

Gliding Australia Training Manual

Pilot Guide



Unit 17

Stabilised Approach and Landing

Unit 17 - Stabilised Approach and Landing

WHAT THIS UNIT IS ABOUT

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

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

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

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

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

KEY MESSAGES

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

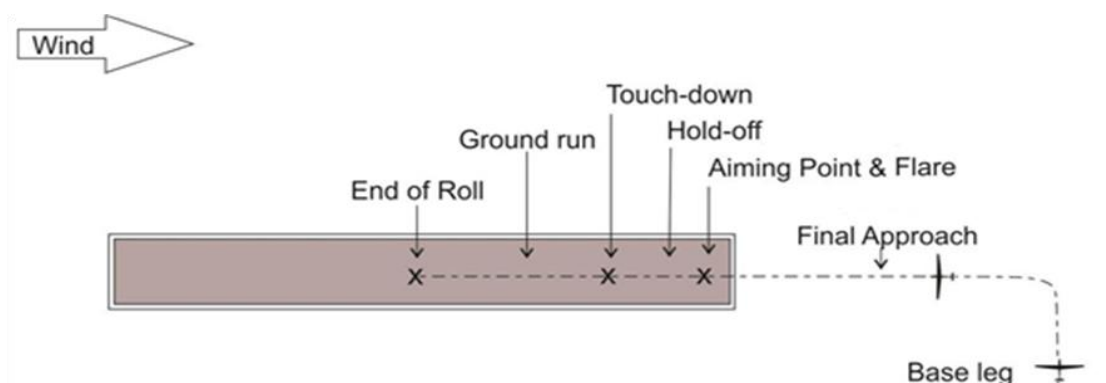
PILOT GUIDE FOR THIS UNIT

Early in the Approach

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

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



Wind gradient

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

Use of Airbrakes

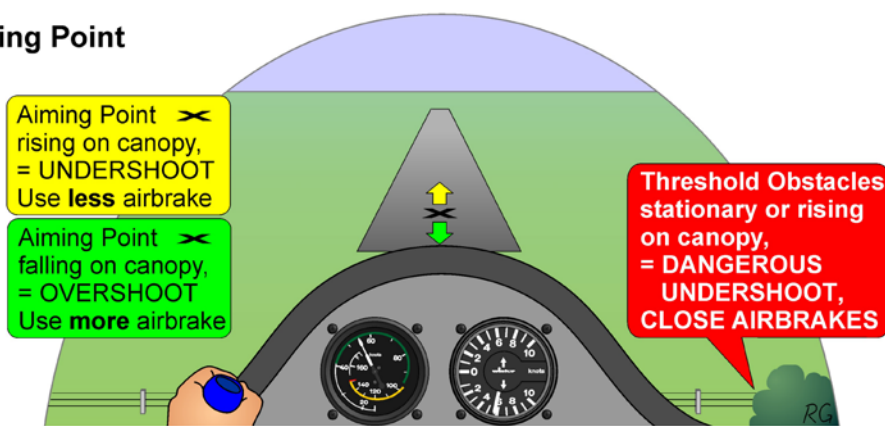
- Control the descent path with the airbrakes and the speed with the elevator. Be prepared to close the brakes and land long to clear obstructions.
- Do not use large and unsafe elevator inputs, particularly close to the ground.
- Use of airbrakes will be introduced at safe altitudes, long before any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

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Approach – Using the Aiming Point to Maintain Glide Slope

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

Aiming Point



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

Overshoot

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

Undershoot

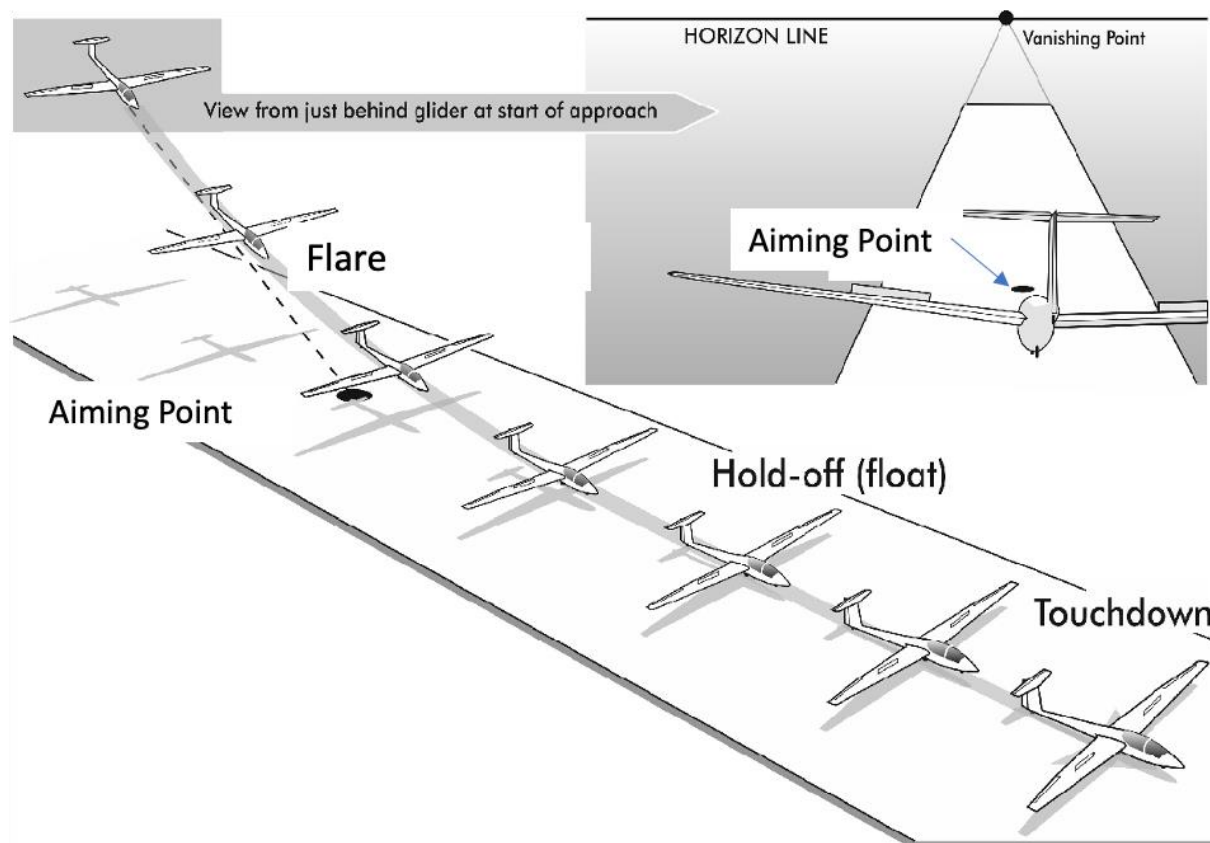
- If the glider is undershooting (i.e. it is below the final approach path), the aiming point moves upwards in the canopy towards the horizon. It becomes obvious that the glider will land before the aiming point is reached.
- An UNDERSHOOT requires reducing the amount of airbrakes/spoilers, in order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

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Lineup/Directional control

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

Landing – Flare, Hold-Off and Ground Roll



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

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

Sloped Runways

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

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FLIGHT EXERCISES

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

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

THINGS YOU MIGHT HAVE DIFFICULTY WITH

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

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

HOW DO YOU DEMONSTRATE COMPETENCE?

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

RESOURCES & REFERENCES

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

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SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

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