

Gliding Australia Training Manual

Trainer Guide



Unit 12

Slow Flight, Stalling

Unit 12 - Slow Flight, Stalling

AIM

THE AIM OF THIS GPC UNIT IS TO ENSURE THE STUDENT:

- Can fly accurately and confidently close to the stall;
- Is aware of the importance of always maintaining a safe margin from the stall whenever close to the ground i.e. below 1000' AGL;
- Can recognise the approach of a stall; and
- Will initiate prompt prevention and recovery from stalls.

PREREQUISITE UNITS

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

COMPLEMENTARY UNITS

There are no complementary units for this GPC Unit

COMPETENCY ELEMENTS AND PERFORMANCE STANDARDS

ELEMENT	PERFORMANCE STANDARDS
1. Demonstrate slow flight techniques	<ul style="list-style-type: none"> • Demonstrate: <ul style="list-style-type: none"> ○ Monitoring of attitude and air sounds together with the 'feel' of the stick to maintain flight above the stall without reference to instruments. ○ Moving the stick forward when a wing drop is experienced, to lower the angle of attack with sufficient rudder away from the wing drop direction to counter any yaw.
2. Safe flying practices	<ul style="list-style-type: none"> • Describe: <ul style="list-style-type: none"> ○ The individual glider's 'flight envelope' as indicated by the cockpit weight and speed placard and the use of ballast to ensure flight is within these limits. ○ The significance of the yellow triangle on the airspeed instrument. ○ The need for coordinated turns in the circuit. ○ The need to avoid using excess rudder during a turn which may lead the glider to spin. • Demonstrate: <ul style="list-style-type: none"> ○ Use of the GFA Pre-aerobatic checklist HAS(E)LL. ○ Identification of the near onset of a stall and counter by easing the stick forward to decrease the angle of attack. ○ Selection and maintenance of a suitable safety margin above stall speed (1.5 Vs) habitually when flying below 1000 ft AGL.

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3. Stall recognition	<ul style="list-style-type: none"> • Describe: <ul style="list-style-type: none"> ○ The aerodynamics of the stall. ○ Factors that impact stall speed – angle of attack and wing loading (G force, angle of bank, flaps and use of airbrakes). • Demonstrate: <ul style="list-style-type: none"> ○ Recognition of symptoms of flying near and below the stall speed.
4. Stall recovery	<ul style="list-style-type: none"> • Demonstrate: <ul style="list-style-type: none"> ○ Moving the stick forward to decrease the angle of attack to regain and maintain a safe speed, prior to the stall. ○ Stall recoveries with minimal height loss appropriate to type: <ul style="list-style-type: none"> i. Without and with full airbrake/spoilers and; ii. Without and with flaps: <ol style="list-style-type: none"> 1. Straight and level; 2. 30 degree turns; 3. 45 degree turns. ○ Additionally for self launching gliders: <ul style="list-style-type: none"> i. With and without engine power; ii. With and without engine pod extended: <ol style="list-style-type: none"> 1. Straight and level; 2. 30 degree turns; 3. 45 degree turns.

KEY MESSAGES

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

LESSON PLANNING AND CONDUCT

Classroom Briefing

- Explain the aerodynamics of the stall with reference to details in the Pilot Guide:
 - Progression of stall from root to tip.
 - Loss of lateral damping and how washout impacts on stability.
 - Change in location of the centre of pressure.
- Turbulent, low speed airflow at the stall produces a number of useful indicators that the stall is imminent:

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- Increasingly quiet.
- Buffeting of the glider's tail from turbulent air from the wing.
- The stick becoming less responsive and effective in both pitch and roll.
- The feel of Loss of lateral dampening.
- Increasing descent rate.
- The nose dropping in spite of the stick being held fully back.
- Typically the stall results from a higher nose attitude than normal but the attitude may not appear significantly higher.
- Explain lateral stability and lateral damping and that at low speed, and how the stall may also occur at higher airspeed if the stick is pulled back rapidly – over rotating the glider. (e.g. at 60 knots in a turn, excessive and rapid back stick can result in a stall). The turbulence is quite noticeable in this situation.
- Explain the purpose of washout on the wing tips is to ensure that the wing roots stall before the wing tips.
- A stall is easily recovered, but it is important to avoid the stall at low level or when flying close to other gliders, as there is potential for it to quickly develop into a spin. This gives rise to the definition of Safe Speed Near to the Ground. (1.5 Vs)
- The yellow triangle on the airspeed instrument marks the lowest approach speed at maximum gross weight - without ballast recommended by the manufacturer. JAR 22.1545 (d) refers.
- It may not be the same speed as 1.5 Vs.
- Flying faster than the stall speed and not applying excessive G forces, will avoid a stall.
- Recognise when a stall is imminent, and act immediately by moving the stick forward to un-stall the aircraft.
- The glider controls will have a more solid feel when the glider is flying normally again.

PRE-FLIGHT BRIEFING

- Explain that you will be investigating flight at low speed as gliders often fly in this situation.
- Normal flight in an aircraft is conducted between the stall and VNE.
- Thermalling is often conducted close to stall speed and it is not uncommon for gusts in the air to stall the glider, so you need to recognise when this happens and act accordingly to “un-stall” the wing.
- Explain that stalling is not a dangerous situation provided that you act to un-stall the glider by simply moving the stick forward.
- Explain the symptoms of approaching the stall, as listed above. We want to fly slightly faster (with a lower nose attitude) than the stall speed.
- Explain that as the glider gets close to stall, a small forward movement of the stick will reduce the angle of attack and prevent the stall.
- Describe simple aerodynamics – particularly:
 - Relate to angle of attack.
 - Lift depends on speed and angle of attack

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- As the glider slows the angle of attack increases.
- Cause of stall is angle of attack
- Stall is fixed by correcting angle of attack – stick forward

FLIGHT EXERCISES

Flying Near the Stall

Objective

- Principally precautionary – recognition of condition
- Introduce and explain loss of lateral damping
- Use of rudder to catch wing drop – but does not result in recovery. Rudder may pick the wing up but without stick forward the other wing will drop.
- BUT recovery is immediate with reduced angle of attack
- However, if the manoeuvres which resulted in the approach to stall resulted in a speed lower than the stall speed the stick must be held forward till the speed increases to above the stall speed before the stick can be eased back so that the wing again can take the full load of the weight of the glider.

Three issues:

- Rudder can pick the dropped wing up but does not recover the stalled wing and is not actually necessary
- Stick forward reduces the angle of attack immediately and hence recovers normal flight characteristics
- The glider speed must be higher than the stall speed before the wing will carry the full weight of the glider.

Briefing

- Describe as precautionary
- Describe loss of lateral damping and aileron control reversed if anything (except for wash out).
- Recovery with elevator
- Optional use of rudder to remove yaw.

Air demonstration and exercise

- Emphasise feel of loss of lateral damping.
- And recovery of lateral damping immediately with angle of attack
- And recovery of flying speed
- Rudder to catch yaw – does not recover.
- Explain - may need to wait for speed recovery before

The important competence is recognition of the feel of loss of lateral damping and the development of an **AUTOMATIC** response to move the stick forward.

Specific demonstration and practice of the Stall

- For all stall manoeuvres, conduct a HASLL check.
- If possible, introduce the in-air exercises when thermal conditions enhance the possibility for regaining height, otherwise higher than normal aerotows are required or many winch launches may be required to cover this unit.

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- Ask the student to fly at 45 knots and trim the glider accordingly. Then ask the student to raise the nose slightly and continue to fly straight and level. Point out that the trim may not be sufficient, and they may have to hold backward pressure on the stick.
- Ask questions to see if they can identify indicators of an approaching stall:
 - reduced controllability;
 - reduced noise level;
 - slight shuddering on the elevator; and
 - loss of lateral damping.
- Some students may be apprehensive and you may need to take control and ask them to follow you through as you get closer to the stall.
- Demonstrate that moving the stick forward slightly removes these indicators and the glider feels like it is flying normally again.
- Demonstrate what happens when you fly a slightly higher nose attitude where the glider stalls and the nose drops, (in some gliders this may not be possible at a low nose attitude).
- Again, indicate that the glider flies again when you move the stick slightly forward.
- Let the student demonstrate this a few times so they start to relax with the situation.
- Explain that you will now demonstrate a higher nose attitude and they should more clearly identify the indicators of the approaching stall. Ask the student to describe these indicators when they then do the same manoeuvre.
- Introduce the techniques to deal with a wing drop close to stall, through use of opposite rudder, and that forward stick solves the overall problem. However, it needs to be clear that the problem is angle of attack - so recovery is stick forward. Glider will recover normal flying characteristics by stick forward only.
- Over time you may be able to demonstrate a high nose attitude stall with the ensuing nose drop, and that even with the nose of the glider pointing down again it is not flying properly until the stick is moved forward to un-stall the wing. Some gliders may let you demonstrate that pulling the stick back in this situation does not raise the nose. You must push forward on the stick to un-stall first and then recover.
- As students relax more, ask them to read the airspeed as the glider stalls.

Advanced training

- In later flights you can introduce the impact of airbrakes and flaps on stall speed and glider reaction.
- Introduce the stall in a turn, primarily to identify the indicators and the effect of moving the stick forward.
- Avoid entering a spin through these exercises.

Notes:

1. The student may be overanxious undertaking this unit. A calm and matter-of-fact approach to instructing the stall is required.

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2. Introduce the flight exercises with gentle slow flying and straight-ahead stalls demonstrating ease of recovery, gradually developing to more aggressive stalls in differing configurations with growing student confidence over a number of flights.
3. Direct the student's attention outside the cockpit towards the horizon to counter any discomfort felt during the stall and recovery.
4. Stalls should be demonstrated by the instructor with the stick right back followed by the student trying in the same configuration. This is to demonstrate that accidents occur when the stick is held back in the stall due to visual interference of dropping towards the ground instead of easing it forward to recover by reducing the angle of attack to get the wing flying again.
5. In no or poor lift conditions it is wise to pre-flight brief the pilot on the sequence of activities to be conducted and to confirm most of the HAS(E)LL checks during launch to enable more height and time for the exercises after the release.
6. Ensure that the student differentiates between the nose drop at the stall and the sensations associated with reduced "G".

COMMON PROBLEMS

Problem	Probable Cause
<ul style="list-style-type: none"> Not holding the higher nose attitude 	<p>Apprehension of the stall</p> <p>Unwilling to hold pressure on the stick.</p>
<ul style="list-style-type: none"> Excessive forward stick movement 	<p>Apprehension of the stall</p> <p>Too Tense, not feeling when the glider is flying normally again</p> <p>Adverse reaction to reduced G</p>

THREAT AND ERROR MANAGEMENT

- Ensure the glider is stall/spin rated and know and follow the aircraft Flight Manual specifications/limitations for these exercises.
- The control stick must be guarded closely when the student tries to recover to prevent excessive forward movement leading to negative "G" which may lead the student to think the aircraft is still stalled and move the stick aggressively further forward.
- Ensure that the student also recognises the difference between the pitch change employing the air brakes/spoilers and stall onset at height before circuit work.
- With aerotow launches, brief the tow pilot pre-flight regarding the proposed stall exercises, so the tug can descend well clear of the glider and look out for the glider when the tug enters its circuit.
- Similarly, both glider pilots must maintain situational awareness of the tug's and other aircraft positions.
- It is recommended that the pilot should transmit immediately prior the exercise a call of "(LOCATION) TRAFFIC (GLIDER REGISTRATION) CONDUCTING STALL MANOEUVRES FROM approximate POSITION AND HEIGHT (LOCATION)". This follows conducting HAS(E)LL checks to warn other traffic in the vicinity.

TRAINING MATERIALS AND REFERENCES

- Theory Lesson 4
- Australian Gliding Knowledge (AGK) pages 63-66
- GPC Pilot Guide Unit 12
- The Glider's Aircraft Flight Manual
- Gliding Basics: British Gliding Association 2019
- Gliding Handbook: FAA 2013
- The Glider Pilot's Manual: Ken Stuart: 2nd Edition; Airlife 1999
- Understanding Gliding: Derek Piggot: 3rd Issue; AC Black 1996