9 – SLOW FLIGHT & STALLING

SPL Syllabus: Exercise 9a Slow Flight			
(i)	**Safety checks**	**(iii)**	**Controlled flight down to critically high angle of attack (slow air speed)**
(ii)	**Introduction to characteristics of slow flight**		
SPL Exercise 9b Stalling			
(i)	**Safety checks**	**(iv)**	**Recovery when a wing drops**
(ii)	**pre-stall symptoms, recognition and recovery**	**(v)**	**Approach to stall in the approach and in the landing configurations**
(iii)	**Stall symptoms, recognition and recovery in straight flight and in turn**	**(vii)**	**Recognition and recovery from accelerated stalls**

INTRODUCTION

Even though stalling is a benign flight condition, it is still a major contributory factor in gliding accidents: not because the pilots involved did not know the correct recovery action, but because they did not recognise what was happening. This is why the training must strongly emphasise recognition of, and familiarity with, the symptoms of the stall.

Slow Flight, whilst not strictly speaking a stalling exercise, is an important part of stall recognition and hence avoidance. Both this exercise and stalls should be practised often enough to ensure that the trainee's habitual response to slow flight is to move the stick forward. Slow flying may be perceived as a trivial exercise and when conducted correctly is unspectacular, but do not skimp time on either the slow flying or stalling exercises; it is valuable accident prevention.

In addition to teaching our trainees to be safe at first solo and through to licence standard, we should be teaching them to be sufficiently competent and confident to indulge in practice stalls in any type that they subsequently fly. Trainees should keep themselves familiar with stalls and recoveries for the rest of their flying life.

When introducing **slow flying**, make it clear that the exercise is to help the trainee recognise the feel of the glider and control response rates near the stall; not to develop skill in 'slow flying'.

The objective of the slow flying exercise is to:

- **recognise** inadvertent flight at critically low speeds (high angle of attack) and take timely action to avoid a stall.
- avoid inadvertent stalling by developing safe flying habits in all phases of flight.

Stall training progresses from extensions of the Slow Flying exercise on to gentle, wings-level stalls, to accelerated stalls in turns and climbing attitudes.

The aim of stall training is for the trainee to:

- recognise the symptoms of an approaching stall and take timely avoiding action.
- become familiar with the characteristics of the full stall and learn how to recover with minimum loss of height.
- avoid inadvertent stalling by developing safe flying habits in all phases of flight.
- establish an automatic link in the trainee between this symptom and the need for stall recovery action.

Trainees may be apprehensive about stalling, so use these slow flying exercises and a very gentle 'confidence stall' before introducing the further stalling exercises. Everything possible should be done to make the stalling exercises a positive learning experience: otherwise, if they are too anxious, then they will not be learning.

Reduced G and pilot reactions

The 1G we are used to, can reduce when we fly. If we move the stick forward when flying at normal speed or at the stall, as the lift reduces the glider will start to accelerate downwards relative to its previous flightpath and we experience reduced G.

There have been fatal accidents where gliders have dived steeply into the ground. No technical problems seem to have been involved, so there is a strong possibility that the pilots confused the sinking sensation due to reduced G with the stall and/or became disorientated. There have been accidents in two seaters where a low-level launch failure produced enough reduced G to panic an over-sensitive trainee into pushing forward on the stick so hard that the instructor was unable to take over.

Many trainees dislike reduced or negative G, but rarely this may be accompanied by a sense of panic. Beware of doing stalls with markedly reduced G before you have determined whether the trainee is sensitive to it or not.

In the rare event that a trainee seems over-sensitive to reduced G, inform the CFI. Affected pilots who want to persevere with flying may be helped/de-sensitised by practising dozens of reduced G exercises.

The exercises:

Together with the slow flying exercise, the following are covered in this chapter:

- 4 unaccelerated stalls (often referred to as the ' basic stalls) i.e.
    - Stall without a nose drop (mushing stall)
    - Stall with a nose drop (straight stall)
    - Stall with a wing drop
    - Stall in landing configuration
- 2 further stalling **demonstrations**
    - reduced G is not a reliable symptom of the stall and
    - the lack of the elevator at the stall
- accelerated stall exercises
    - stall in a turn
    - stall speed increases in the turn – demonstration only
    - high speed stall - demonstration only

All except the last 2 demonstrations must be satisfactorily flown before solo, and the last 2 demonstrations before licence standard.

With the exception of winch launch failures, it is unlikely that a pilot will stall inadvertently with the nose held very high, simply because the attitude is so obviously abnormal. **Realistic** training is vital. There is no point in stalling from an attitude which the trainee knows they will not encounter in real life.

A likely and dangerous place for an inadvertent stall is close to the ground. For example, the pilot might under-estimate the wind gradient or unconsciously attempt to stretch the glide. Thermalling low down while trying to select a field often leads to inadvertent stalls, sometimes with fatal results. Turbulence and wind gradient can increase the chances of a stall and delay the recovery. If the strong visual signal of a nose high attitude is absent the pilot is less likely to recognise the onset of the stall. High workload also increases the chances of other symptoms going unnoticed.

To help the pilot avoid stalling in such situations, training should cover not only the deliberate stall exercises - which suggest that the symptoms are fairly obvious and are often continued until the glider is fully stalled – but also those more subtle stall entries where the emphasis is on recognising the symptoms and initiating immediate and appropriate recovery action.

Many training gliders are sufficiently vice free, and their stall so innocuous, that it is difficult to convince trainees of just how hazardous an inadvertent stall can be. This does not prevent their use in providing familiarisation with the symptoms of an approaching stall but severely limits their usefulness in the teaching of certain exercises. Attempting to demonstrate 'Stall in a turn' and 'Stall in a steep turn' in two-seater gliders like the K21, which lack sufficient elevator power, may prove impossible. Attempting and failing to provide an effective demonstration may very well serve only to convince your trainee that, as you cannot make your point, that they are at no risk from stalling. If a more suitable two-seater is available, then use it.

When to teach

Some of the exercises result in attitudes which may alarm trainees or produce disconcerting sensations.

Do not demonstrate the accelerated stalling exercises until the trainee is fairly confident in both stalling and recovering the glider from basic and steeper stalls, including those with wing drop.

If at any stage of a trainee's stall recovery training, they over-control - creating reduced G - the instructor should take the opportunity to give the appropriate demonstration before any wrong ideas are formed i.e. to emphasise what caused the sensation, and the implications of confusing it with the sensations in the stall.

Initially, these exercises should be demonstrated with the trainee's hands and feet **off** the controls. Only invite the trainee to follow through once they know what to expect, and you are certain they are not going to react badly.

Considerable height can be lost during some of these exercises.

NOTE: Most of the exercises in this manual have no recommended patter. In the following exercises, patter is in italics to distinguish between the few key things that should be said, and tips on how to fly the exercise. These exercises are demanding of your handling ability. Never be afraid, if a demonstration fails to work or is unconvincing, to say; *I'm sorry, that didn't work, I'll do it again*.

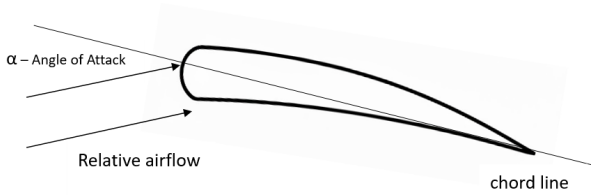
THEORY BRIEFING

Angle of Attack (AoA) and the stall

In normal flight a glider's wings must produce a lifting force near enough equal to the glider's flying weight. The amount of lift generated depends on the aerofoil (overall shape), wing area, and the speed and angle at which the airflow meets the wing. The angle is called the **Angle of Attack**, **(AoA)** (figure 1), and is measured between the aerofoil **chord line** and the **relative airflow**.

If the glider is in steady, fast straight flight, the AoA will be small, but becomes progressively larger as the glider slows down, or as G increases. There is a **critical angle** for the AoA where the lift coefficient, or C_L reaches a maximum. This is aerofoil specific, but typically about 15°. If the AoA is

increased further, lift will reduce, often quite sharply, but the drag will continue to rise. Technically, the stall is defined as occurring when the C_L has reached its highest value, regardless of anything the glider is doing at the time. **Fig 1**



Changes occur in the handling and feel of the glider when indulging in 'slow flight' at high angle of attack close to the stall and these can provide useful warning of an impending stall.

The wings of most gliders are designed to stall in a smooth and progressive manner, either through using a different aerofoil section near the tip or building in 'washout' or both. Airflow breakdown begins at the upper surface trailing edge, near the wing root, and spreads forwards and outwards as the AoA increases.

The above features enable many gliders to maintain some aileron control at, and sometimes just beyond, the stall. In general, though, as more of the wing stalls, the ailerons become increasingly sluggish and ineffective.

Secondary effects of rudder inputs at, or just prior to the stall can have much the same effect, except that the glider may roll strongly in the direction of the rudder input.

However, note that aileron input close to the stall **can** result in very rapid roll in the **opposite** direction to the one intended. This is caused by the downward deflected aileron stalling the tip that was supposed to go up.

As the glider slows down there may be a perceptible change in the airflow noise. While usually quieter, it can also be louder or different in character and may sound completely different if there is any significant yaw present. As modern gliders approach the stall any variations in airflow noise may be very subtle.

Separated airflow can produce airframe buffet, and turbulent flow across the static ports can cause the ASI readings to flicker. However, this will only be experienced if the glider is flown at the stalling speed rather than just above it as intended in the slow flight exercise.

Summary of <u>Slow Flight</u> symptoms

Not all the following may be present, or all that obvious:

- The nose is higher than normal.
- The airspeed will be slow.
- Changes in airflow noise.
- Changed effectiveness of ailerons, elevator and/or rudder.
- Unusual control positions for the phase of flight. For example, lots of out-turn aileron or stick further back than usual.

Summary of the <u>Stall</u> symptoms

Not all the following may be present, or all that obvious:

- The nose attitude is higher than normal.
- The airspeed slow or reducing.
- Changes in airflow noise.
- Flickering ASI.
- Airframe buffet
- Changed effectiveness of elevator, ailerons and/or rudder.
- Unusual control positions for the phase of flight. For example, lots of out-turn aileron.
- Higher rate of descent.
- **Inability of the elevator to raise the nose.**

Depending on the glider's elevator authority and/or the rate at which the speed is reduced, the elevator may fail to raise the nose in response to backward movement of the stick, or the nose may drop regardless. **Inability of the elevator to raise the nose or prevent it going down is the most important symptom of a stall.**

Some actions when flying a glider, are learned very early in training and become habitual. For example, to reduce the speed, we raise the nose by moving the stick back. Conversely, if the nose starts to go down, we move the stick back to try and raise it again.

Habits form a major part of our reactions and under pressure it is normal to revert to previously learned patterns, even if the response is completely inappropriate. For example, if the nose drops because the glider has stalled, the 'normal' reaction - using the elevator to raise the nose - will make the situation worse.

There have been a number of accidents and incidents in which the glider has hit the ground at a high rate of descent and the pilots, sometimes very experienced, were convinced that the elevator had become disconnected. In fact, the elevator was connected, but the glider was stalled, and the pilot continued pulling back on the stick. If the pilot(s) had recognised the symptoms of an approaching stall, and taken the correct recovery action, the accident would not have occurred.

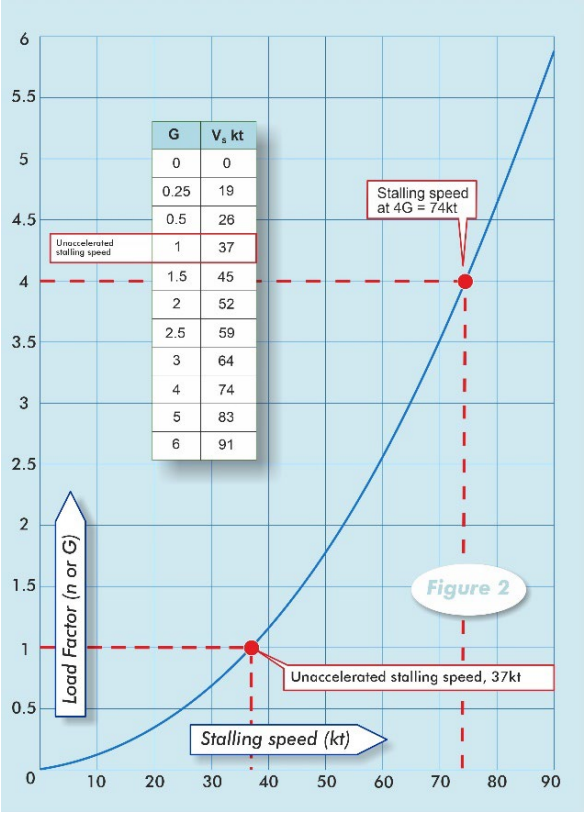
Stalling speed

The actual value of the stalling speed of the glider depends on the following factors:

- **Design of the wing**, particularly its size and aerofoil section.
- **Airspeed.**
- **Wing loading**. If the wing loading increases, so too does the stalling speed. The wing loading depends on:
- The **glider's flying weight**, also referred to as the All-Up Weight or AUW.
- **Download** resulting from **cable tension** during a winch launch.

- **contamination.** In unaccelerated flight at a given AUW and with a clean air frame, the stalling speed (V_S) will have a specific value, say 35kt. If the wing is wet or the leading edge covered with bugs, the stalling speed can increase by anything from 1kt to 10kt; possibly more if the airframe is covered with ice. The change in stalling speed is glider/aerofoil dependent, and some gliders are more badly affected than others
- **use of the airbrakes.**
- **increase in G** loading in relation to the glider which alter its effective weight e.g. any change in direction (turning, pulling out from a dive)

Figure 2 below and the inset table show how the stalling speed changes with G for a glider with an unaccelerated stall speed of 37 kts.



Stalls with a wing drop

When one wing reaches the critical angle just before the other, an asymmetric stall occurs, and a wing will drop. Normal stall recovery action will prevent the wing dropping further, and as soon as it has started to take effect, the wings may be levelled with coordinated aileron and rudder. Positive use of the elevator gets the wing flying again very quickly and arrests any tendency for a wing to drop.

When a wing drops at the stall, it is essential to unstall the glider before attempting to level the wings. Once the glider is unstalled, level the wings with coordinated ailerons and rudder.

Do not attempt to use the secondary effect of rudder to restore the wings to the level position. This will introduce yaw which can result in the glider entering a spin, often quite suddenly. The priority must be to unstall the glider by moving the stick forward.

Pilots often over-react when 'unstalling' by pushing the stick hard forward, regardless of whether this is necessary. Considerable height can be lost. The instructor should demonstrate and encourage 'least loss of height' recoveries. The success of this depends on the trainee's understanding and appreciation of the situation, and of the aircraft they are flying. On balance slightly over-reacting is safer than **slightly** under-reacting.

The Flying

EXERCISE 9a

SLOW FLYING

SLOW FLYING - AIR EXERCISE BRIEFING

Before flying all this exercise include Threat & Error Management and the HASSELL check [Chapter M] in all the pre-flight briefings.

Assess your trainee to check they are not overly anxious.

Carefully check seating positions and straps. It is important that even if an overzealous trainee moves the stick fully forward, you can still reach it. Reduced G combined with loose straps might leave you unable to take control.

Brief the exercises for the flight and remind the trainee of the stall recovery procedure.

TEM

Threats:	**Mitigation:**
Trainee Adverse Reaction	Prepare and brief the trainee appropriately & monitor them carefully
Trainee fails to or overreacts at recovery	Monitor trainee & take over promptly
Collision	Maintain lookout
Errors:	
Running out of height for appropriate circuit	Monitor height & position
Allowing a stall to develop	Be prepared to recover immediately if a stall appears imminent

SLOW FLYING - MANOEUVRE DEMONSTRATION

Initially, ask the trainee to keep their hands and feet off the controls. Only invite them to follow through once they know what to expect and you are reasonably sure that they will not react badly. Given the risk of accidentally stalling whilst conducting this exercise the trainee should be shown a gentle introductory stall ahead of this exercise. This advice is relevant to all stalling exercises.

The exercise consists of flying just above the 1 G stalling speed, in the region where the aircrafts handling is beginning to change from that at normal speeds, but not actually yet stalled.

The objective of this exercise is to train pilots to **recognise and avoid stalling.** The trainee needs to experience the response and feel of the controls at this crucial point.

- Complete the HASSELL check (some of it can be done prior to take-off)
- Bring the nose slightly above the normal flying attitude.
- Identify the symptoms of slow flight as they occur.
- Note the airspeed.
- Stabilise the glider in this attitude.
- Emphasise that this is the Slow Flying and is very close to the stall.
- Demonstrate the recovery action.

Emphasise that:

- Because the glider is being flown too slowly that it is essential to move the stick forward to recover.
- That flying too slowly is both inefficient and potentially dangerous.

SLOW FLYING - TRAINEE ATTEMPT

The aim is for the trainee to fly just above the 1G stall speed and to:

- identify the symptoms of slow flight
- recognise the impending stall

The trainee needs prolonged experience of the feel of the controls when the glider is too/very close to the stall.

- Complete the HASSELL check.
- The trainee reduces speed very gradually (approximately 1kt/sec) towards the stall. The aim is to try and fly the glider just above the stall while keeping the wings level with coordinated controls.

Emphasise the change in feel of all the controls.

An optional addition to this exercise is to demonstrate a very gentle turn, at a few knots above the stall and have the trainee repeat it. The difference in handing is marked and this is a good lead in to the later 'stall in a turn exercise.'

EXERCISE 9b -STALLING

UNACCELERATED STALLS

AIR EXERCISE BRIEFINGS - for unaccelerated stalls

TEM

Threats:	**Mitigation:**
Trainee adverse reaction	Brief appropriately & monitor trainee
Trainee fails to or overreacts at recovery	Monitor trainee & take over promptly
Collision	Maintain thorough Lookout
Errors:	
Running out of height for an appropriate circuit	Monitor height & position
Allowing a spin to develop at an inappropriate time or height	Be prepared to recover anything that occurs immediately

Brief the exercises for the flight and remind the trainee of the stall recovery procedure.

The aim is to:

- identify the symptoms of the approaching stall.
- recognise the stall itself.
- recover with the **minimum loss of height**, avoiding a secondary stall.

If the pilot either fails to notice or ignores the symptoms, the glider will STALL and:

- begin to descend at a very high rate.
- the nose may drop.
- a wing may drop.

To recover, the AoA MUST be reduced:

- ease forward on the stick (the attitude should be more nose down than the normal gliding attitude).
- regain flying speed.
- return to the required gliding attitude (for that phase of flight).

The degree of forward stick movement and the time and height taken to unstall the glider depends on the circumstances of the stall. For example:

- A stall without a nose drop - a mushing stall - normally requires more forward stick movement for recovery than if the nose is already dropping.
- Recovery action whilst descending through a wind gradient requires a very much lower nose attitude if flying speed is to be regained. Obviously this should not be demonstrated because the wind gradient occurs very close to the ground

A secondary stall may occur during or after recovery from the first if the recovery is hurried, and if:

- the glider has not been allowed to regain sufficient speed for the next manoeuvre, causing it to stall again, or
- the stick is pulled back too harshly during the return to the required attitude, creating excessive G. The accelerated stall that results may be vicious.

UNACCELERATED STALLS

Stall without a nose drop (Mushing stall)

MUSHING STALL - MANOEUVRE DEMONSTRATION

This is a repeat of exercise 9a, slow flying, but it is continued into a mushing stall.

Demonstrate 1G stalls to cover the symptoms of the approaching stall, the stall itself, and the recovery. Repeat the exercise several times, each demonstration concentrating one symptom of the approaching stall, followed by the stall and recovery.

A full HASSELL check may not be required between every demonstration, but do not forget to monitor height and check regularly that it is still clear below

Initially, ask the trainee to keep their hands and feet off the controls. Only invite them to follow through once they know what to expect and you are reasonably sure that they will not react badly.

Complete the HASSELL check (some of it can be done prior to take-off).

- Bring the nose slightly above the normal flying attitude.
- Identify the 'Symptoms of the Stall' as they occur.
- Note the airspeed at which buffet begins.
- Stabilise the glider in this attitude, with a high rate of descent.
- Emphasise that this is the stall.
- Demonstrate the recovery action.

MUSHING STALL - TRAINEE ATTEMPT

- Complete the HASSELL check.
- The trainee reduces speed very gradually (approximately 1kt/sec) towards the stall. The aim is to try and fly the glider into a mushing stall while keeping the wings level with coordinated controls.

Emphasise;

- the need for coarse aileron and rudder movements.
- that the stick is considerably further back than for normal flying speed, even though the glider's attitude is not dissimilar to 'normal.'
- the rate of descent is high, and a wing may drop.
- Recover from the stall.

UNACCELERATED STALLS

Stall with a nose drop (Straight stall)

STRAIGHT STALL - MANOEUVRE DEMONSTRATION

- HASSELL check
- Lookout.
- Repeat the 1G stall but ensure that the nose drops; to do this, raise the nose above the horizon and hold it there while the glider slows down, then bring the stick further back to induce the stall.

Emphasise that:

- because the glider is stalled the nose drops, despite the stick being held back
- although the nose is dropping it is essential to move the stick forward to recover.
- once unstalled, the recovery from the dive needs to be smooth to avoid a secondary stall.

STRAIGHT STALL - TRAINEE ATTEMPT

Check that you still have sufficient height.

- Lookout.
- The trainee brings the nose up in straight and level flight to about 20 degrees above the horizon and waits for the nose to drop.
- Ease forward on the stick (the aimed for attitude needs to be more nose down than the normal gliding attitude).
- Regain flying speed and return to the required gliding attitude (for that phase of flight.

Make sure the trainee understands the need to hold the glider in the 20 degrees nose up attitude while it slows down. If they simply pull the stick back steadily until the stall then, depending on the initial airspeed, you may get a much steeper stall than intended. A re-demonstration may be needed.

UNACCELERATED STALLS

Stall with a wing drop

STALL WITH WING DROP - DEMONSTRATION

- HASSELL check.
- Repeat the 1G stall but provoke a wing drop using rudder and demonstrate the recovery.

Emphasise that:

- the wings are levelled with coordinated use of ailerons and rudder, BUT ONLY AFTER the glider is unstalled.

STALL WITH WING DROP - TRAINEE ATTEMPT

Check that you still have sufficient height.

- Lookout.
- You may wish to bring the glider up to the stall and provoke the wing drop, and handover to the student for the recovery.
- Ease forward on the stick (the aimed for attitude needs to be more nose down than the normal gliding attitude).
- The wings are levelled with coordinated use of ailerons and rudder, BUT ONLY AFTER the glider is unstalled
- Regain flying speed and return to the required gliding attitude (for that phase of flight).

UNACCELERATED STALLS

Stalls in Landing Configuration

DEMONSTRATION AND MANOEUVRE

- Complete the HASSELL check including, where appropriate, drawing attention to the limiting speed when landing flap is employed.
- Fly the 1G stall with the airbrakes or spoilers fully open and where appropriate wheel down.
- Note the stall' symptoms and the higher stalling speed.
- Recover from the stall Point out that recovery includes closing the airbrakes or spoilers.

UNACCELERATED STALLS - DE-BRIEFING

Review the symptoms of the approaching stall. Emphasise that only one symptom needs to be recognised for stall avoidance or recovery to be initiated. (There can be some exceptions to this. For example, buffet may not always be associated with an imminent stall.)

Discuss the many different situations where a stall can occur but emphasise that the one thing they have in common is the need to move the stick forward to recover. Review the recovery action, including the degree of stick movement required and the amount of height lost in stalls

FURTHER STALLING DEMONSTRATIONS

LACK OF EFFECT OF ELEVATOR AT THE STALL

Demonstration only

LACK OF EFFECTIVE ELEVATOR - DEMONSTRATION

Complete the HASSELL checks:

Explain that you are going to show how ineffective the elevator is at the stall.

- Dive the glider to 55-60kt. Pull up into a steepish climb and wait for the stall.
- As the nose drops, move the stick fully back and knock it on the back stop two or three times.
- *No matter how hard I pull back on the stick I cannot raise the nose.*
- *The elevator is ineffective.*
- *I must move the stick forward to unstall the glider before I try to raise the nose.*
- Move the stick forward and recover.

DIFFERENCES BETWEEN STALLING AND REDUCED G

Demonstration only

This demonstration is to show the differences between stalling and reduced G. It aims to:

- determine if the trainee is critically/excessively sensitive to reduced G.
- show the trainee that a sinking sensation is an unreliable symptom of the stall.

There is optional extension to the exercise is to push the stick forward when the reduced G is felt, as if one believed the glider was stalled. This aims to demonstrate:

- how quickly the glider will go into a steep dive if inappropriate stall recovery action is taken.
- how disorientating reduced G can be.

DIFFERENCES BETWEEN REDUCED G and STALLING AIR EXERCISE BRIEFING

A scenario often helps to bring home to trainees the points you are trying to make.

A possible situation: Imagine that for some reason - a severe gust or a sudden forward movement on the stick - the pilot experiences the sensation of reduced G. If they are oversensitive to it, or have not experienced it before, they may feel that the glider is falling away from them and incorrectly deduce that it must be stalled. They may possibly:

- take the stall recovery action i.e. move the stick forward, increasing the sensation of reduced G.
- which will increase their belief that the glider is stalled.

It is hard to believe that under normal circumstances a pilot would continue to keep pushing long enough for the glider to enter a vertical dive, or even inverted flight, but both have happened. Panic and disorientation may set in. Unable to work out what is happening, the pilot then becomes unable to recover from the situation.

DIFFERENCES BETWEEN STALLING AND REDUCED G MANOEUVRE DEMONSTRATION

Conduct the initial demonstration with the trainee off the controls in case of adverse reaction.

Complete the HASSELL Checks.

First stall the glider as a reminder of the stall.

- Dive to 55-60kt.
- Pull up into a moderate climb – about 20-30 degrees.

When stalled:

- *Notice the sensation, low airspeed and ineffective elevator; as the nose drops past the horizon, bang the stick against the back stop to show that the elevator will not raise the nose.*
- *We are stalled.*
- *Stick forward to recover.*
- *Now we will look at reduced G.*
- dive the glider to 55-60kt and then pull up into a moderate climb (as before).
- about 5kt above the stall, push over to create the same sensation as in the stall; do not leave this too late or you will stall when you try to raise the nose.
- *Notice the same sensation, but this time the elevator is effective and air speed OK; demonstrate by raising the nose as it drops past the horizon.*
- *We are not stalled.*
- *Stick back to recover.*

The sensation of reduced G sensation is an unreliable symptom of the stall.

The two demonstrations looked and felt the same but in the first case the glider was stalled and the elevator ineffective, whereas in the second case the glider was not stalled, and the elevator raised the nose as normal.

DE-BRIEFING

Ensure that the trainee understands that reduced G is not a reliable indicator of the stall. If the elevator is effective and the airspeed OK, then the glider is not stalled. Make it clear to them that the sensation of reduced G requires the stick to be moved back not forward when the glider is not stalled.

ACCELERATED STALLS

AIR EXERCISE BRIEFINGS - for accelerated stalls

It is important for trainees to understand that the glider can stall at any speed. For instance, a stall may occur at a speed higher than the normal stalling speed if the glider is turning, the airbrakes are out, the wings are contaminated with rain or ice, the glider is being 'loaded' as in a wire launch or during any manoeuvre where G increases.

The purpose of the demonstrations is to show that:

- the stalling speed is G related.
- the high-speed G related stall may be more dramatic than the 1G stall.
- smooth stall-recovery technique is essential to avoid a pilot-induced secondary stall.

Review the factors which can cause the glider's stalling speed to increase and establish the relationship between load factor and stalling speed.

ACCELERATED STALLS

Stall in a Turn

STALL IN A TURN - MANOEUVRE DEMONSTRATION

- Complete the HASSELL check.
- Enter a normal, balanced banked turn (30°) and slow gradually towards the stall.
- **Point out the unusual control positions required to maintain the attitude and angle of bank.**
- Note the airspeed at the onset of buffet compared to the unaccelerated stall.
- Continue until the glider is stalled.
- Recover as for 'stall with wing drop.'
- Also note that if the glider is in balanced flight – i.e. the yaw string remains central, the glider does not 'drop a wing.'

STALL IN A TURN - TRAINEE ATTEMPT

The trainee repeats the manoeuvre as above, i.e.;

- complete the HASSELL check.
- enter a normal banked turn (30°) and slow gradually towards the stall.
- continue until the glider is fully stalled.
- note the airspeed at the onset of buffet compared to the unaccelerated stall
- recover as for 'stall with wing drop.'

ACCELERATED STALLS

Stall Speed Increases in The Turn

Demonstration only

This is a demonstration only in the early stages of training as it involves significant demands on handling. It is a useful exercise for more advanced trainees/check flights to develop their handling skills and stall awareness.

This exercise is to re-enforce the message that stalling speed is not fixed and is independent of attitude. It also demonstrates that the increase in stalling speed is not linear. i.e. the increase in stalling speed at 60 degrees is much more than three times that at 20 degrees. This is particularly relevant in relation to thermalling at steep angles of bank.

MANOEUVRE DEMONSTRATION

Complete the HASSELL check:

- conduct a calibration stall getting the trainee to read the ASI i.e. a 1G stall with wings level.
- enter a balanced turn of about 20° of bank at normal speed.
- maintain balanced flight (not skidding or slipping) and a constant angle of bank.
- gradually slow to the stall buffet whilst maintaining constant bank and balanced flight.
- *Tell me at what speed the glider buffets.*
- the glider buffets but with little or no tendency for the nose to rise. Some gliders may drop a wing at this point. Assuming that this does not happen
- *We can feel the buffet at this higher speed. By relaxing forwards on the stick.*
- relax the back pressure – *the glider recovers.*

Repeat the exercise several times using different angles of bank, but in increments which are obviously different, say 20°, 40° and 60°, as suggested earlier.

TRAINEE ATTEMPTS – ADVANCED TRAINING ONLY

The trainee repeats the manoeuvre as above at each of the speeds.

This is probably the most demanding of the stalling exercises to teach the trainee. Whilst at this stage of their training they should be reasonably good at moderate turns, most find it difficult to hold the bank accurately in steeper turns, particularly as the speed reduces. However, it is worth persisting until they get it right as not only is the increased stall speed instructive, but the unusual control feel is marked, and you should draw it to their attention.

ACCELERATED STALLS

High Speed Stalls

Demonstration only

HIGH SPEED STALL - MANOEUVRE DEMONSTRATION

The intention of this exercise it to ensure the trainee understands that stalling can occur at high speed if the controls are mishandled.

Again, this exercise requires good timing and handling. Get the trainee to fly the pitching manoeuvre first without the stall and when they can do that, tell them when to bring the stick smartly to the back stop. When correctly conducted the trainee will experience a brief period whilst the glider is stalled, and not responding to up elevator. Get the trainee to read the ASI whilst the glider is buffeting.

It is a good idea to precede this exercise by a 'calibration' stall; a normal unaccelerated stall which will establish the 1G buffet and stall speed. It is more of a reminder than anything else.

WARNING! If the speed is in excess of 55kt at the start of the pull-out, do not continue with the exercise. Recover normally and try again at a slower entry speed. If the exercise is performed with any yaw present, then a high-speed spin entry or flick roll will occur.

Complete the HASSELL check:

- *Follow through on the stick.*
- dive to 55 - 60kt and pull up into a fairly steep climb.
- *I am going to completely stall the glider*
- wait for the nose drop and ease the stick forward as in a normal stall recovery.
- *If I recover from the stall normally - but pull back too soon.*
- as soon as the glider stops pitching down, pull the stick to the back stop.
- wait!
- *The glider buffets and stalls at a higher speed - notice the ASI reading.*

- stick forward to recover, then smoothly back to normal flying attitude.

Point out the circumstances in which a high-speed stall may occur e.g. the recovery after a spin, hurried completion of stall recovery and raising the nose too soon after cable break recovery. The need to recover gently or exercise smooth and accurate control whenever a pull-out manoeuvre is required, especially near the ground.

ACCELERATED STALLS DE-BRIEFING

Remind the trainee about the effect of G on the stall speed. The circumstances in which a high-speed stall may occur e.g. the recovery dive after a spin, hurried completion of stall recovery and raising the nose too soon after cable break recovery. The need to recover gently or exercise smooth and accurate control whenever a pull-out manoeuvre is required, especially near the ground.

COMMON DIFFICULTIES

HASSELL check. Uncertainty about how much of the HASSELL check is required and the appropriate areas of lookout.

Failure to Stall. If you ask the trainee to show you a stall and recovery, they will often begin by raising the nose but fail to continue moving the stick back to maintain the attitude. As the speed reduces the gliders' natural pitch stability gently lowers the nose, often helped by the trainee making a small forward movement of the stick, and soon the speed increases again. The glider has NOT stalled even though the speed may have become very low. This may indicate that the trainee:

- does not appreciate that it is not the initial attitude that causes the stall and so does not attempt to raise the nose or prevent it dropping with back pressure on the stick.
- has not developed the habit of a brisk recovery action.
- is unhappy about 'stalling' possibly because of sensitivity to reduced G.

Recovery from the dive can often be:

- too soon, before the glider has accelerated to a safe speed.
- too late, resulting in a greater loss of height and excessive speed.
- too abrupt, bringing the risk of another and more dramatic stall.

Long established pilots often reveal poor skills when handling stalls because they do not practice them. Even if their club requires annual checks, this will not be sufficient to keep them on top of these issues. They should be encouraged to keep in practice stalling their usual glider.

Converting power pilots. Power pilots are apt to push the stick to the front stop for stall recovery. This is rarely necessary in gliders, but a good pre-flight brief and your full attention during the exercises is required.

Occasionally a trainee may react with panic to an alarming change of attitude, or to reduced G. In rare cases they may freeze on the controls. Instructors should make sure that trainees are never flying the glider or even following through, in any situation which they have not previously experienced.