

Gliding Australia Training Manual

Pilot Guide



Unit 30 Thermal Centring Techniques

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

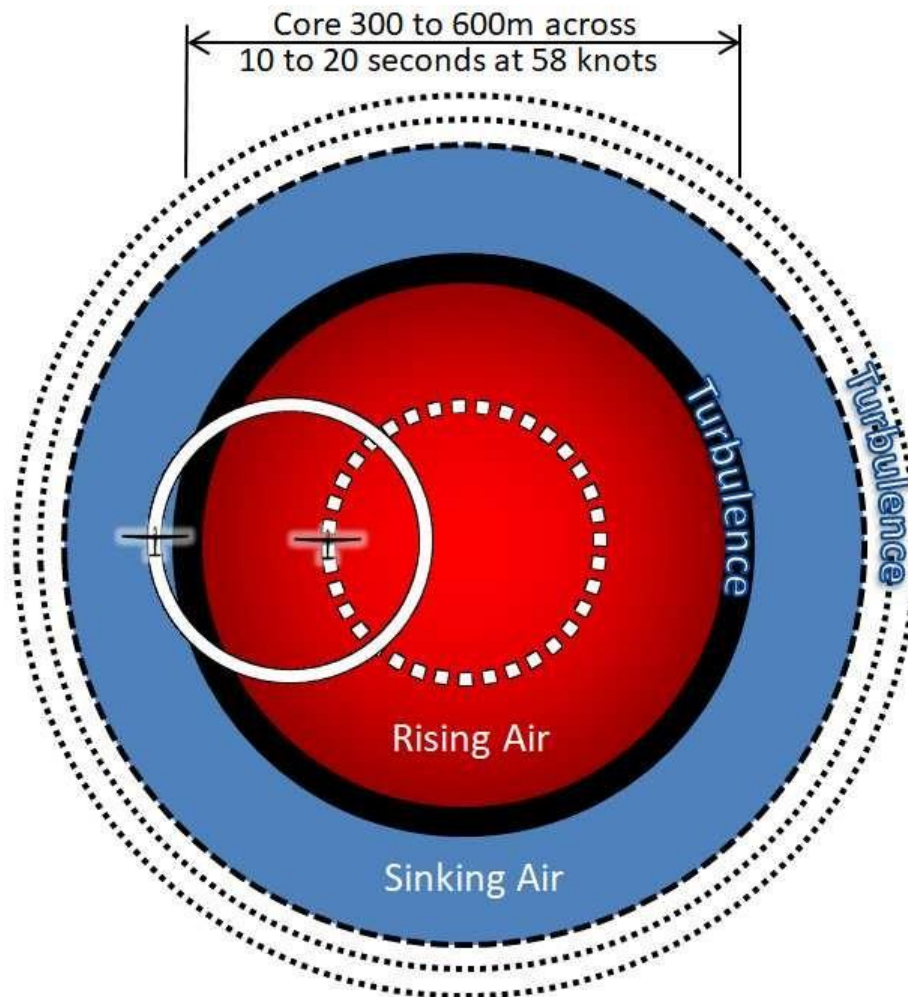
PILOT GUIDE FOR THIS UNIT

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 constant nose attitude and angle of bank – 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 40 degrees 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 fly just fast enough to maintain good control at the 40 degree angle of bank.

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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.

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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.

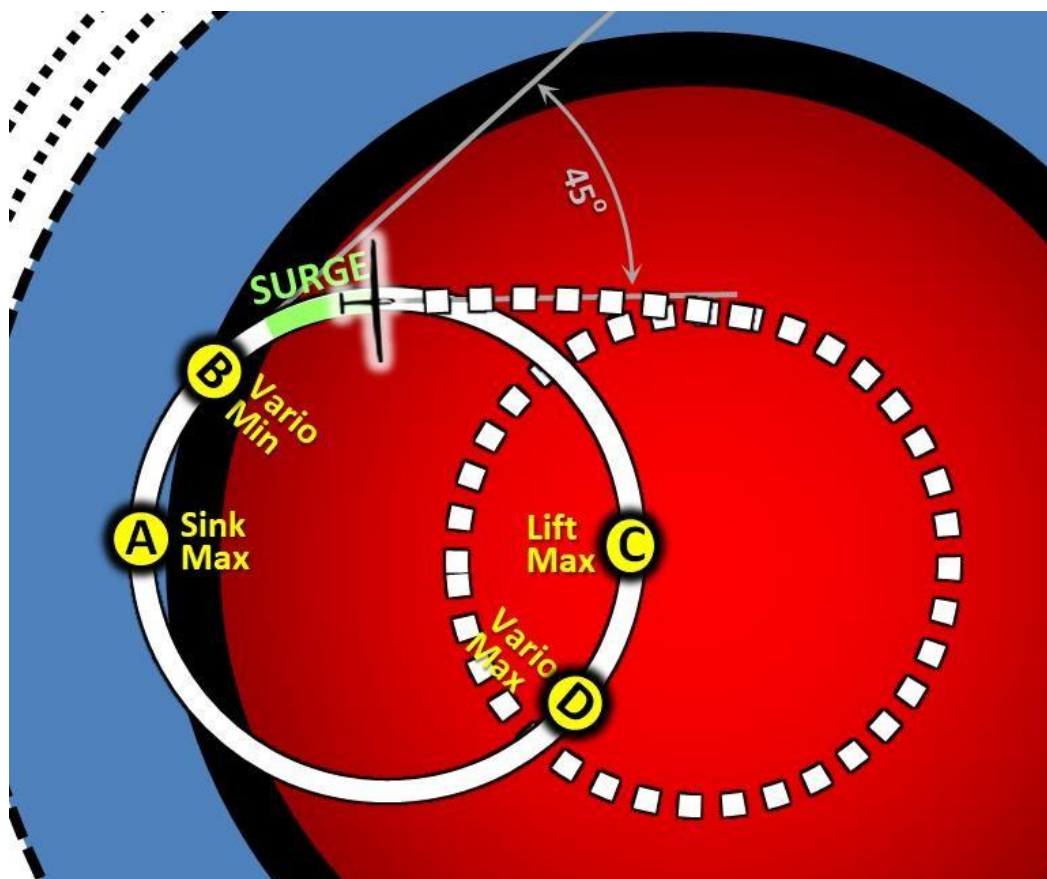
2. Vario Technique

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.

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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.

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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
<ul style="list-style-type: none"> Not maintaining constant nose attitude 	<ol style="list-style-type: none"> Flying using airspeed indicator instead of nose attitude relative to the horizon Not trimmed correctly
<ul style="list-style-type: none"> 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.

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

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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?