7 - STRAIGHT FLYING

SPL Syllabus Exercise 7: Straight Flying			
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INTRODUCTION

New instructors soon discover that flying straight is often trickier than turning. The ability to fly in a straight line accurately, impacts on the launch, circuit, approach and the landing. It involves the lookout scan cycle whilst trying to fly straight in varying weather conditions.

THEORY BRIEFING

Lookout Procedures

The trainee should already have been briefed on Lookout. See Chapter D. Do not allow concentration on the exercises to compromise the trainees' lookout. This is a good time to quiz the trainee's understanding of the lookout scan cycle and to re-emphasise that it should be a continuous part of the flying process.

Maintaining Straight Flight

To maintain straight flight, a pilot has to be able to detect deviations from the intended path as early as possible. Small frequent corrections should be made to keep the desired heading. Each correction will need coordinated input of aileron and rudder. Elevator input to maintain the appropriate gliding attitude may also be needed, especially if the glider has not been correctly trimmed.

Detecting changes to the flight path will be both visual i.e. the nose is moving away from a point identified on the horizon, and/or a wing is seen to go down, and/or physical e.g. a wing is felt to be pushed up. Being able to detect both these aspects is essential. If the aircraft appears to be level but the nose is gently traversing the horizon, there must be a small amount of bank present. This is corrected by the application of a tiny amount of aileron and rudder in the opposite direction to the direction that the nose is moving to roll the aircraft level.

Conversely, trainees often tend to 'over control' the glider early on and 'stir the pudding' rather than accept small movements of the air which do not cause a permanent displacement to the heading. They may need encouraging to 'just let the glider fly itself.'

Despite the trainee's best efforts, hands, feet and head can get 'out of sync'. Brief the trainee to bring all the controls back to neutral, wait for the glider to settle and then correct the heading with co-ordinated controls.

Inherent longitudinal stability

Gliders are designed to be stable in pitch – a combination of the effect of the tailplane being set at a different angle of attack to the main wings, combined with finesse from the trim tab. This should form part of a wider briefing on basic aerodynamics.

Control of pitch & use of trim

Attitude should be the prime reference for speed, and only glancing at the ASI to check after any disturbance has settled. The ASI only shows what the speed was, if attitude changes are still in progress.

Flying in trim is a good habit to acquire early in a pilots training. The instructor should check from time-to-time check that the trainee is trimming and re-trimming when appropriate.

The advantages of trimming:

- easier control of speed
- more attention can be paid to other important activities, such as airmanship
- easier to maintain attitude whilst thermalling, resulting in more accurate circles
- greater safety when speed is a critical, such as when in the circuit.

For those reasons, introduce trimming as soon as the trainee has successfully mastered the use of the elevator, and begun to appreciate the relationship between attitude and speed.

There are different types of trimmer, aerodynamic and spring and the pilot needs to be aware of the positioning and mechanism for a particular glider before flight.

The pilot should select the attitude to give the required speed, then keep that attitude constant whilst moving the trim lever to remove the load on the stick. Going faster requires a push load which is removed by moving the trim forward and vice versa. As soon as the load on the stick goes away, relax the hand, check the speed, then if required make further small adjustments. It is important to keep the attitude constant whilst trimming, no matter if the stick wants to move, so that the point at which the load on the stick disappears is apparent.

Airspeed monitoring and control

The trainee should learn to monitor the airspeed indicator and, as soon as possible, be required to fly within specified airspeed limits. A steady airspeed monitoring is achieved by ensuring that the attitude of the aircraft is correct, then checking the ASI for confirmation. The frequency of monitoring is increased at more critical parts of the flight, such as on a winch launch or on the final turn and approach to landing. If the airspeed varies too much then the trim may be wrongly set, or the attitude is being allowed to vary. Watching the ASI too much and following the changes means the trainee is spending too much time with head in the cockpit.

Lateral Level direction and Balance and trim

The trainee needs to be able to determine whether the glider is in coordinated flight. The main glider imbalance detector is the yaw string. It must be correctly positioned (usually in the most sensitive area of the canopy) and readily observable to the pilot. It is very sensitive at indicating small errors.

Flight at critically high airspeeds

The pupil should understand the basic meanings of the flight limitation placard, including:

Va - the max manoeuvring Speed (VA) of an aircraft is an airspeed limitation determined by the aircraft designer. At speeds exceeding the manoeuvring speed, full deflection of any flight control surface can result in damage to the aircraft structure.

Vne – Velocity never exceed is the manufacturers designated speed at which structural failure or flutter may occur and must literally never be exceeded. Explain what Va and Vne mean and why they are important.

As speed is increased significantly, the controls become stiffer to operate, but small forward movement of the stick can quickly cause overspeed if close to Vne. If the forward trim is not sufficient to maintain the high speed, then releasing the stick may cause large vertical acceleration.

Straight flight - correcting for drift

Since flying straight cannot always be conducted up or down wind, it is necessary to explain that even in a cross wind, the aircraft should always be flying straight with balanced controls, with respect to the air. See figure 1 below. However, flight relative to the ground (track), will appear to the pilot as travelling sideways. This sends mixed messages to the trainee pilot; the tendency then is to keep adjusting the flight path rather than heading more into wind to make good the required track. The following diagrams help to demonstrate the problem. This is most noticeable when hill soaring in a medium to strong wind.

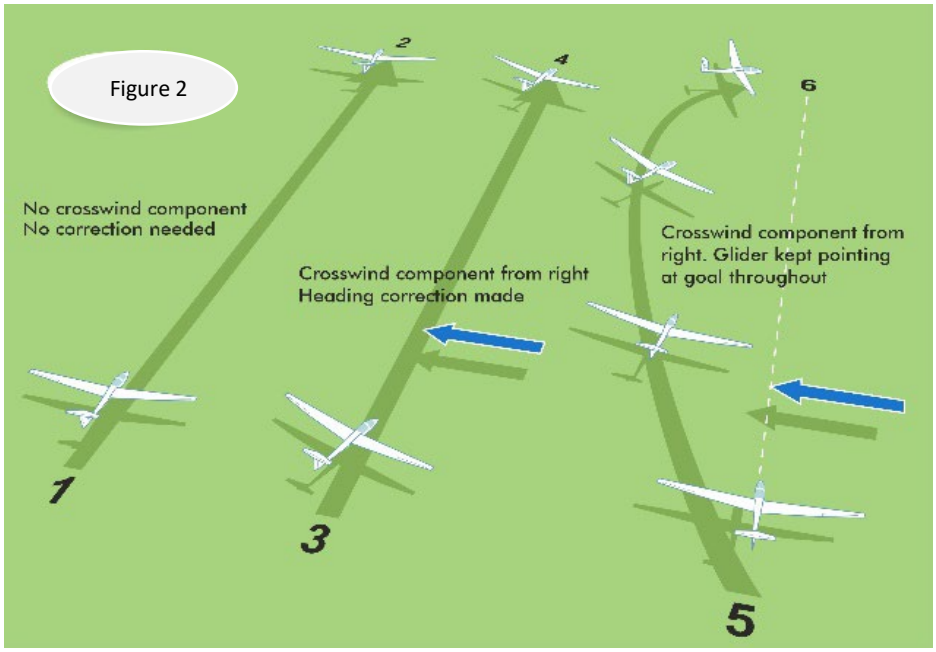
MAINTAINING STRAIGHT FLIGHT

Lookout and maintaining straight flight

AIR EXERCISE BRIEFINGS

The elements to this section of training may take several flights to complete and is weather dependant. Attempting to teach straight flight or trimming in rough air is likely to fail and result in a disheartened trainee.

If it is intended to teach trimming make sure that with the trainee in the glider, they operate the trim system to become familiar with it, before flight. This is particularly important with spring trims operated via a stick mounted trigger or any system that puts a significant load on the operating lever when unlocked.



Remind the trainee that the glider should always be flown in trim for steady phases of flight i.e.

- continuous turning (thermalling)
- flying slowly in lift, or faster in sink
- in the circuit or on the approach
- anywhere where the speed will remain constant for more than a short time.

The exception is that the trim is set in advance for a winch or motor launch or during the initial stages of an aerotow.

TEM

Threats:	**Mitigation:**
Collision	Maintain thorough Lookout
Trainee mishandling at high speed	Progressive approach to exercise
Errors:	
Running out of height for appropriate circuit	Monitor height & position

MANOEUVRE DEMONSTRATION & LESSON

Remind the trainee to use the lookout scan cycle throughout these exercises, as always. Having launched, settle the aircraft into the required gliding attitude and trim. Ask the trainee to follow through and then demonstrate the control movements required to keep the glider flying straight using all three controls.

Then ask the trainee to fly the glider to a fixed point on the horizon, preferably directly up or downwind, using all three controls observing the control movements and prompting where necessary. Continue with the practice until a measure of accuracy is achieved.

MAINTAINING STRAIGHT FLIGHT

Control of pitch and use of trim.

MANOEUVRE DEMONSTRATION

With the trainee following through, fly the glider, at a steady attitude and point out that as long as the attitude is steady, the speed will be steady. Repeat this for a number of different attitudes. Explain that the trim enables the pilot to maintain that attitude without having to keep forward or backward pressure on the stick. Make it clear that attitude is the prime reference for speed control and only glances at the ASI for confirmation of the speed are required. Point out that the ASI only shows what the speed was, if the attitude is still changing.

TRAINEE ATTEMPT

Ask the student to try changing the attitude to select a new speed and wait for the speed to settle at that attitude. Re-practice with for different attitudes.

Use of Trim

Hand control to the trainee.

- Ask them to maintain the attitude but warn them that you are going to alter the trim. Ask them in which direction they are having to apply pressure to the stick.
- Now ask the trainee to use the trim lever to reduce the stick load to zero and then to check whether they have trimmed correctly or not release the stick.

Be on your guard! Some gliders will pitch quite violently if the trim lever is not close to the correct position. If necessary, ask the trainee to return to the initial attitude and re-trim

- repeat the exercise by moving the trimmer fully backwards while the trainee maintains the attitude. Get them to re-trim again

Repeat the exercise for various speeds, say 50kt and 60kt. Tell the trainee that from now on, whenever the glider is in steady flight, whether straight or turning, they should always fly the glider in trim. Make sure they do so.

TRAINEE ATTEMPT

MAINTAINING STRAIGHT FLIGHT

Airspeed monitoring and control

A demonstration is not necessary, so the trainee should fly the exercise. Ask them to fly the glider in the normal attitude and to read off the airspeed aloud so that you can check they is looking at the correct instrument. Ask them to Fly at a set speed (e.g.50kt) and then to lower the nose to the position which they estimate will result in 60kt. After allowing the glider to accelerate, ask the trainee to check the ASI to see if they have succeeded in finding the correct attitude/air speed combination. If it is not very close to what you asked for, ask them to adjust the attitude and try again.

Emphasise the importance of attitude (and lookout) to avoid the trainee becoming fixated on the ASI, before continuing with the next demonstration.

'Chasing' the ASI, and the importance of attitude

This demonstration is useful if you think the trainee is over correcting the attitude because they are following the ASI rather than flying by attitude.

From the 'normal attitude.' take control and move the stick smoothly forward, and keep moving it forward until the ASI reads, say, 60kt (or some value between 10kt and 20kt above the glider's 'normal' speed). Hold the stick in that position. The speed will eventually go beyond 60kt. Talk through the demonstration so that the trainee understands why this is happening and draw their attention to the time it took for the glider to accelerate.

Now smoothly raise the nose until 60kt is again indicated. Hold whatever attitude the glider happens to be in at that point. (Don't pull up too quickly as the glider will be well nose up by the time the speed has fallen to 60kt, and the only way you will then avoid a fairly vigorous stall is to make a recovery under reduced G). The speed will bleed off to well below 60kt. Move the stick forward again to prevent the glider stalling.

Emphasise that the only way to control the glider is by setting the attitude and waiting for the speed to stabilise. If it does not stabilise at the required speed, re-adjust the attitude. Hand back control to the trainee so that he can practice attitude/speed control.

MAINTAINING STRAIGHT FLIGHT

Lateral level direction balance and trim

MANOEUVRE DEMONSTRATION

This exercise is best done straight up or down wind to avoid the potentially confusing issue of track and heading differences.

Trim the glider to the required attitude. Point out that the glider is flying straight towards some obvious landmark because the wings are level. Apply a small amount of bank and point out to the trainee that the glider is now turning. Then, bank slightly back the other way to turn the glider back to the original heading and level the wings.

TRAINEE ATTEMPT

Pass control to the trainee and ask them to continue to fly towards the significant landmark. If, as is likely, air movements tips them slightly and they begin to wander, then give them a little time to spot the error themselves, then prompt them to correct it if they haven't. If the air is smooth and no error develops then briefly take over and introduce a deliberate slight change of direction for the trainee to correct.

MAINTAINING STRAIGHT FLIGHT

Straight flight - correcting for drift

Track v. heading

MANOEUVRE DEMONSTRATION & LESSON

For obvious reasons, this exercise is best conducted on a reasonably windy day. First fly directly into wind. Identify a clear landmark or line feature and the demonstrate that the track of the glider is straight in the direction that it is pointing. Then point the nose of glider at 90 degrees to the wind at another obvious aiming point or feature. The glider will drift sideways in relation to the landmark. Therefore, the nose has to be pointed a little into wind to maintain the track in the required direction. This is called correcting for drift. Point out that you can identify the fact that you are heading directly at your aiming point by the fact that it remains in the same place in the canopy. If there is a local ridge, this is an excellent exercise to conduct whilst ridge soaring.

Ask the trainee to repeat the first two parts of your demonstration. They may need some help in assessing what the wind direction is initially. It is likely that they will need a few tries to apply the correct heading change to accurately counter drift.

MAINTAINING STRAIGHT FLIGHT

Inherent longitudinal stability

MANOEUVRE DEMONSTRATION/LESSON

New trainees frequently struggle with pitch control. They tend to overcontrol and become frustrated.

Trim the glider out in reasonably smooth air, and then release the stick, best glide speed will be OK. Remove your hands from the controls and make it clear to the trainee that neither of you are at that point flying the glider, but none the less, the speed is steady and the glider flies well without help!

Longitudinal stability can be further demonstrated by:

- Setting the attitude in straight flight, for a steady speed – (say 50kts but as a minimum best L/D for the glider) and trim.
- Lower the nose to attain a steady speed of 10kts higher than the trimmed for speed e.g. 60kts but leave the trim.
- Release the stick and observe the glider's response. The glider should initially pitch up (static stability) to an attitude higher than the datum attitude but then perform a series of 'damped oscillations' before settling back at the trimmed speed; this demonstrates positive (dynamic) pitch stability.

MAINTAINING STRAIGHT FLIGHT

Flight at critically high airspeeds

MANOEUVRE DEMONSTRATION &LESSON

Compared to most light aircraft, gliders are aerodynamically very 'clean' and usually have much lighter control in pitch. It is easy to go fast and important that appropriate caution and handling are exercised when at speed. Satisfactory completion of this exercise will prepare them for handling the recovery from the various spin and spiral dive exercises. Ask the trainee to follow through on the controls and speed the glider up to Va pointing out the sensitivity of the elevator and very modest movements you are making.

Ask the trainee to repeat the exercise, holding Va for 10 – 15 seconds before slowing smoothly to normal speed. If the trainees handling is not appropriate, repeat the exercise until they get the feel for it.

When their handling is good enough repeat the exercise going up to about halfway between Va and Vne. Again, repeat until they demonstrate satisfactory handling.

DE-BRIEFING

Reinforce key messages such as the need to fly in trim and the importance of understanding the flight speed limitations on the placard and check there understanding. Always give the opportunity for the trainee to reflect on the flight and ask questions.

ADVICE TO INSTRUCTORS

Trimming as an exercise is sometimes taught, fully or partially learnt, but then neglected.

If the trainee is having difficulty with speed control, check whether the glider is being flown in trim or not. Repeat the trimming exercises if necessary. Re-enforce the message about always flying in trim.

COMMON DIFFICULTIES

The commonest difficulty is the rudder not being moved sufficiently with the stick movement, sometimes due to tense legs opposing the movement.

Over-controlling. Some trainees may overcontrol and swing from side to side about the point they are aiming at. A demonstration showing how less movement and more patience will help.

Trainees often have trouble how to recognise deviations from the proposed path, especially if they have never flown before. To help with this get the trainee to select an aiming point in the distance.

Trainees may find trimming difficult if they alter the trim before adjusting the attitude. The correct order is:

(1) adjust the glider's attitude and allow the speed to stabilise

(2) trim

(3) check that the trim is set correctly

(4) re-trim if necessary.

Trainees may find it difficult to maintain a steady attitude with one hand whilst adjusting the trimmer with the other.

