wires, crops, wind direction are key observations required
- Every landing you make is practice for an eventual outlanding.

PILOT GUIDE FOR THIS UNIT

The Decision to Land

Changing from a Soaring pilot to a Landing pilot

- The predecessor to a successful outlanding is putting yourself in a position to be able to plan the outlanding. The lower you get, the less options you have available to you and the less time to execute the landing. On windy days there may be less available suitable paddocks for instance. The transition from soaring pilot to landing pilot can happen quite quickly in heavy sink.
- On every flight you need to be aware of having a suitable landing field within your reach. Even when flying local you may experience heavy sink or strong winds which means that your airfield cannot be safely reached. In this case you must identify and then select an alternate landing field.

- An outlanding is safe provided you have enough time to prepare and plan, and adjust your decisions based on a close look at the field. Accidents as a result of outlanding are often due to not having enough time to thoroughly inspect and choose a field and plan the landing. The trap is when you keep hoping that you will find a thermal so you delay making the decision to land.
- Set your personal minima as to when you will make this decision and become a landing pilot.
- In rough terrain, even very experienced pilots will make this decision at a higher altitude.
- For your early outlanding you are advised to have selected your field by 1500 feet AGL and remain close to the field until you are ready to start your circuit, all the time looking at the field to confirm that it is suitable. You should have alternative landing fields identified in case you discover a problem with the field you selected.
- If you find a thermal during this pre-landing phase you may use it, but retain awareness of your landing field so that you don't drift away from the circuit joining area. This is no different from what you might do near to your home airfield.
- As you reach circuit joining height then you transition from Soaring Pilot to Landing Pilot and are now committed to landing in the field so you must now focus on that task only. Ignore any other thermals.

Field selection

- On a cross country flight remember that an outlanding is always a possible outcome. This is normal practice.
- You need to look well ahead (20-40km) to ensure that the ground you will be flying over in the next 30 minutes has landable fields available.

How far can you fly?

- Plan on achieving 7km for each 1000 feet of height AGL plus 1500 feet for circuit planning and landing. So, if you are at 4500 feet AGL you can fly 21km before having to land (assuming no excessive sink) so make sure there are suitable fields in the next 21km.
- Suitability of your track will be indicated by the colour of the fields and presence of hills and rough ground. Flat ground with bright green crops may be OK once the crops have been harvested but possibly not suitable in spring. Select a track that will keep you within reach of landable areas.
- Colour is a good indicator because it gives a clue as to what's growing in the field, if anything. Freshly cropped and fallow fields are better than fields which are in crop but low crops are better than high. Fields with deep furrows are to be avoided if possible and if not, land in line with the furrows, not across them.
- Local knowledge is a good idea. If you're not a bush dweller, ask a local to describe to you the appearance of common crops in the region and what to avoid, crops like canola and cotton. Examine the appearance of the fields either side of the road as you drive to the strip. Brown fields have often been cultivated and can be a good surface… there's a saying "if it's dirt, you won't get hurt."
- Getting used to finding fields, assessing them at a distance and confirming or rejecting them as possible landing places when you get closer is an essential part of gaining confidence when soaring.

- As you get down to 2000ft AGL you need to have identified specific fields that you can land in, rather than areas of suitable fields. This means that you have to identify fields based on a series of criteria.
- The criteria for selecting a field are shown the following table

WSSSSSS

Field Selection Check list

W **Wind**	If there is no indication of wind on the ground, use the longest distance along the paddock which may be a diagonal. Assess the wind from drift when thermalling, dust, smoke, ripples on dams or other signs. Land into wind as much as possible.
S **Size**	Adequate length for landing, normally 300 metres, corner to corner diagonally if necessary. Choose the largest available rather than the most convenient.
S **Slope**	If a slope can be detected from circuit height, it is too steep to land in. Pick another paddock. Land uphill, even if there's a small downwind component.
S **Surface**	As smooth as possible. Stubble and dirt are best. Avoid crops like canola. Fields with many trees may not have been cropped and so can be rough, with fallen branches and holes to cause problems.
S **Stock**	Avoid paddocks with animals. Sheep are usually not much of a problem. Cows eat or walk on gliders. Single cows aren't cows (Bulls!), Horses may panic.
S **Surrounds**	With adequate approach paths. An approach over trees means a longer distance into the field before touchdown and there's a risk of wires hung between trees, wind shadow or turbulence off the trees.
S **SWER**	Single Wire Earth Return power lines are very hard to see. Overhead power *lines and wires strung between trees as well as fence wires are a fact of life in* the country, especially near buildings. It's hard to see wires so look for poles or plant growth along fence lines. Don't fly an approach between trees

Circuit

- Your circuit height must not be too high, and definitely not too low. You are able to identify problems with the field more easily at 800 feet than at 1200 feet. As you fly downwind focus on seeing power lines, fences, rough ground, stock etc and adjust your aiming point accordingly.
- Your circuit should be a normal circuit, same angles and speeds with a final turn no lower than 300 feet AGL. Perform Pre-Landing checks (FUST), make a broadcast radio call to advise your plans if you have time to do this.
- Select an aiming point that reduces obstacles on approach. It does not have to be in the middle of the field if the ground and obstacles are better on one side.
- Once you land, stop as soon as you can – there may be unseen holes and obstacles in front of you.

Post landing actions

- Radio others to let them know that you have landed safely. They may be able to help you make contact with home-base to arrange a retrieve.
- Tie the glider down before you walk away. It may be a few hours before you are back at the glider with your crew, and the weather can change quite quickly.
- Orient yourself and review your map to identify main roads and tracks. Try and identify nearby houses where you can seek assistance. Look for gates into the field and if possible check if they are locked. Leave flashing lights at key locations, Take water with you because it may be a long walk.
- Use your mobile phone to contact your crew. Text may work better if in a low reception area.
- Try to locate the owner of the property so that they are aware that you are there. Generally farmers are happy to meet you, but get grumpy if you have not made contact with them before your crew arrives in the field. Giving the children a look at the glider is always good Public relations.
- GFA insurances will cover any crop or property damage. It is rarely used but good to offer if the farmer is concerned.

Use of See You and Google Earth and Simulators

- These tools will give you a chance to review available fields in your flying area. (crops may be different but you can see many issues.)
- Identify power lines and roads and houses.
- Identify fields that could be suitable.
- Select a suitable field and plan the circuit

FLIGHT EXERCISES FOR THIS UNIT

Local flying exercises

- Estimate your height above ground based on observation of features such as trees, stock, fences.
- Develop some rules of thumb to estimate your height around your airfield.

At 500 feet

- Trees appear to have a solid canopy, below 500 feet you can start to see through between the branches and identify leaves.
- Fence posts become individually visible
- Cows have visible legs, a little lower sheep have visible legs
- Power poles become more visible and you can identify guy wires where present

Identify Crops:

- Learn to identify major crops from the air.
- When driving, stop and look at various crops to identify height and density.
- Beans and Peas and Sunflowers have potential for damage due to density or strong stalks
- Beware of crops that are trellised, most obvious are grapes.

Field size.

- At your home field, when getting lower, look at the length of your normal landing area and compare it to the size of nearby paddocks. Learn to identify fields that are big enough to land in.
- Select a field that is at least twice this size so you have capacity to adjust your aiming point to avoid obstacles.
- Trees on the final approach will require you to be higher and so the effective length of the field is reduced considerably.

Power lines/ SWER lines

- In your normal circuit area, identify power lines that would make it hard to land in the field.
- Initially you will see the line of the poles and less likely to see the wires. This is true down to quite low altitudes. Get used to seeing the lines of poles and observe how far apart they are. Look for changes in the crops around the poles due to machinery not being able to get close to them.
- As you get lower when flying cross country, regularly look for power poles and follow the lines, identifying when another line splits from the main line. Best places to start searching for power lines is from the farmhouse, sheds or dams.
- When landing in a field with power lines, landing under them is difficult. The wires sag well below the poles and you may not see them. You will need to be very low, close to round-out altitude to avoid them. Best to land in a different field. If you want to fly over them, you should fly over the top of the pole as you can see this more clearly and get proper depth perception. Best to land in a different field.

Simulated outlanding at your airfield

- Ask your Instructor to select an area of the field where you have not landed before. This removes the familiar approach surroundings so requires new judgment. You can even simulate fences and rough ground with suitable props. It is most important that the marked area has a safe undershoot and over-run area available.
- If doing this solo, ask your instructor to observe and give feedback.

Motor gliders

- The best training opportunity is where you have a motor glider available, for identifying and selecting a suitable field, and then to fly the circuit down to low level. Landing if the Aircraft is suitable. It may be worth visiting a gliding site where this is possible

Outlanding

- Where possible, a dual landing in a 2 seat glider in a field is great training. Even having an identified field with farmer approval for an outlanding provides the pressure and focus required to fly the circuit and landing.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS
• Making the decision to land enables you to concentrate on a safe outlanding. Set personal minima for making this decision and then stick with it. • You will be making a lot of decisions in preparing for and flying the circuit and landing. Make sure that you have enough time so that you are not overly pressured. • Landing in a new field means that you won't have the normal landmarks to help with decisions on where to fly and where to turn. You must learn to make decisions based on angles to the aiming point. • Focus on the basics of speed by attitude and descent to the aiming point with airbrake, aiming for a half airbrake approach. • As you get lower you will be able to identify problems with wires and fences and rough ground which were not previously visible. Keep looking so that you can adjust your flight path to avoid obstacles. You need to be flexible and adapt to changing circumstances.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Commit to landing.
- Select a suitable landing area (W & 6S)
- Prepare and plan circuit and landing
- Perform a safe circuit to a field
    - Monitor suitability of field and approach path throughout the circuit
    - Final turn above 300 feet AGL
- Land safely
    - Adjust touchdown point to optimise safety
    - Ensure clearance from any obstacles (minimum of 50ft)
    - Minimise ground roll

- Describe Post outlanding actions
    - Communicate successful outlanding
    - Secure glider
    - Contact property owner

RESOURCES & REFERENCES

- Australian Gliding Knowledge; Pages 162-165.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. List the W & 6S for field selection?
2. You are at 7500 feet AGL. How far can you expect to fly from this height and then select a field?
3. On the flight in Q2 above, 30km ahead you see there is an area of forest which looks like it will be say 10km wide. Can you expect to safely fly across the forest?
4. At what height should you have identified suitable landing fields?
5. You are at 1500 feet AGL and have selected a suitable field. Can you search for and use thermals?
6. You decide to start the circuit at 800 Feet AGL. What are the benefits and risks with starting the circuit at 1000 feet or 600 feet?
7. You start downwind leg, what actions do you need to perform to set up for a safe landing
8. At what height do you expect to turn final?
9. As you turn final you note that there is a fence across the middle of the paddock previously hidden by long grass. The field is 800-1000m long. What do you do?
10. What are the benefits of touching down in a field as slow as possible?
11. What are the key actions after your successful landing?

Gliding Australia Training Manual

Pilot Guide

GLIDING AUSTRALIA

Unit 35

Flight preparation, glider, trailer and pilot

WHAT THIS UNIT IS ABOUT

To develop your skills, knowledge and ingrained habits to minimise risks due to inadequate preparation for yourself, the glider and trailer. This is essential to be able to concentrate on achieving your goals when flying cross country.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- There are no pre-requisites for this unit

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 36 Navigation and Airspace
- GPC Unit 38 Meteorology and Flight Planning
- GPC Unit 39 Advanced Soaring Instruments and Flight Computers

KEY MESSAGES

- Effective personal and equipment preparation leads to a greater likelihood that you will achieve your goals and increases your overall enjoyment of the sport.
- Being prepared and relaxed will reduce the risk when outlanding.
- Concerns over the state of a retrieve vehicle, the trailer or availability of crew leads to concerns about the possibility of an outlanding and not being willing to leave the circuit area, abandoning tasks at the first sign of difficulty and/or not concentrating on the basics of flying. You need to be well prepared to enjoy cross country flight.

PILOT GUIDE FOR THIS UNIT

Effective preparation leads to a greater likelihood that you will achieve your cross country goals and will increase your overall enjoyment of the sport. Be prepared and relaxed and your outlanding safety will also be greatly improved. If you are concerned over the state of a retrieve vehicle, the trailer or availability of crew you'll be concerned about the possibility of an outlanding - you'll likely be reluctant to leave the circuit area, abandon tasks at the first sign of difficulty and/or not concentrate on the basics of flying.

Preparation can be broken down into the categories of **Personal Preparation**, **Glider Preparation** and **Trailer and Retrieve Preparation**. Pointers for these are below but it is important to develop your own routine.

Personal Preparation

A reason for concentrating on preparation is to minimise physiological impairment to flying. Are you in good physical condition and well rested for the day of the flight? Drinking excess alcohol, the day before, leads to dehydration and fatigue the following day. This cannot be fully resolved on the day of the flight. Subsequently, hydration and relief become a bigger problem than normal and flying performance will suffer.

Make sure you have essential items prepared for the day such as hat and sunglasses, drinking container with water and food for the flight. Have the right clothes for flying on a hot or cooler day. Use long sleeves in hot weather, have comfortable shoes that are stout enough to walk over open fields. Make sure you have money and your (charged) mobile phone with all necessary phone numbers saved. If you are flying over remote areas carry an electronic locator transmitter – have you considered Search and Rescue (SAR) requirements?

Refer to Unit 38 in relation to meteorology and pre-flight planning which deals with planning of the task, required task time and latest start time. Also having relevant maps available for the task area, being aware of airspace restrictions and different radio frequencies that may be needed and checking the weather for the day of the flight.

Glider Preparation

The glider needs to be prepared as well as possible. It needs to be airworthy and it's too late to find out it isn't on the day! It should also be cleaned before flying. Special attention should be paid to the canopy, both inside and out. Do the wings/tail need re-taping?

Have the batteries been put on charge the day before? Batteries need to be able to last for the flight duration and still power the radio effectively to transmit. They should be fully charged before flight. Battery chargers need to be capable of fully charging a battery from flat overnight, and ideally will show the state of charge. A glider with radio, Flarm, electric vario and modern navigation screen typically draws 700mA and as much as 1 Amp constantly. Remember, sealed lead acid (SLA) batteries can only provide about 50% of their nominal capacity on a regular basis.

The glider needs to be ready for you, not just any pilot, and for extended flight duration. Try sitting in the glider and adjusting seating position such that it is as comfortable as possible wearing a parachute and to allow you to reach the panel and all controls.

Many gliders have adjustable backrests to change leg reach. Pilots can also use cushions or padding to further adjust the seating position and improve comfort. Parachute choice also affects this as well as how the parachute has been packed.

Are you familiar with the operation of the instruments, particularly the flight computer? Have you declared the flight to the logger? Are all of the instruments working? Is oxygen available and are you familiar with operation of the oxygen delivery system.

Make sure you have an emergency water supply and a tie down kit stowed in the glider.

Trailer and Retrieve Preparation

Trailers are commonly poorly maintained and have missing fittings – check over the trailer and check that everything works and nothing is missing. Is the trailer registered? Tyres must be in good condition and appropriately inflated. You must be aware of weight limits for car/trailer combinations and the appropriate braking systems. Over-run brakes work with all cars. Electric brakes may need the car to have a controller or to supply adequate power on the brake light circuit to run an on-trailer controller.

Does your car have insurance for any driver and a full tank of fuel. Have you pre-arranged a crew and do they know where to find the trailer and know how to drive your car? And don't forget to leave the keys to the car and trailer – you wouldn't be the first to take off with the keys in your pocket!

It is useful to use a checklist for preparation. The checklist below can be used as a guide but it is suggested that you make your own to match your circumstances and your club arrangements.

> Preparation does not begin 30 minutes before flying, or even on the morning of a flight. It begins weeks in advance. Having to fix equipment the day of the flight can lead the pilot to becoming frustrated and unsettled. Preparing earlier means no distractions on the day of the flight and less anxiety.

Unit 35 - Flight preparation, glider, trailer and pilot

Flight Preparation Checklist	
Personal Preparation	**Trailer and Car Preparation**
☐ Hat, Sunscreen	☐ Car insurance
☐ Hydration (including emergency water)	☐ Full fuel tank
☐ Nutrition	☐ Retrieve crew available, know where the car and trailer are and can access the keys
☐ Relief	☐ Car and trailer road legal
☐ Weather forecast	☐ Electrics are compatible
☐ Flight Planning (task, airspace, frequencies)	☐ Rigging / de-rigging aids
☐ Maps	☐ Trailer fittings working
☐ Charged mobile phone (with you)	☐ Tyre condition and inflation
☐ SAR arrangements (ELT?)	☐
☐ Flight declaration, logger and official observer	☐
☐ Car and trailer keys not with you!	☐
☐	
☐	
Glider Preparation	
☐ Ready to fly	
☐ Clean	
☐ Comfortable	
☐ Parachute	
☐ Oxygen (if needed)	
☐ Instruments working and use understood	
☐ Batteries working and charged	
☐ Tie-down kit	

EXERCISES FOR THIS UNIT

You'll spend time looking at and finding faults with various trailers and gliders around the club and point out the simple remedies. For example, what are the ballast limits for the glider, are the batteries charged, do you know how to operate the flight computer? Has the trailer been prepared for the upcoming flying season? Have the tyres been checked, are all the rigging aids present and working, can you find the keys to unlock the trailer?

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
☐ Not remaining hydrated in flight	Not set up for or comfortable peeing in flight
☐ Rushed preparation on the day of a flight	Lack of preparation prior to the day of the flight
☐ Missing preparation items	Not using a check list

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe physical limitations that may affect a pilot's performance on the day of a flight
- Describe personal needs for cross-country flying
- Demonstrate glider preparation to ensure the glider is ready to go
- List common faults that would prevent or delay a retrieve
- Demonstrate trailer inspection to ensure the trailer is ready for go

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Why is it important to remain hydrated in flight?
2. Why is it important to commence preparation well before the day of your flight?

Gliding Australia Training Manual

Pilot Guide

Unit 36

Airspace and Navigation

Unit 36 - Airspace and Navigation

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge to operate in uncontrolled airspace, complying with "Rules of the Air" Regulations, Radio procedures, Altimetry, Flight planning, Search and Rescue requirements, as well as basic navigation skills without use of electronic navigation aids.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 21 Radio Use and Endorsement
- GPC Unit 23 Rules of the Air
- GPC Unit 35 Flight Preparation

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

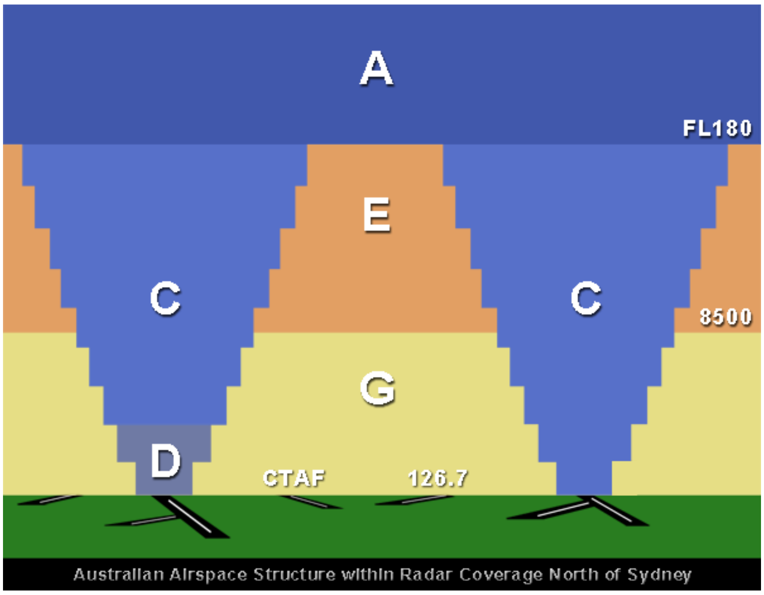
- GPC Unit 38 Meteorology and Flight Planning
- GPC Unit 39 Advanced Soaring Instruments and Flight Computers
- GPC Theory Lesson #11

KEY MESSAGES

- Flight within a broader range of airspace increases exposure to other aircraft types, requiring compliance with rules and procedures designed to keep all forms of aviation safe.
- Pilots must be able to navigate and communicate effectively within Australia's Airspace.
- Pilots must be able to obtain all the prefight information for a planned task and provide notification of their plans.
- Pilots must be able to navigate a planned cross-country flight

PILOT GUIDE FOR THIS UNIT

Australian Airspace



- From your training so far, you would have noticed that a large proportion of your flying has been in G class airspace perhaps with a small proportion in E and for a couple of clubs, operations from D class aerodromes.
- No aircraft is permitted to enter controlled airspace (except Class "E") without a clearance from Air Traffic Control. If your operation requires you to obtain a clearance from Air Traffic Control in either C or D class airspace then you will need to complete the Touring Motor Glider training which is beyond the scope for this unit.

Prohibited, Restricted and Danger areas

- The following link provides detail of Prohibited, Restricted and Danger areas and pilot responsibilities in entering this airspace. https://www.casa.gov.au/search-centre/visual-flight-rules-guide - Prohibited, restricted and danger areas

Visual Charts

- It's important to understand your rights and privileges as a pilot. We are using the same airspace and sometimes landing at the same aerodromes as aeroplanes carrying passengers. None of us want to unwittingly fly into Controlled, Restricted or Danger areas without the appropriate clearance or knowledge.
- This means learning navigation by more traditional methods is essential. If you are flying anywhere near controlled airspace, you must make sure that your paper charts are up to date and that you've been properly briefed on NOTAMS and any recent changes to airspace.

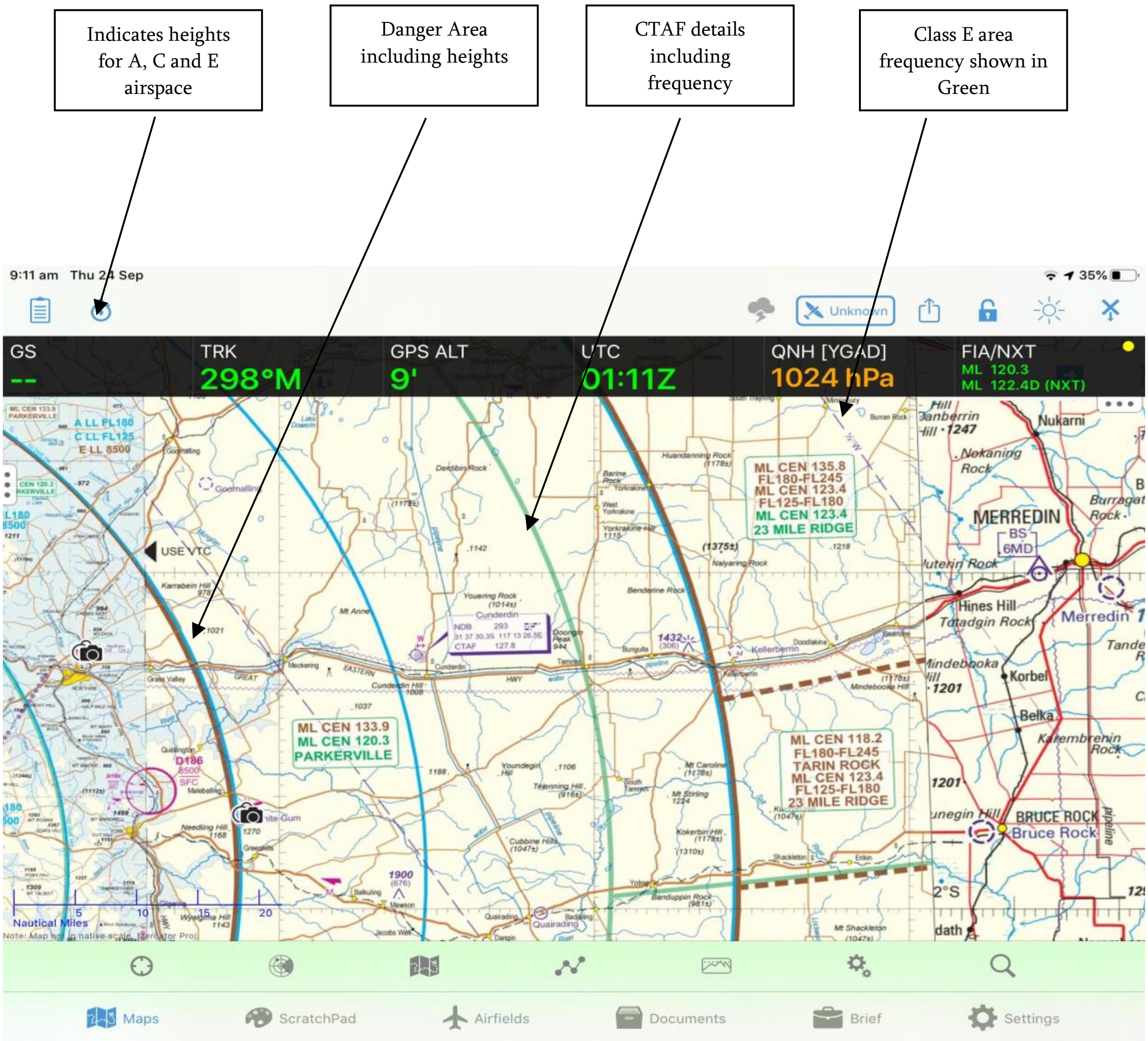
The charts you will need are:

- **World Aeronautical Charts (WACs**) (scale 1:1,000,000) are designed for pre-flight planning and pilotage. They are constructed on Lambert's Conformal Conic Projection. Australian coverage is shown on the front of each chart.

- **Visual Navigation Charts (VNCs)** (scale 1:500,000) are designed for VFR operations. They contain an aeronautical overlay of controlled airspace over a topographical base and contain some radio communication and other navigational data appropriate for visual navigation. Map coverage is shown on the front of each map.
- **Visual Terminal Charts (VTCs)** (scale 1:250,000) are designed for visual operations near terminal areas. They contain some topographical detail and appropriate airspace, radio communication and navigation aid information. VTCs are intended for use up to and including FL180.
- WAC or World Aeronautical Charts, which are very useful for gliding can be bought, downloaded and printed out, remembering always to check currency before using any chart.
- WAC charts look a little like a conventional road map in that they show larger towns, roads, aerodromes, rivers and contours but importantly, they don't show airspace or many of the smaller strips used by gliders, sports and General Aviation (GA) aircraft.
- WAC charts are available in electronic (pdf) - ideal for self-printing, and paper format but at this moment, they all must be purchased. These charts have a reasonably long-life span and at the time of writing, most of the downloadable charts were published at least two years earlier.

Printing Charts

- If you download charts in digital format, you can print sections to the size you need. All charts get out of date due to changes in airspace etc. and need to be renewed before they expire, but the cost of printing your own digital maps should be well below the cost of buying the paper version.
- If digital maps is the way you decide to go, tough waterproof plastic paper is available which is perfect for charts. If you print on ordinary paper, you run the risk of having your maps decompose in flight when you have a leak from a water bottle (and you will have a leak!)
- Electronic Flight Bag apps have printing features and as long as the app and databases are kept up to date, you can be sure that the printouts are current (at least at the moment you press print). The printout is great for things like runway diagrams but it doesn't seem to be great for printing large areas of WAC or VNC because the print resolution is only adequate and no substitute for the higher resolution downloaded charts.
- Visual Navigation Charts (VNC) are another useful chart for VFR and glider flights. VNC are made to a scale of 1:500,000 (2 millimetres on the chart to one kilometre on the ground).
- Unlike WAC, VNC shows airspace. Because of that, they're updated much more frequently than WAC. VNC can either be downloaded in pdf format free from the Airservices Australia website's Aeronautical Information Package (AIP) area or a print version can be bought through the same website.
- At first glance, VNC are ideal for gliding however there are only 14 charts that cover Adelaide, Tasmania, Darwin, Perth and a strip of the eastern seaboard from Cairns to Melbourne. They don't cover a large amount of the inland where most gliding takes place.
- There are other charts which could be used when planning cross-country flights like En- Route Charts (ERC) and Visual Terminal Charts. (VTC). Both these chart types are updated frequently and can be downloaded from the Airservices Australia website's Aeronautical Information Package area.
- Airspace is shown on the Visual Navigation Chart (VNC) or Visual Terminal Chart (VTC).



For additional detail see these documents:

- ☐ https://www.casa.gov.au/search-centre/visual-flight-rules-guide
- ☐ https://www.casa.gov.au/operations-safety-and-travel/airspace/airspace-regulation/radio-procedures-non-controlled-airspace
- ☐ https://www.casa.gov.au/operations-vicinity-non-controlled-aerodromes

Aerodrome and Other information

- ERSA (En-Route Supplement Australia) https://www.airservicesaustralia.com/aip/aip.asp

  Your Trainer will demonstrate information available in ERSA.

Radio procedures in uncontrolled airspace

- Refer https://www.casa.gov.au/operations-safety-and-travel/airspace/airspace-regulation/radio-procedures-non-controlled-airspace
- Focus on terminology to be used in radio transmission and information to be provided in a CTAF.
- Identify the relevant radio frequencies (area frequency in class E and CTAF frequencies).
- Note the need to monitor the Area frequency in E class airspace. With a group of gliders, one pilot can monitor the area frequency on behalf of the group.
- Your trainer will show you how to access ATIS (Automatic Terminal Information Service), and the information that it provides. If available, you should demonstrate in flight. An explanation of ATIS is in the VRFG and frequencies are listed in ERSA aerodromes.

Anti-Collision Systems Available in Australian Airspace

Secondary Radar Transponders

- In some controlled airspace, especially around capital cities but possibly in other areas too, Air Traffic Services will not permit entry into that airspace unless the aircraft carries a secondary radar transponder. Although very few gliders carry these devices, it is worth knowing what they are and what they do.
- It all starts with the ground-based radar systems used by controllers for the control and separation of aircraft. There are two kinds of radar in general use.
    - The first kind, known as "primary" radar, sends out a pulse of microwave energy which reflects off the aircraft's skin and produces a dot (known as a "blip" or “paint") on the controller's radar screen, thus giving its position. This system suffers the limitation that the controller may not be able to identify that the blip he is looking at is exactly the one he wants to see, especially if there is a lot of traffic about and the controller's screen is cluttered. In addition, some aircraft skin surfaces are good reflectors of radar energy, others are poor; metal surfaces are very good, wood and glassfibre are very poor.
    - These limitations led to the development of "secondary" radar, properly called Secondary Surveillance Radar (SSR). In this type, the aircraft carries a microwave receiver-transmitter, known as a "transponder", derived from a military system known as "Identification Friend or Foe" (IFF). This transponder is interrogated by the ground-based radar. The pilot dials into the transponder a unique code, assigned by the air traffic controller (a process known as “squawking”). Every time the ground radar sweeps past the aircraft, it interrogates the transponder, which “squawks” the coded reply to the controller.
- If the ground-based radar is purely of the "secondary" type (typical of the new radars installed all around Australia in recent years), there appears on the controller's screen the coded reply from the aircraft, thereby providing positive identification. There is no primary "blip", nor is one needed for identification. Ground-based secondary radar is not capable of producing a return from an aircraft which is not fitted with a transponder.
- A transponder giving only the coded reply and nothing else is known as a "Mode A" transponder.
- A refinement of the transponder system is the fitment of an altitude-encoding device to the aircraft. This may be either in the form of an "encoding" altimeter or a device known as a "blind encoder", separate from the altimeter. Both these devices can provide altitude information in

electronic form to the transponder, for onward transmission to the ground when interrogated. A transponder fitted with one of these devices and therefore capable of giving continuous altitude readout to a controller is known as a "Mode C" transponder. Most Australian controlled airspace which requires a transponder to enable a clearance to be obtained requires that the transponder be Mode C.

- Another feature of transponders is an “Ident” button. If the controller wants to be absolutely sure about identification, a pilot will be asked to “squawk ident”. All the pilot does is press the “Ident” button and the controller will see the “Ident” mark on the radar screen.
- For gliders, the main drawback of a transponder and its associated altitude- encoder is its electrical power requirement. This is difficult to accommodate in a glider without considerable effort and loss of payload, as the battery needed to meet such demands is necessarily large and heavy. Many gliders have neither the space nor the weight-carrying capacity to cope. As a result, gliders have a dispensation against the carriage of transponders in “E” and “G” Airspace.
- It goes without saying that, if a pilot flying a non-transponder glider requests a clearance to enter controlled airspace and is denied such a clearance without a transponder, the pilot must not enter that airspace.

Automatic Dependent Surveillance – Broadcast (ADS-B)

- Automatic Dependent Surveillance – Broadcast is a system that Airservices Australia is in the process of adopting to replace or supplement their aging Secondary Radar ground sites. The ADS-B “Out” aircraft equipment consists of an approved standard of GPS receiver and radio transmitter to relay the aircraft’s position either to an Airservices ground station, or another aircraft.
- The receiving aircraft must be additionally equipped with an ADS-B “In” system to display any confliction.
- The controller’s display is identical to SSR, excepting that the aircraft is represented by a different symbol.
- At the time of publishing this booklet, GFA expects that the glider dispensation against the carriage of SSR Transponders will be extended to the carriage of ADS- B.
- However, some gliders are fitted with transponders and ADS-B equipment which does makes it easier for ATC to identify you. Refer to the VFRG.
- https://www.casa.gov.au/sites/default/files/2021-08/advisory-circular-91-23-ads-b-enhancing-situational-awareness.pdf

FLARM

- FLARM (FLight alARM) is an electronic aircraft awareness system that warns of the proximity of another FLARM carrying aircraft. It consists of a small box which contains a GPS receiver and a small radio transmitter with a range of a few kilometres, with a small power drain. The system has many optional methods of display, ranging from the basic small clock-like LED display, to PDA or voice alert. At present, GFA recommends its usage, but has not made it mandatory. Some GFA Competition organisers may make its usage mandatory as a condition of entry into their competitions. FLARM is NOT part of the National Airspace System (NAS).
- Neither ADS-B nor FLARM are designed to replace adequate lookout to ensure seeing and avoiding conflicting traffic in VMC.

Altimetry

- General
- An altimeter depends for its operation on the change in atmospheric pressure with height. It is in fact nothing more than a simple aneroid barometer, calibrated to read in feet instead of hectopascals (HPa) or inches of mercury.
- The settings and procedures described here apply to aircraft operating under the Visual Flight Rules (VFR).

Altimeter Settings

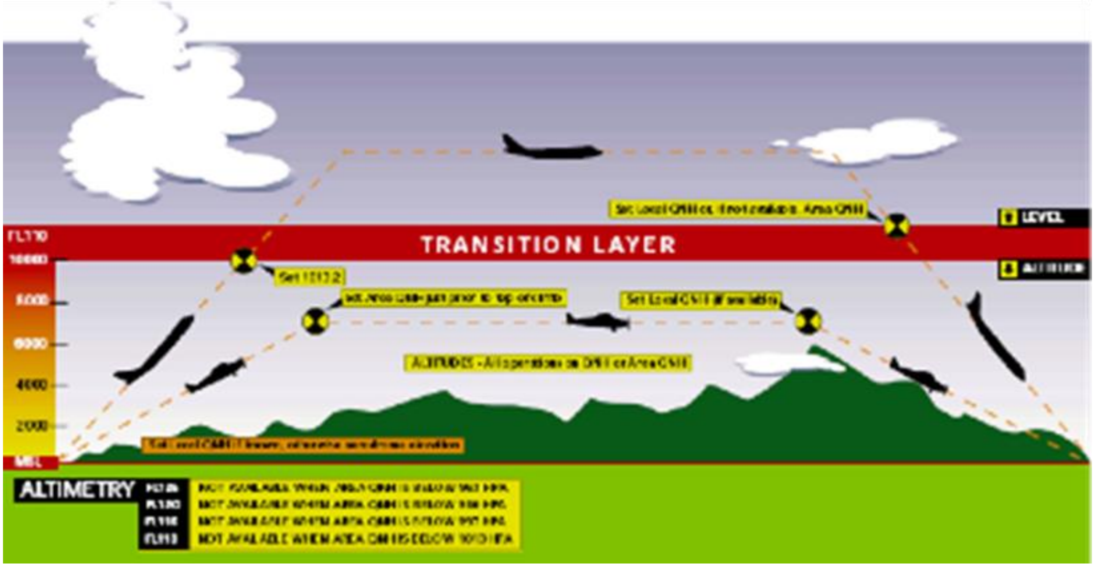
- To be of any use, the altimeter must have a reference pressure from which to measure. There is a sub-scale on the dial of the altimeter on which to set this reference pressure. Once it is set, the instrument will measure with reasonable accuracy the vertical distance above that reference. This is measured in feet.
- The pilot may set one of three reference pressures on the altimeter:
- Aerodrome level pressure, known as QFE, at which the altimeter will read zero when the glider is on the ground at the aerodrome. This setting is no longer in common use.
- Mean sea level pressure, known as QNH, at which the altimeter will read either the aerodrome's level or a specified area's level above sea level when the glider is on the ground. This is the setting used by all aircraft operations below 10,000ft, INCLUDING GLIDERS.
- Standard atmospheric pressure, at which the internationally-agreed standard setting of 1013.2 hPa is set in the altimeter sub-scale. All aircraft flying above 10,000ft are required to operate with this setting on their altimeters, INCLUDING GLIDERS.
- If QFE (aerodrome level pressure) is set, the altimeter is said to measure height based on the reference location on the aerodrome.
- If QNH (mean sea level pressure) is set, the altimeter is said to measure altitude.
- If the Standard Pressure Setting (1013.2 hPa) is set, the altimeter is said to measure flight level.

Altimetry Procedures

- Glider pilots do not regard the altimeter as a dependable aid to accurate height measurement. The reason for this is the nature of cross-country flying in gliders, which may result in an outlanding in strange terrain with very little knowledge of the location. The terrain over which they are flying may be at quite a different level from the terrain at the takeoff point. Pilots are therefore trained to estimate their height above the local terrain by eyeball alone and they become surprisingly accurate at doing this. The altimeter is used as a "coarse" guide to height and the justification for the past use of the QFE setting has always been that it is used principally as a back-up for the visual judgement which is a glider pilot's primary aid.
- However, the purpose of the altimeter is not solely to provide height readout to the pilot for his/her own purposes. An aircraft in any given piece of airspace may be interested, for collision avoidance reasons, in the altitude of other aircraft in close proximity. For this reason, the various settings were devised and must be used in the normal course of flying by all aircraft.
- It is essential that glider pilots integrate with the procedures used by other airspace users to fit into the total system as smoothly as possible. The system works as follows:
    - All aircraft (including gliders) operating below 10,000ft will be on the QNH (mean sea level) altimeter setting. This may be an aerodrome QNH if the aircraft, or setting the elevation of the airfield prior to take-off, or it may be an "Area" QNH given for a

designated area by the Air Traffic Services personnel. The Area QNH may be obtained on request on the Area VHF frequency. When the QNH setting is in use, all levels are altitudes.

- For aircraft climbing, 10,000ft is the upper limit of operations on the QNH altimeter setting and is known as the transition altitude. Any aircraft climbing above this level will re-set the altimeter to the standard setting of 1013.2 hPa.
- For aircraft descending, 11,000ft is the lower limit of operations on the standard pressure setting of 1013.2 hPa and is known as the transition level. Any aircraft descending below this level will re-set the altimeter to the Area QNH.
- Since 11,000ft is the first of the "Flight Levels" it is referred to, not as 11,000ft, but as Flight Level One-one-zero (FL110). All Flight Levels are referred to in a similar way.
- The airspace between the transition altitude and the transition level is known as the transition layer. It varies in thickness according to the Area QNH and is not available for cruising flight.



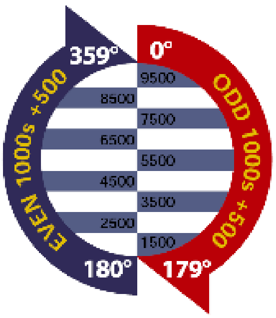
- To re-cap, aircraft (including gliders) operating below the transition altitude use the QNH altimeter setting and refer to their vertical positions as altitudes. Aircraft (including gliders) operating above the transition level use the standard pressure setting (1013.2 hPa) and refer to their vertical position as flight levels.

Cruising Levels

- It is obvious that gliders are unable to cruise at constant heights, altitudes or flight levels. They are always in climbing or descending flight. Powered aircraft (and Touring Motor Gliders) are however required to adhere to certain procedures when in cruising flight, as follows:
- Above 5,000ft altitude, up to FL195, aircraft operate in accordance with a principle known as "ICAO Cruising Levels". The International Civil Aviation Organisation (ICAO) has decreed that all aircraft operating under the Visual Flight Rules (VFR) will do so as per the table below.

Magnetic tracks	From 000 Degrees through East to 179 Degrees	From 180 Degrees through West to 359 Degrees
Cruising altitudes	1,500	2,500

(area QNH)	3,500 5,500 7,500 9,500	4,500 6,500 8,500
Cruising Flight Levels (1013 HPa)	115 (not available if area QNH less than 997 hPa) 135 155, 195 etc	125 (not available if area QNH less than 963 hPa) 145 155 185 etc



- Below 5,000ft, the ICAO Cruising Levels are not mandatory for VFR aircraft but are strongly recommended.
- Note: that a tug/glider combination must adhere to the cruising level guidelines when carrying out any towing operations involving level flight. The same applies to powered sailplanes and power-assisted sailplanes used for engine-on cruising.

Basic Navigation

- If you are going to fly cross-country you need to learn some navigation skills.
- GPS has completely changed the way we fly. You can now glance at a single display and read your latitude and longitude, speed over the ground, track, height above the ground, distance to go, distance made good and more.
- But you can still be lost. And of course, the GPS may stop working because the battery runs flat or there’s a fault in the electronics. GPS may have changed everything but it hasn’t rewritten the rules about basic navigation. In fact, GPS has made learning the basics even more important.
- On most days when we fly, either the sun will be visible or we’ll know where it is. Though the sun moves around a lot, from minute to minute, your angle to the sun is one of the best clues as to which way you are heading.

- A lot of the terrain we fly over in Australia is flat but in the same way that we look at the ground for clues as to where thermals might trigger, we should look for significant landmarks to aid our navigation. Like using a bread-crumb trail, we can fly from landmark to landmark, always remembering that when we return, the sun will be lower and we'll be approaching from the opposite side and the landmarks may look quite different.

- By watching our drift across the ground when circling, the pattern of wind on water, drifting smoke or the shadows of clouds moving across the landscape, we can get clues as to the wind direction. These elements help us build a mental picture of where we are as we fly. If we rely only on GPS and forget to note all these details, we'll get lost more easily!
- What this means is that we should all fly with current charts and use our GPS, glide computers and EFBs to update our position on the chart. We should not rely on unapproved electronic navigation aids as primary in-flight tools.

Flying from A to B

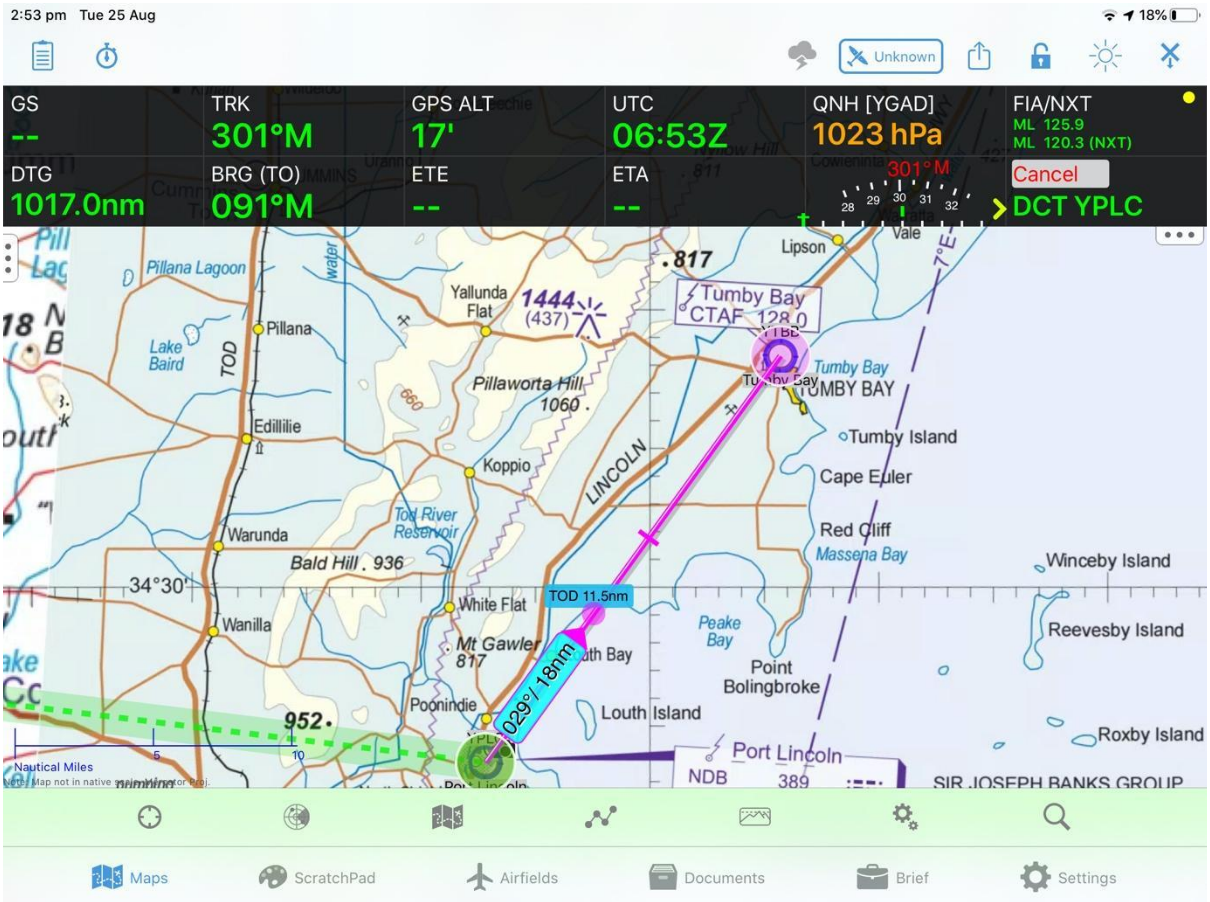
- At some time, you're going to want to fly to somewhere far enough away that you can't see it. You can get the distance and bearing from a chart or by entering its waypoint on a GPS or glide computer.
- Many experienced navigators draw their course on a map, either in pencil or with a removable felt tip on a plastic laminated map before launching.

How to measure distance and track on a WAC chart

Distance

- As each small division along the line of longitude (lines going north south) is 1 NM it's quite easy to determine the distance between two points. A scale of 1:1,000,000 on a WAC Chart means that each mm measured on the map is 1km distance. Your Trainer will demonstrate this to you.

Track



- Above we see an example of a track drawn between two points. To measure the track, we need a protractor which is lined up with the line of longitude to give us 029 degrees (True). Your Trainer will show you.
- If we look just to the right of our track, we see a dotted line and at the top is says 7E.
- This is the compass variation in this area indicating the difference from True North to Magnetic North. As it's indicating 7 degrees (E) East we have to subtract this figure from our measured track of 029 giving us 022 (Magnetic) to steer on our gliders compass.
- If you fly this heading using your compass and if there's zero wind (which is hardly ever) and you fly accurately, your glider's Track will be the same as the line on the chart.
- Since there's almost always some wind, and you'll drift while cruising and circling, your Heading, or the direction in which the glider is pointing is hardly ever the bearing you read off the chart. You will need to offset your heading to compensate for the drift due to the wind and any excursions when thermalling.
- Steering to a compass heading is quite difficult, so pick a large distant landmark on your chart that is close to the right bearing shown on the chart and keep the glider tracking more or less at that until you are close enough to pick another landmark further away.

- It doesn't matter if the point you pick is not exactly on the right track. Most pilots can't fly that accurately and you'll almost certainly have to correct for drift due to the wind. At least you will be looking out of the window rather than staring into the cockpit.
- As you get close to one chosen landmark, pick another large landmark further along your course and track for that.
- When flying gliders cross-country, we have a few differences compared to powered aircraft. We're going to spend a significant percentage of our time circling and if there's any wind at all, we will drift downwind with the thermal when circling.
- Gliders are quite capable of flying cross country at well over 100 kph average speed. Combine that with the fact that we generally fly from thermal to thermal rather than in straight lines, and you can see that navigating in a glider is an interesting challenge.
- In-flight navigation is done with a combination of instruments like compass, paper charts, GPS and our mental map, most of which needs to be prepared in advance.
- Unlike many other countries with active aviation, almost all Australia's population centres are close to the coast and the inland areas, though great for gliding, are not that interesting to most aviation cartographers.
- What this means is that for flights under Visual Flight Rules (VFR) the detailed aviation charts are coastal. If you want VFR charts of the inland, they're probably going to be WAC or VNC charts.

Search and Rescue. (SAR)

- The purpose of the SAR organisation is to provide assistance to aircraft in distress and to search for, provide aid to and organise the rescue of survivors of aircraft accidents and forced landings (Extract from AIP Australia).
- Responsibility for the overall coordination of SAR action rests with Australian Search and Rescue (AusSAR). Gliders are recognised as being a somewhat special case for SAR, as they generally operate under the close supervision of gliding clubs. Part of the SAR process is therefore left to clubs to organise in the way best suited to the mode of our operations. Only if the club is unable to achieve the required result is the SAR organisation called upon, in the form of the Canberra-based Rescue Coordination Centre.

SAR Phases

- There are three phases of SAR action, in ascending order of urgency. The following descriptions apply to gliders and differ somewhat from the requirements which apply to powered aircraft.
- Successful SAR assumes that someone knows where you were heading and is expecting you to return. If you don't tell anyone then no one will come looking. Not a great position to be in. They also need to know where you are expecting to fly to, so if you say that you are heading towards Town A but then change your mind and head in the opposite direction, SAR will never find you. So make sure you let people know when you change your plans.

Uncertainty Phase (INCERFA)

- This phase is declared when a glider cannot be accounted for. The glider may have outlanded and the pilot may be safe, lack of communication with base being caused by a flat radio battery and/or a long walk to the nearest telephone. On the other hand, the pilot may have been injured or incapacitated in an outlanding which did not go according to plan.

- Whatever the eventual explanation for the glider being missing, the club organisation cannot take a chance on a pilot's life. Given the nature of cross-country glider operations, a compromise has to be reached between over-reacting to an overdue glider and taking action to preserve life. The compromise in the case of gliders is that, having exhausted all possible avenues of trying to find out what has happened to the glider, the AusSAR organisation must be alerted at 2100hrs (9pm) local time regardless.
- When the club or your crew has done all it reasonably can and the SAR system is finally notified, the INCERFA phase is initiated. During this phase, everything possible is done to ascertain the whereabouts of the glider, based on information on its last known position and intended track. Actions will include telephone contact with police stations in the vicinity of the known track, the police then venturing out to search for the missing glider and crew, asking around local farms, pubs, etc, to get all the information they can. Broadcasts on local radio stations are also used. These actions have a high success rate in locating the glider or its pilot(s).
- If the Uncertainty phase fails to turn up any information on the glider or its crew, the next phase is declared, viz. the alert phase.

Alert Phase (ALERFA)

- This phase is declared when, following the uncertainty phase, all checks and enquiries fail to locate the glider or its crew. Actions may include an air search (usually initiated the next day at first light, for obvious reasons), or an extended ground search based on the possibility of a local resident seeing or hearing something unusual.
- Although the SAR action has been handed over to the Rescue Coordination Centre (RCC), the gliding club's assistance will probably be called upon, possibly in the form of a tug aircraft to take part in the search. If this is the case, those gliding personnel will be under the overall control of the RCC and will be expected to cooperate fully.
- There may be a fine line between the ALERFA and the next phase of SAR, which is the distress phase.

Distress Phase (DETRESFA)

- SAR action enters this phase when there is reasonable certainty that the glider and crew are threatened by grave and imminent danger and require immediate assistance. It may occur that a club knows or has every reason to suspect that the glider is in deep trouble right from the time they realise it is missing, in which case the SAR number should be contacted without delay. This initiates the distress phase immediately.
- A call on the number shown below will initiate the SAR action you require.

1800 815 257

- Civil SAR Units include local charter operators, Royal Flying Doctor Service, aero clubs, police air wings and other state-based agencies. They represent a first-response capability. All have access to trained observers, and dropmasters if supply-drops are required. If additional civil resources are required, these are chartered from local aircraft operators.

Survival Tips

- Flying in remote areas carries a number of possible risks, For further details review the survival tips in included in ERSA and in the ***GFA Airways and Radio Procedures Manual***.
- Cross-country flying in Australia can take a pilot across some very inhospitable terrain. Combined with summer temperatures in the high 30s or low 40s, this makes survival a real problem if the pilot is forced to outland.

- There are some Designated Remote Areas (DRAs) in Australia, which are obviously hazardous places to be and demand certain precautions to be taken. However, some areas which have not been traditionally regarded as remote can also be hazardous if not treated with the right attitude of mind. An example of this is the tendency in recent years for pastoral properties to be abandoned and homesteads which look inhabited from the air turn out to be deserted. This can raise the prospect of a walk of several kilometres in searing temperatures in order to reach habitation.

Before Flight

- Sensible precautions which can be taken before flight include the following:-
- Make a detailed flight plan and ensure that you leave those details with someone at the club before you depart. "Someone" may be the Duty Instructor or it may be a relative or friend.
- As well as your usual maps and charts, take with you in the cockpit a list of frequencies carried by other aircraft such as domestic and international airliners and commuter traffic. Remember the international distress frequency of 121.5 MHz, which is monitored by most airliners and military transport and maritime reconnaissance aircraft. Don't be afraid to use this frequency if you really need to - it's better than frying in the desert.
- It sounds obvious but take plenty of drinking water with you. If flying a ballasted glider, give some thought to retaining some water ballast if forced to outland.
- An Emergency Locator Transmitter (ELT) or EPIRB or ELT is a sensible piece of equipment to carry, if venturing into remote areas.
- Even if the glider is equipped with a panel-mounted radio, an additional hand-held radio is an advantage for use in remote areas.
- White emergency strobe lights are very effective in guiding a retrieve crew to the exact location of the glider after dark.

In Flight

- Keeping in Touch.
- Gliders obviously cannot stick strictly to any particular plan, as they are dependent upon the vagaries of the weather in order to stay in the air at all. However, it makes sense to report on the radio if you find it necessary to make major deviations from your intended task. On a long cross-country flight, periodic "ops normal" calls are a good idea. These can be pre-arranged to be made on the hour, or at any interval you think is appropriate to your task.

Don't leave the aircraft

- You know that the country has been totally uninhabited for the last 100km or so, so there is no point in trying to walk anywhere. This is rule number one for survival in real outback areas - don't leave the aircraft unless you have a very good reason for doing so. You have everything you need at the aircraft, so settle down to make good use of it.

Mobile Phones

- These can be a useful tool for search and rescue purposes. They require the user to be within line-of-sight of the nearest ground antenna. This means that range is restricted with the hand-held phone at ground level, but greatly increased with height.
- On the ground, an SMS message which includes your GPS location may be able to be transmitted successfully in an area of marginal coverage, where voice communication is breaking.

FLIGHT EXERCISES FOR THIS UNIT

- A mixture of cross-country flights to demonstrate use of maps and charts, identification of airspace and radio frequencies, flight within a CTAF and compliance with procedures. This can be combined with assessment for other cross country related units.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

- Navigation is difficult under some conditions such as poor visibility and similar terrain, compounded by wind effects such as strong cross winds.
- Complex airspace and radio procedures can lead to errors unless carefully managed. Possible errors include airspace infringements, incorrect use of radio and incorrect radio Frequencies

HOW DO YOU DEMONSTRATE COMPETENCE?

- By demonstrating knowledge of Airspace classifications, and ATC clearances, SAR procedures and Basic navigation.

RESOURCES & REFERENCES

- GPC Theory Lessons #7 and #11
- Reviewing the various links contained in this Pilot Guide – ERSA, VFRG, various CASA documents
- https://www.airservicesaustralia.com/wp-content/uploads/NWS-User-Guide.pdf

SELF-CHECK QUESTIONS

- Review a WAC and VNC for your local flying area, up to 200km radius. Identify P, R, D areas, and areas with E,C,A airspace. For each area, identify the heights that you can fly in these areas.

Gliding Australia Training Manual

Pilot Guide

Unit 37

Passenger Carrying

WHAT THIS UNIT IS ABOUT

To develop the knowledge and skills to safely carry passengers.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 26 – Assessment of Competence for First Solo

COMPLEMENTARY UNITS

There are no complementary units.

KEY MESSAGES

- The carriage of passengers is a privilege not a right and the approval to do so will be determined by competence in this Unit and your Club's Operational Policies.

- There are specific legal rules about passenger flights. Failure to comply may leave the pilot or Club open to fines, sanctions and other legal actions.

- In a passenger flight, the Pilot in Command is entirely responsible for another person's safety & wellbeing.

- You must provide a through safety brief to the passenger. Ensure the passenger is aware they should report traffic they see.

- The passenger may be nervous or unwell and you must know how to handle these situations. Ensure there is a sick bag in the passenger seat.

- **THE FLIGHT IS FOR THE PASSENGER'S ENJOYMENT**

- **The passenger will tell everyone about their experience so make sure you demonstrate safety, professionalism**

- Generally, a passenger flight does not need to be more than half an hour if the person is not a pilot.

PILOT GUIDE FOR THIS UNIT

The knowledge of Conditions associated with Carriage of Passengers

- The regulations regarding passenger flying are specific in that no advertisement should take place; you are allowed to share the operational flight costs, and your passenger must not use the controls.

- Your flight is a "Joy Flight" and instruction must not be given.

- The human factors you must be aware of are:

- the need to fly accurately and smoothly; don't try to impress or show off; you must keep your passenger informed and remember the flight should be a pleasant experience.

- With the added weight of your passenger, ensure your aircraft loading and configuration is correct and the weather/environment is suitable.

- The threats and errors associated with flying with other (non-pilot) people are distractions (questions, conversation, illness, attempting maneuvers outside training).

- Consider the welfare of the passenger – flying coordinated and conservatively, ensure hydration, not flying longer than necessary. Ensure passenger health and safety needs have priority.

- Ensure that if in doubt remember the primacy of – aviate, navigate, communicate.

Passenger Briefing

You must provide a thorough briefing to the passenger that covers:

- airfield safety, safety in the aircraft (harness, canopy, controls), where to put hands and feet, what not to touch, use of FOD (cameras, phones), need for sterile cockpit during checks and critical sequences.

- Providing a thorough briefing on the wearing, aircraft egress, parachute deployment and landing (If parachutes are worn)

- A briefing on potential launch failure scenarios (such as winch launch failure) so that they may be aware of recovery maneuvers ahead of time.

- Explaining to your passenger the objectives of the flight.

- Encouraging the passenger to be part of the aircraft crew by reporting traffic they see.

- Providing hints on how to assist an anxious or nervous passenger, prior to and during flight. E.g Fresh air-keep looking out.

- Providing advice on the safe handling of the aircraft and hazardous or fragile areas to avoid touching (If the passenger is assisting in moving the aircraft on the ground after landing)

FLIGHT EXERCISES FOR THIS UNIT

You will be asked to demonstrate a passenger flight from briefing to landing.

This will involve:

- Briefing your passenger before flight. Providing information on local area landmarks, airfield/s, other traffic, weather during flight whilst maintaining good lookout, situational awareness and responding as needed to radio calls.

- At the circuit joining, briefing the passenger on the landing sequence and need to ensure harness is tight.

- Ensuring a sterile cockpit procedure in the critical flight sequences (launch, approach, emergencies).

- A demonstration of conservative and accurate flight maneuvers (including thermalling) to reduce stress on passenger.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

Problem	Solution
• Accepting responsibility for and respecting the passenger's needs.	
• Distraction from safe flying due to demonstrating or explaining what you are doing.	Explain to the passenger that there are times when you may not be able to respond. Maintain situational awareness

HOW DO YOU DEMONSTRATE COMPETENCE?

- By demonstrating you have the knowledge, skills and professionalism to safely carry passengers.
- Conducting a simulated passenger flight with your instructor as passenger.

RESOURCES & REFERENCES

- Civil Aviation Regulations 2(7A), 228 & 249
- GFA Operational Regulations 4.1.5 & 4.1.6
- Manual of Standard Procedures, Part 2, paragraph 10.5.

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Can you let your passenger touch the controls?
2. Can the passenger pay the total cost of the flight?
3. Who is responsible for your passenger's safety?

Gliding Australia Training Manual

Pilot Guide

Unit 38
Meteorology and Flight planning

WHAT THIS UNIT IS ABOUT

To develop your knowledge and skills in determining the suitability of the forecast weather for cross country flight and in setting an appropriate task for the expected conditions.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 33 Thermal sources and structure
- GPC Unit 34 Outlanding planning, demonstration and execution
- GPC Unit 36 Navigation and airspace

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 40 Cruising, speed to fly, height bands and thermal selection

KEY MESSAGES

- How to access and use weather information relevant to planning a flight.
- Weather threats such as wind, rain, thunderstorms, and dust/smoke and effect on flight planning.
- The concept of the soaring window.
- The likely cross-country speed that can be achieved based on predicted thermal strength, wind and other conditions.
- Selection of a suitable task.

PILOT GUIDE FOR THIS UNIT

Meteorology and flight planning is a very large subject – this unit is only an introduction to allow you to predict basic soaring weather for flight planning purposes. Further detail is covered in the advanced training syllabus and beyond. You'll never stop learning!

You should start conservatively – if in doubt don't fly cross country or speak with an instructor or coach. You'll also find that daily club weather briefings are a valuable resource - this is a great learning environment. Also talk with experienced pilots on the day.

Weather predictions

Weather information is available from multiple sources (including looking outside). You'll need to be familiar with these sources and have the appropriate registration and login where required.

A brief list of weather sources is:

- Looking outside!
- Bureau of Meteorology – General forecast, synoptic chart, prognostic chart, satellite images
- NAIPS area forecast (requires a free login through the Air Services website or there are apps available) – Terminal Area Forecasts, Meteorology Aerodrome Reports, Graphical Area Forecasts
- Atmospheric soundings (search BOM for "Aerological Diagrams")

- Gliding weather models (such as GFAMet (free) or subscription services Skysight and XCSkies)

Gliding weather models are seductive and not always correct. You should learn to interpret and use general weather forecasts and not rely solely on gliding weather models.

For task planning and assessment of weather hazards you'll need to predict such things as:

- Weather events and timing (fronts, wind, rain, thunderstorms, dust/smoke etc)
- Wind speed and direction during the day (at surface and selected altitudes)
- Cloud – cumulus cloud base and high cloud over the day
- Maximum temperatures over the task area
- Thermal heights
- Thermal strength
- Soaring window

Predicted versus actual. It is important to compare information from general and gliding forecasts with actual observations such as local temperatures and satellite images – look outside and don't get seduced by computer models. Are fronts/troughs/cumulus development progressing as expected?

Cumulus cloud is formed from condensation of rising water vapour forming water droplets (condensing when the dew point is reached). A useful rule of thumb is that cumulous cloud base in feet (where present) is the difference between the observed dew point and temperature multiplied by 400 – for example if the temperature is 30 degrees and the dew point is 15 degrees then cloud base will be approximately 6000 feet above the ground.

At this level predicting thermal heights and strengths from modelled and observed atmospheric soundings is not covered. This information can be found in the gliding weather models, or from talking with experienced pilots. The rule of thumb generally applies that the higher the thermals go, the stronger they are – for example often 3 to 4 knots for 4000 foot thermals, and 6 to 7 knots for 10000 foot thermals.

Similarly predicting the time when thermals start and stop (the soaring window) from first principles is not covered in this unit – this information is available from gliding weather models.

Wind has a big impact on cross country flight. In particular:

- Wind gradient and gust fronts make outlanding more hazardous;
- Your achieved cross-country speed will be lower;
- Thermals are likely to be broken and so harder to use, so slower average climb rate is achieved; and
- Increased danger in using thermals low due to turbulent gusts, wind shear and outlanding risks.

Flight Planning

Flight planning in the context of this unit is the process of using the weather predictions to plan an appropriate task. You'll need to develop an understanding of achievable cross-country speeds under various conditions and other considerations for planning a task including safety.

MacCready theory can be used to calculate achievable cross-country speed given the performance of the glider and the strength of the thermals, however for inexperienced pilots it is not necessary to understand the theory or its limitations. In any case, inexperienced pilots can only be expected to achieve speeds much lower than theoretically possible – generally due to average climb rates significantly lower than for experienced pilots. MacCready theory is covered in the post-GPC syllabus and numerous references (google MacCready theory).

What is important is to gain an understanding of what average cross-country speed you might expect given the conditions of the day. The simple task planner table at the end of this section is a tool that can be used for planning a task. The task planner provides guidance on typical achievable speeds for an inexperienced pilot flying an unballasted glider such as an LS4. The speeds indicated are good for task planning purposes – your challenge is to better those speeds on task! If there is any significant wind, then cross country speed will be reduced. A rule of thumb that can be applied is that if predicted winds are above 5 knots at flying heights, reduce the predicted average speed by about 1 kph per knot of wind speed.

Some considerations for task planning are:

1. Task time. This should be shorter than the soaring window as predicted from the weather analysis and should take into account time to climb in the first thermal and before leaving on task. You should not be too ambitious with task time. Consider landing well before significant weather events.
2. Task distance. Calculated from the predicted cross-country speed in the task time available.
3. Task waypoints. The following should be considered:
    - Airspace restrictions.
    - Areas of adverse weather.
    - If possible, fly down wind on 1st and last legs - into wind during the peak of the day.
    - Avoid flying west at the end of the day (visibility is poor).
    - Placing the airfield mid-leg minimises any retrieve.
    - Silver Distance requires flying to at least 50km from the tow release point and launch point. Be aware of other geometry requirements for badge flights.
    - Choose a task that avoids difficult outlanding terrain (or make sure enough height is available to cross) or choose a task that remains within range of suitable airfields.
    - What is the longest retrieve you are comfortable with (if needed)?

The main weather threats include wind, rain, thunderstorms, and dust/smoke. Ensure that you assess the likelihood of these weather events and consider appropriate actions to minimise associated risks. Actions may be not to fly, task in a different direction, task for a shorter part of the day, abandon the task, or simply increased vigilance. Be aware of the dangers of outlanding in difficult conditions such as strong winds or gust fronts. At all times it's always a good idea for pilots to seek advice from experienced instructors.

Ensure that you know areas of unlandable terrain in the local tasking area – speak with an experienced cross-country pilot or take a look at the terrain with Google Maps. At some sites it is advisable to fly with a database of airfields and always keep at least one within glide at all times.

Use a map or use a program such as SeeYou to plan a task within the constraints.

Review your flights

It is useful to review the cross-country speeds you actually achieved under the conditions for each cross country flight you fly. You may wish to keep the completed planner for each day to use for future reference and add some notes on what speed you achieved and how the conditions compared to the forecast.

Flight analysis applications such as SeeYou, and an increasing number of online analysis tools such as WeGlide and Online Contest (OLC), provide details of speeds on each leg of the flight, average achieved climb rate, percentage time spent thermalling etc. Flight analysis is covered under the post-GPC syllabus. If you'd like to do this earlier speak with a coach or experienced pilot to speed up your learning.

Example Task Planning Form

Simple Task Planner			Date	*12/01/2019*
Wind	Surface	2,000 ft	5,000 ft	10,000 ft
	350 / 4	*345/8*	*290 / 12*	*N / A*
Thermal Height	*6000*	Average achieved climb		*3 kt*
Cloud	*Cu + Cirrus*	(This will be less than the average thermal strength)		
Key Events	*No fronts expected.*			
Notes	*Max temp 31. More cu to north*			
Expected XC Speed			*60 km/h*	
Planned Task Time (allow for longer flight time)			*1400 - 1700*	*3 hours*
Task Length			*180 km*	
Task				
Flight review				

NOVICE XC Speeds (LS4)	
AVERAGE CLIMB	**KM/HR**
2KT	**50**
3KT	**60**
4KT	**70**
5KT	**80**

FLIGHT EXERCISES FOR THIS UNIT

Flight

You will conduct the planned flight, most likely in conjunction with flight exercises from Navigation and Airspace or Advanced soaring instruments and flight computers.

As the flight progresses, you'll be queried on your perception of the conditions encountered relative to the predicted conditions. You'll need to watch for changes such as the progression of a front, cloud and changes in wind direction and strength.

How is your task progressing relative to what you planned? Replan the remainder of the flight as necessary?

Debrief

Your flight will be recorded using a flight recorder and your coach will review the flight data. You'll look at individual thermals and the climb rate achieved for the duration of the thermal. You'll review parameters like average thermal climb rate, percentage of the time spent thermalling and achieved cross country speed.

The achieved heights, thermal strengths and weather will be reviewed against the forecasts for the day and possible reasons for variations will be discussed.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
Incorrectly setting task distance	Incorrectly predicting the wind and or thermal strengths/heights over the soaring window Incorrectly estimating likely task speed with your experience in the predicted conditions Not factoring in the time from launch to leaving on task
Choosing an inappropriate task	Unfamiliarity with local conditions, terrain and airspace

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate accessing relevant weather information for the local area
- Predict
    - Wind speed and direction at different times and heights
    - Cloud layers
    - Thermal heights, strengths and the soaring window
- Describe weather threats and mitigation strategies
- Predict cross country speed
- Plan suitable task distance and suitable waypoints

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Why is it important to compare observed conditions with predictions?
2. If the observed ground temperature is 27 degrees and the observed dew point is 11 degrees, at what approximate height above the ground is cloud base (assuming clouds will form)?
3. What is a soaring window?
4. What average cross-country speed would you expect to achieve in an LS4 with 4 knot average climbs with 15 knots of wind?
5. If the soaring window is from 11am to 4pm, what would be a reasonable task distance in an LS4 with the above conditions?
6. What average cross-country speed would you expect to achieve with the above conditions in the glider you normally fly?

TASK PLANNER

Simple Task Planner			Date	
Wind	Surface	2,000 ft	5,000 ft	10,000 ft
Thermal Height		Average achieved climb		
Cloud		(This will be less than the average thermal strength)		
Key Events				
Notes				
		Expected XC Speed		
		Planned Task Time (allow for longer flight time)		
		Task Length		
Task				
Flight review				

Novice XC speeds (LS4)	
Avg Climb	km/h
2 kt	50
3 kt	60
4 kt	70
5 kt	80

Gliding Australia Training Manual

Pilot Guide

Unit 39

Advanced soaring instruments and flight computers

WHAT THIS UNIT IS ABOUT

To develop your knowledge and skill in the use of modern flight computers without degrading your lookout and situational awareness.

The focus is on moving map flight computers, including personal devices such as the Oudie and mobile phones.

You should become familiar with the operation of the devices you will use and apply the concepts outlined in this unit.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 38 Meteorology and flight planning

KEY MESSAGES

- You need to think and look ahead.
- Flight computers can be a distraction from the tasks at hand and degrade your performance.
- Flight computers display accurately what's happening now and in the past. Predictions of finish height, ETA etc. are based on assumptions of climb rate and winds.
- Flight computers can display a huge amount of information - only relevant or useful information should be displayed.
- The display should be uncluttered to allow relevant information to be seen clearly and quickly.

PILOT GUIDE FOR THIS UNIT

Electric Variometers

Electric varios have been around for a long time and are gradually replacing mechanical varios. They display instantaneous vertical movement of the glider but, to varying degrees, still suffer from the same lag and gust sensitivity limitations.

They offer many other advantages over mechanical varios including:

- Averaging of the instantaneous vertical climb/sink rate (averager)
- Netto and relative netto
- Configurable parameters such as total energy compensation based on a mix of the total energy probe, pitot, GPS and inertial sensors
- Speed to fly information
- Many other display features blurring the distinction between varios and flight computers

Figure 1 - the LX S100

Averagers display a moving average of climb rate over the last 20 to 30 seconds (often configurable). They provide a much better indication of climb rate than the instantaneous reading.

Netto vario modes display the movement of the air mass the glider is flying through. It's calculated by subtracting the sink rate of the glider from the instantaneous reading of climb or sink. To do this the gliders polar needs to be correctly configured in the instrument and other settings need to be entered such as the weight and performance degradation due to bugs or rain etc.

Relative netto is a variation that calculates and displays the climb rate that would be achieved at thermalling speed; however given the inherent vario lag and gust sensitivity (ref GPC units 30 and 31 on thermal centring and thermal entry) relative netto is not particularly useful.

With the exception of the basic averager more advanced functions of electric varios require configuration and will give incorrect information if not correctly set up. Speak with your airworthiness inspector if you are unsure.

Flight Computers

There are many types of soaring flight computers available ranging from enhanced electronic variometers (such as the S100, Eos), to apps running on mobile devices (such as Oudie, XCSoar, SeeYou Navigator), to full up flight computers (such as the LX9000, Zeus and ClearNav). This unit can't cover the breadth of these devices, and nor is it appropriate for an in-experienced pilot to use many of the features – you should learn to fly cross country using the basics first then move on to the fancy devices if you wish.

All devices have a manual – read the manual to become familiar with the basis features of the device(s) you will be using. However you'll most likely learn best by actually setting up and using the device, much of which can be practiced on the ground. Most devices have a simulator that can be run on a computer – these are a great way to practice use of the device. If you have access to a gliding simulator with an appropriate flight computer these are a great way to practice before flying.

Figure 2 - Oudie flight computer with simple uncluttered display

At a minimum, before you fly, you'll need to understand how to set up and use the following features:

- Configuration of the glider polar and connection to other devices
- Enter a task, start the task navigation, move to the next waypoint etc
- Set the MacCready setting (assumed climb rate), ballast and bugs
- Configure airspace boundaries and warnings and understand how this information is presented in flight
- How wind strength and direction is calculated and displayed
- Display of required track and actual track
- Distance and bearing to next turn point
- Finish height or final glide data, including setting a safety height above the ground to finish the glide

Task predictions and speed to fly information are based on MacCready setting (MacCready theory is introduced in GPC unit 40 – Cruising, speed to fly, height bands and thermal selection). This MacCready setting is typically manually set, but in some instruments can be automatic. It is recommended that you start with a manual and conservative setting – for example if you expect your next climb to average 4 knots then set MacCready to 2 knots. The MacCready setting makes a large difference to the prediction of Expected Time of Arrival (ETA) and arrival height.

Notes

- Be aware that flight computers will distract you from other tasks such as maintaining good lookout. Screen time should be kept to a minimum – this can be achieved by ensuring that only the required information is presented and that you are well practiced in using the device. Where increased screen time is unavoidable, such as reprogramming a task, this should only be conducted after moving away from other aircraft, conducting a full scan lookout with a 180 degree turn, and then regular full scans. Break longer tasks into smaller sub-tasks and conduct a full scan between each sub-task.
- Incorrect interpretation of the information displayed can lead to errors such as misjudging final glides or infringing airspace. In addition, configuration of flight computers is complex and misconfiguration may give erroneous results, potentially impacting safety. You must be familiar with the use of the device, be aware of limitations and the potential for incorrect setup; basic setup problems include such items as incorrect glider polar, weight, airspace, and task. This should be practiced on the ground.
- Even with correct configuration, predictions by a flight computer are dependent on history and assumptions about future events. For example the flight computer won't know about wind changes and changes in flight conditions ahead – so ETA and final glide height may be incorrect.
- When cruising, use the flight computer to get the correct direction and pick a point in the distance to fly towards. This allows navigation with infrequent looks at the computer.
- While thermalling, check the computer's wind vector by comparing it to the snail trail on the screen. To achieve this, set the screen to zoom-in while thermalling.
- Focus on lookout when approaching the start, turn points and finish line.

FLIGHT EXERCISES FOR THIS UNIT

You'll be asked to check the configuration on a flight computer and set up a task it. Before you fly, make sure that you are familiar with the main functions, can use it for navigation and can correctly interpret arrival height information. In the air make sure that you maintain good lookout at all times. You'll be queried on some of the information displayed and the validity of the assumptions.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
Distraction with flight computers resulting in poor lookout	Lack of familiarity with use of flight computers Lack of discipline with dividing on-screen tasks into small units
Relying too much on the information displayed	Lack of understanding of the underlying assumptions and calculations used by flight computers Incorrect configuration of the flight computer

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe
  - Averager and netto modes of electric variometers
  - The purpose of relevant items shown on flight computer pages and at what stage of the flight each item is of use
  - The basis on which flight computer predictions of wind, ETA and arrival height are made
- Demonstrate
  - Setting up a task and parameters on the ground
  - Navigating a task and adjusting parameters (such as thermal strength) in the air
  - Excellent lookout with minimum "screen time"
  - Correct interpretation of the information displayed

RESOURCES & REFERENCES

- Flight computer manuals and device simulators

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What does the netto mode of a vario display?
2. Why is it important to configure an electronic variometer?
3. Why is it important to configure a flight computer?
4. How is wind typically calculated?
5. What are the main assumptions used for calculating ETA and arrival height?
6. Why is it important to divide in-flight changes on a flight computer into small tasks?

Gliding Australia Training Manual

Pilot Guide

Unit 40

Cruising, speed to fly, height bands and thermal selection

Unit 40 – Cruising, speed to fly, height bands and thermal selection

WHAT THIS UNIT IS ABOUT

To develop your skills and ingrained habits in selecting a path through the air that improves achieved glide performance; selecting and maintaining an appropriate speed to fly; using height bands to manage risk in terms of locating the next thermal; and choosing which thermals to accept.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 39 Advanced soaring instruments and flight computers

KEY MESSAGES

- Aim to fly a track through rising (or less sinking) air to improve glide performance and maximise the chance of finding the best climbs.
- The speed to fly should be based on the expected conditions ahead, not the last thermal.
- Cruising strictly to MacCready speed to fly theory is inefficient and impossible to achieve - use block speeds (plus or minus 10 knots) that approximate MacCready speeds.
- Don't take every thermal unless necessary - be selective with thermal strength and avoid wasting time by centring too many thermals.
- Don't climb to the top of each thermal - leave when you think the next climb will be better (or to remain below cloud).
- Divide the convection height into three bands: in the top band cruise fastest and only take strong climbs; in the middle band cruise more conservatively and be prepared to take weaker climbs; below 2000 feet prepare for an outlanding and stay within reach of an appropriate landing site while searching for a climb.
- Transition from a soaring pilot to a landing pilot with sufficient height for a safe circuit.

PILOT GUIDE FOR THIS UNIT

This GPC unit introduces the final cross-country elements of the GPC syllabus. It covers appropriate track and speed for cruising, height bands and thermal selection, and a very basic introduction to final glides.

Cruising – Track selection

Cruising efficiently maximises your chances of finding the best thermals, reduces the number required and increases your average rate of climb. You'll be more efficient if you select a pathway that optimises the amount of time you fly through rising air.

This is most easily done when cumulus clouds can provide guidance to where lift will be – look to run along streets wherever possible as long as good progress is being made on task. On blue days the same pathways still exist but you have to rely on your feel for all of the improvement. This takes concentration and practice. Choose pathways that keep you generally on track – deviating more than 30 degrees is often a disadvantage. Always deviate upwind instead of downwind given an equal choice. (Ref GPC units 33/36/38)

Looking 20-60km ahead enables you to pick better lines of energy and identify if weather is improving or getting worse. Learn to recognise the best looking cumulus clouds, or feel for lines of rising air in the blue. The feel of the air will be assisted if you maintain a constant speed, the glider is trimmed, and you have a light grip on the stick. If required, fly a little slower in order to feel the air between thermals and identify lines of reduced sinking air.

Height Bands

Considering height bands is a way to determine when you can fly faster and when you should slow down so as to avoid getting low. It is a way of determining risk and acting accordingly.

For simplicity, nominate 3 bands of 1/3 available convection height. You should fly faster in the top height band and slower in the lower bands.

You should stay in the top height band if possible, but extend the glide and only thermal when you find a suitable thermal or as you approach the bottom of the height band.

Note the bottom 2,000' of convection should always be in the bottom band. This is the height where you should be planning and preparing for an outlanding, selecting and staying within reach of an appropriate paddock – Transitioning from a soaring pilot to a landing pilot. (Ref GPC units 15/16/34)

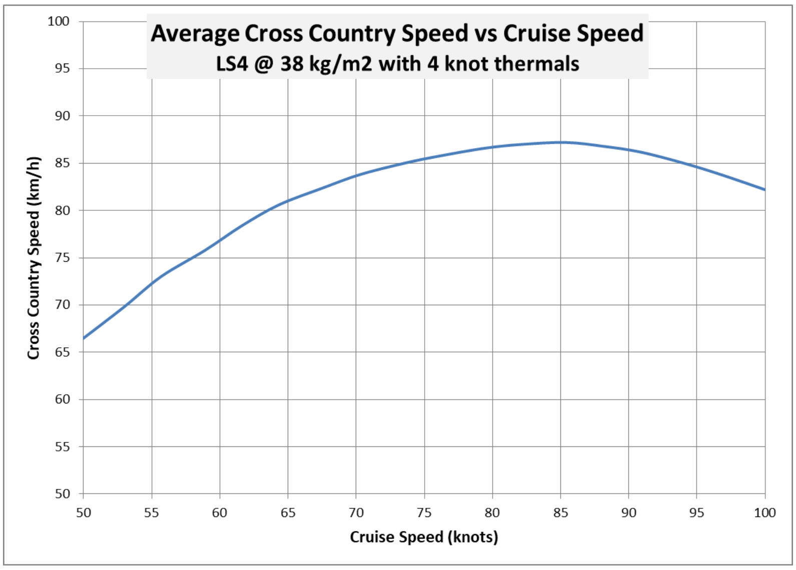
Speed to Fly

Cruise speed is important for achieving the best cross-country speed. Flying at minimum sinking speed makes your flight longer but you don't travel very far. Flying at the best glide speed gets you a little further, but it takes more time to get there. And if you fly too fast you'll lose too much height.

Generally you should maintain suitable speed (typically 60-80 knots without ballast) depending on height band and achieved rates of climb.

MacCready theory (developed by Paul MacCready in the 1950s) defines, based on the polar performance curve of the glider, an optimal cruise speed given the strength of the next thermal and the air the glider is cruising through. The theory states that your cruise speed should be faster with strong climbs and should vary based on the sink or lift that you fly through – faster in sink and slower in lift. MacCready theory is explained in many books and online resources – it's not essential that you understand the theory from first principles.

Based on MacCready theory a curve such as shown in the chart below can be derived to show average cross-country speed versus cruise speed. You can see in this typical case, for an unballasted LS4, that the cross-country speed achieved varies by only a small amount when cruising 10 knots faster or 10 knots slower than the theoretical optimum speed.



MacCready speed to fly theory is theoretically sound but is almost impossible to accurately fly, and constantly changing speed is inefficient. Since plus or minus 10 knots cruise speed does not make much difference 'block speeds' are used that approximate MacCready speeds. In the case of the unballasted LS4 the theoretical block speeds are approximately 70/85/90 knots if your next thermal is 2/4/6 knots respectively; however if you cruise at these speeds you'll find it hard to feel the air, it's much harder because everything happens faster, and you're likely to get low. The table below shows more appropriate LS4 cruising block speeds for typical weak, medium and strong thermals, and depending on the height band (see next section). As you become more experienced you can increase these speeds by up to 5 knots.

Block Speeds – Unballasted LS4		
Thermal strength (your average climb rate in the thermal)	Cruise Speed *Mid height band*	Cruise Speed *Upper height band*
2 knots	55 knots	65 knots
4 knots	70 knots	80 knots
6 knots	75 knots	85 knots

As a rule of thumb, cruise at 75 knots between thermals. You can vary this by plus or minus 10 knots depending on height and thermal strength. If you fly through an extended area sink you should increase your speed by up to 10 knots, similarly decrease your speed when flying through an extended area of lift.

Adjust these speeds a few knots slower if you fly a lower performance glider than the LS4 and faster if you fly a higher performance glider. Ballast has a large impact on cruise speed and will be discussed in the Advanced Training Syllabus.

Remember, the speed to fly is based on the expected conditions ahead, not the last thermal.

Thermal selection

You can fly though a number of thermals without stopping to thermal, just absorbing energy as you pass through rising air. Your aim is to stay in the top height band and only climb in the strongest thermals. You shouldn't get low and have to take a weak thermal.

Taking each thermal as you progress is not efficient because it takes time to centre the climb and your average rate of climb is therefore reduced.

On finding a thermal your decisions are:

- am I likely to hit a stronger thermal before falling out of the bottom of the height band if I keep going?
- If the answer is yes then keep flying, otherwise stop and thermal.

If you aren't sure, sample the thermal:

- if it builds as you start your turn then there is a good chance that you'll centre the thermal quickly with a better average climb rate;
- if it doesn't feel good consider moving on.

Once centred in a thermal stay with it until you reach cloud base (maintaining VMC), or you expect the bottom of the next climb to be stronger than your current climb rate. It's rarely appropriate to keep climbing in weak lift near the top.

Final Glides

Final glides are not covered in detail in the GPC syllabus. There's no problem in taking your last climb to the top so that it is obvious that you'll get home with plenty of height to spare. Be wary of final glide information from flight computers – configuration is error prone and there are many assumptions that can get you into trouble *(Ref GPC unit 39).*

There is an old rule of thumb for final glide height: allow 1000 feet per 10 km plus the safety height for you to do a circuit. This works for most gliders and slower cruise speeds as long there isn't significant headwind or sinking air. If in doubt, climb higher.

At a constant cruise speed you may be able to see your destination move on the canopy in the same way as an aiming point for final approach – if it moves up the canopy you are below glide. With a final glide computer it is useful to display the required L/D (glide ratio) to your destination (with the safety height). If this number decreases you are improving on the glide.

If you think you are falling below glide, take another thermal – simply slowing down to increase the glide angle rarely works. Allow yourself plenty of height to complete a safe circuit, hopefully at the home airfield but always be prepared to outland if you don't make it home.

Safety

Review the threats and mitigating actions identified in the Pilot Guides 'Soaring with other gliders', 'Outlanding planning, demonstration and execution' and 'Navigation and airspace'.

It is extremely important to transition at the appropriate time from a soaring pilot to a landing pilot and allow sufficient height for a full circuit. If you get low on final glide there is a temptation to try to stretch the glide to the airfield – don't do this! Make an early decision to find a thermal and plan for a possible outlanding. Pay attention to possible unlandable terrain when flight planning and select your track to avoid flying over it.

As always, maintain good lookout at all times.

FLIGHT EXERCISES FOR THIS UNIT

Your coach will demonstrate cruising and thermal selection. They will discuss their choice of track and cruise speed, and the height bands appropriate for the current conditions. Remember that the appropriate height bands will likely change during the flight as the conditions change.

You'll then have an opportunity to practice all the elements of this unit.

Key skills are flying in the direction of track, aiming for a good thermal or thermal source, and maintaining the set cruise speed. Monitor these three elements.

Make sure you maintain lookout and trim the glider appropriately.

You can then move onto feeling for better air in the cruise. Fly at a slower speed to get better feel if necessary.

Note the height lost in reaching the next thermal and monitor this for subsequent glides. As the glider descends to the next height band, reduce your cruise speed and put a greater focus on finding a thermal.

There is a lot to cover, and this is likely to take more than one flight to become reasonably proficient. The advanced training syllabus will cover all the elements in far more detail.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
Losing too much height in the glide	Not selecting and following an appropriate track
Cruising speed too slow or too fast for the conditions	Incorrect understanding of appropriate cruise speed Not considering the height band and looking at the conditions ahead Inattention to cruising speed
Limited ability to feel the air	Cruising too fast
Taking every thermal regardless of strength	Not selecting thermals in accordance with the selection criteria (is the next thermal likely to be better?)
Climbing in weak rising air at the top of a thermal	Not leaving when the next thermal is likely to be better

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate looking to the distance on track to identify several thermal sources and/or cumulus clouds and following a pathway through these to maximise the chance of finding thermals
- Demonstrate identifying and following a pathway through areas of rising air to extend glide performance whilst making progress on task
- Identify appropriate height bands for the conditions
- Demonstrate consistently determining and adjusting cruise speed based on height band and expected conditions
- Demonstrate maintaining the nominated speed throughout the flight +/- 5 knots
- Identify the thermal strength required appropriate to the height band and conditions
- Demonstrate selecting only thermals that meet criteria
- Identify sufficient height for final glide
- Demonstrate monitoring glide and taking appropriate actions

RESOURCES & REFERENCES

- G Dale. ‘The Soaring Engine – volume 1’, Chapter: Flatland soaring
- G Dale. ‘The Soaring Engine – volume 3’, Chapter: Flying

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What is the maximum track deviation angle you should generally fly?
2. Why should you not closely follow the theoretical best cruise speed from MacCready theory?
3. If you are flying an LS4 at 3500 feet on a day when the top of the thermals is 6000 feet and you expect your next climb to average 5 knots, what would be an appropriate cruise speed?
4. What are the three key decisions when encountering a thermal? (Refer to GPC Unit 31)
5. When should you leave a thermal?
6. If you are 30km from your airfield and want to arrive at 1500 feet, approximately how high would you expect to need to be without significant wind?

Gliding Australia Training Manual

Pilot Guide

Unit 41

Demonstrated Cross Country Capability

WHAT THIS UNIT IS ABOUT

To evaluate your capability to combine the GPC competencies to safely plan and achieve cross country flight in thermals.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 40 Cruising, speed to fly, height bands and thermal selection

KEY MESSAGES

- For safe and successful cross-country flight good pre-flight preparation is essential.
- In-flight choice of route, thermals and cruise speed must be constantly re-evaluated with consideration of weather, terrain, outlanding options and airspace.

PILOT GUIDE FOR THIS UNIT

Demonstrated Cross Country Capability is an assessment unit following completion of the cross-country syllabus portion of the GPC. You will be observed in all aspects of flight planning and flying a cross country with your coach in a two-seater.

You'll be assessed on your flight planning and the conduct of the flight. Your planned cross-country flight need not be long but must include at least two waypoints well beyond glide of the departure airfield given the anticipated conditions of the day.

Note that if flight planning is not completed to a suitable proficiency, then the flight assessment will not be conducted until you undertake further training and can demonstrate proficient flight planning.

Your flight planning and flight should be competent and safe. You've learned a lot of new cross-country concepts – it's not expected that you'll get everything right on the flight. However, lapses in lookout will require remedial training. Be aware that your lookout may deteriorate in high stress situations and when distracted by multiple task such as navigation and using a flight computer.

Congratulations on reaching the end of the cross-country training in the GPC syllabus. Your cross-country training opportunities don't stop there! The Advanced Training Syllabus will cover all of the cross-country topics in more detail and introduce many more topics, such as meteorological navigation, mountain flying and competitions.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
Lapses in proficiency of previously trained cross-country competencies	Limited multitasking ability – this will improve with time but performance related to safety must not be compromised

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate satisfactory flight planning considering at least
  - personal preparation
  - meteorology
  - airspace and radio frequencies
  - obtaining NOTAM
  - safe outlanding options and trailer/crew arrangements
  - task setting, task declaration and official observer awareness
  - flight computer programming
- Demonstrate
  - Effective lookout throughout all stages of the flight
  - Proficient navigation and choice of route considering thermal sources, weather and airspace
  - Safe consideration of outlanding options
  - Appropriate decisions on when to take thermals and when to leave
  - Safe entry to thermals and centring within 2-3 turns
  - An appropriate cruise speed relative to anticipated climb rate and height
  - Competent use of a flight computer

Gliding Australia Training Manual

Pilot Guide

Unit 42

Daily Inspection, Pilot Maintenance Limits,
DI Certificate

Unit 42 - Daily Inspection, Pilot Maintenance Limits, DI Certificate

WHAT THIS UNIT IS ABOUT

To develop the skills and knowledge required for assessment and examination by an authorised Daily Inspector (DI) Examiner:

- To perform a daily inspection on a glider;
- Including elements of pilot maintenance within approved limits, and;
- Correctly complete the DI Certificate.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC 25 Threat and Error Management;
- GPC 24 Human Factors and Pilot Limitations;
- GPC 3 Pre-flight Preparation

COMPLEMENTARY UNITS

- There are no complementary units

KEY MESSAGES

- Human factors matter. Self-discipline and avoidance of interruptions and distractions are critical to correct daily inspections. If interrupted, start again.
- Use the checklist in the Daily Inspection Schedule in the Maintenance Release.
- Know the glider. Check the type-specific manuals. Seek advice from others with experience of inspecting that glider type.
- Beware of airworthiness problems and risks associated with poor ground handling.
- Pilot safety depends upon Airmanship, Airworthiness discipline and Standards.
- Near enough is NOT good enough, she'll be right is NOT right. Cavalier attitudes towards airworthiness and maintenance may have serious safety consequences.
- A signed Daily Inspection by a qualified inspector certifying an airworthy glider is a prerequisite for flight. No exceptions.
- A signed Daily Inspection certifying an Independent Control Check after disconnection and reconnection of controls is mandatory. No exceptions.
- Look at the glider from a distance first, and flight control functionality, checking major airworthiness defects before examining the detail.

PILOT GUIDE FOR THIS UNIT

The DI training

- All solo pilots should aspire to qualifying for a Daily Inspection (DI) Certificate. Once you are flying solo having DI certificate provides more independence as you no longer need to wait for someone else to do this task.
- There are various levels of qualification related to aircraft inspection, which includes the pre-flight walk around inspection, Daily Inspection (DI) and the Annual Inspection (Form 2). The DI certificate authorises you to inspect and approve the glider for flight on any one day, and record this in the Maintenance Release.
- The DI Certificate also approves you to conduct a number of basic maintenance activities on the glider.

Training to qualify for a DI Certificate

- You will be asked to assist your instructor with daily inspection on your training glider. There is a lot to learn so you should carefully observe the DI on a number of occasions. You will then be invited to assist with the DI, under the supervision of the instructor.
- Your club will offer opportunities to participate in a range of activities:
    - 'Ground school' sessions on airworthiness documents and references, rigging and control connections, common defects and errors, relevant accidents and occurrences.
    - 'Ground school' sessions on human errors and biases, human factors, threat and error management, in the context of both daily inspection and pilot maintenance.
    - Supervised participation in pilot maintenance, defect repairs, annual inspections, glider de-rigging and rigging evolutions and post-rigging checks.
- Once you have gained experience you can receive Airworthiness education, training and examination from an authorised Daily Inspection Examiner.

Pilot Maintenance Training

- It is essential that solo pilots and Daily Inspectors understand the limits of allowed pilot maintenance. These are defined in the DI Handbook (and MoSP Part 3 Airworthiness and CASA regulations).
- Daily Inspectors may carry out and certify the following maintenance:
    - Inflate tyres (under inflation must be rectified before flight);
    - Change main wheels, tyres, tubes and brake shoe plates by exchange with serviceable item(s) or replacement of parts, including fitting axle nut split pins & brake shoe bolt lock-wiring (in the case of a hydraulic disc brake slave cylinder) under supervision from a Form 2 inspector.
    - Adjust cable actuated wheel brakes for better braking;
    - Change nose- and tail-wheels, tyres and tubes;
    - Secure removable ballast;
    - Clean out the fuselage and other components;
    - Replace simple gap tape – fixed surface to fixed surface, e.g. fuselage to wing junction;

- Polish canopies using appropriate materials and processes;
- Remove or replace instruments (other than the ASI and altimeter) where this does not affect the pitot-static system, e.g. TE driven variometer; g meter, navigation display;
- Install and remove/replace batteries;
- Perform Independent Daily Inspections after re-rigging gliders;
- Lubrication as appropriate;
- Change or amend placards under instruction
- Change worn skid shoes and plates.

- It is self-evident that students must be supervised in carrying out these activities, by instructors, airworthiness officers and Form 2 inspectors as appropriate, until they are deemed competent in these tasks and hold a Daily Inspection rating.
- The principle here is: If you are not sure what you are doing, then do not undertake the matter on your own. Rather take the initiative and find competent assistance so that you have appropriate supervision while conducting the task, or that the other person carries out the task while you observe, assist them and learn from them.

THREAT AND ERROR MANAGEMENT

- Human Error may drive many non-airworthy conditions, including:
  - Flight with disconnected, obstructed or incorrectly adjusted controls;
  - Flight with mis-rigged pins and safety devices;
  - Flight with major defects not cleared;
  - Flight with Daily Inspection not completed and signed;
  - Flight with electrical, avionics, fuel, engine management and ancillary systems not correctly configured or functional.
- Pilots may rush inspections and checks may be less thorough. They may also be inclined to downplay the significance of a minor defect. Self-discipline is critical to safety outcomes.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Solution**
• Not knowing what “correct” looks like for the glider you are flying	Study the Aircraft Flight Manual Seek guidance from a qualified DI Inspector/Examiner
• Distraction by other people	Ask others not to interfere until you have finished the DI.

HOW DO YOU DEMONSTRATE COMPETENCE?

- Describe the key elements of the GFA Glider Airworthiness System.
- Conduct Daily Inspections under direct supervision of Instructors and DI Examiners.
- Describe the implications of entries made, or missing, in the Sailplane Maintenance Release and Daily Inspection Record;
- Describe the airworthiness implications of defects, disconnections, obstructions, incorrect functionality, incorrect adjustments discovered during DIs that require judgement of potential non-airworthy conditions.
- Conduct allowed pilot maintenance actions on minor defects under supervision
- Recognise non-airworthy conditions.
- Complete a Daily Inspector Examination.

RESOURCES & REFERENCES

- Aircraft Flight Manual
- You should study the GFA “Daily Inspectors Handbook” available on the GFA web page under MOSP 3 under Documents.

http://doc.glidingaustralia.org/index.php?option=com_docman&view=download&alias=1185-air-d0010-di-handbook&category_slug=di-handbook-sailplanes&Itemid=101