5 – EFFECTS OF CONTROLS

SPL Exercise 5: Effects of controls			
(i)	**Look-out procedures- see chapter d**	**(v)**	**Relationship between attitude and speed**
(ii)	**Use of visual references**	**(vi)**	**A. Effect of flaps (if available)**
(iii)	**Primary effects when laterally level and when banked**		**B. Effect of airbrakes/spoilers**
(iv)	**Reference attitude and effect of elevator**		**C. Effect of undercarriage (if retractable)**

INTRODUCTION

These exercises introduce the trainee to the three primary controls, their names, location on the airframe, and their effects.

Skills taught in the first few lessons set the scene for the trainees' future flying career. Flying faults that develop in the early stages of training can be difficult to rectify later.

Whilst part of Exercise 5, it is recognised that the effect of airbrakes, flaps and retractable undercarriages are likely to be covered some while after those of elevator, aileron and rudder. Therefore, they are covered in separate sections of this chapter.

INSTRUCTING CONSIDERATIONS

As an instructor it is important that you understand the following teaching points and some of their implications for all demonstrations and exercises:

Trainee '*follow through*'

- the trainee **must use the right hand** with the stick held in a light grip between thumb and fingers. Check on the first flight, whether your trainee is right or left-handed and advise them as necessary. Many trainees' idea of a *light grip on the controls* is either so light that they usually let go of the stick the moment it moves, or occasionally so rigid that you find it difficult to move the stick at all.
- in following through, the trainee learns how far to move the control, at what rate, and in what direction, but NOT the forces involved.

You have control/I have control

The importance of the words *You have control/I have control* cannot be over-emphasised. Right from the start it is vital that trainees establish the habit of releasing the controls when asked to do so. It is equally important that the instructor does not keep the hand on the controls whilst the trainee is on the controls, unless and until the instructor needs to take control again. The instructor should 'guard' the stick as necessary to be able to take control instantly, in some situations.

When you use the words *You have control*, the trainee should answer *I have control* (exactly those words). When you know they have control, take your hands and feet off, unless you have specified something else, e.g. *You use the ailerons while I coordinate with the rudder*. Similarly, when you say *I have control*, make sure the trainee replies *You have control*, and then lets go. In rare cases where the trainee seems determined to hang on regardless, an established form of words and the related automatic actions can get the message through where other methods do not.

The instructor interfering with the controls, either covertly or overtly, when the trainee has been told *You have control,* is at best, a waste of their time and money, and at worst, downright dangerous. They gain the wrong impression of the pressure that needs to be applied to the controls, and/or a false idea of what the glider does in certain circumstances. Years later, when you are not around to help, your previous 'assistance' could kill them. If you find you tend to interfere with the controls, fold your arms, except of course when close to the ground or other gliders.

Clear demonstrations

While you do not want to upset your trainee, most of the demonstrations in this chapter should not be done too gently. The movement of the stick should be 'clean' and 'obvious'. If you demonstrate something using tiny movements of the controls, your trainee may not make any connection between what you did (or said you did) and the glider's response.

Avoid obscuring the effect you are trying to demonstrate by inadvertently adding other movements, particularly in rough air.

Keeping in range

As obvious as it may sound, it is easy to fly out of range of the airfield while demonstrating something or monitoring trainee practice. Stay within gliding range, and organise demonstrations and trainee practice so that, as height is lost, you manoeuvre progressively back towards the airfield.

THEORY BRIEFING

The Theory/Classroom Briefing for Effects of Controls should include:

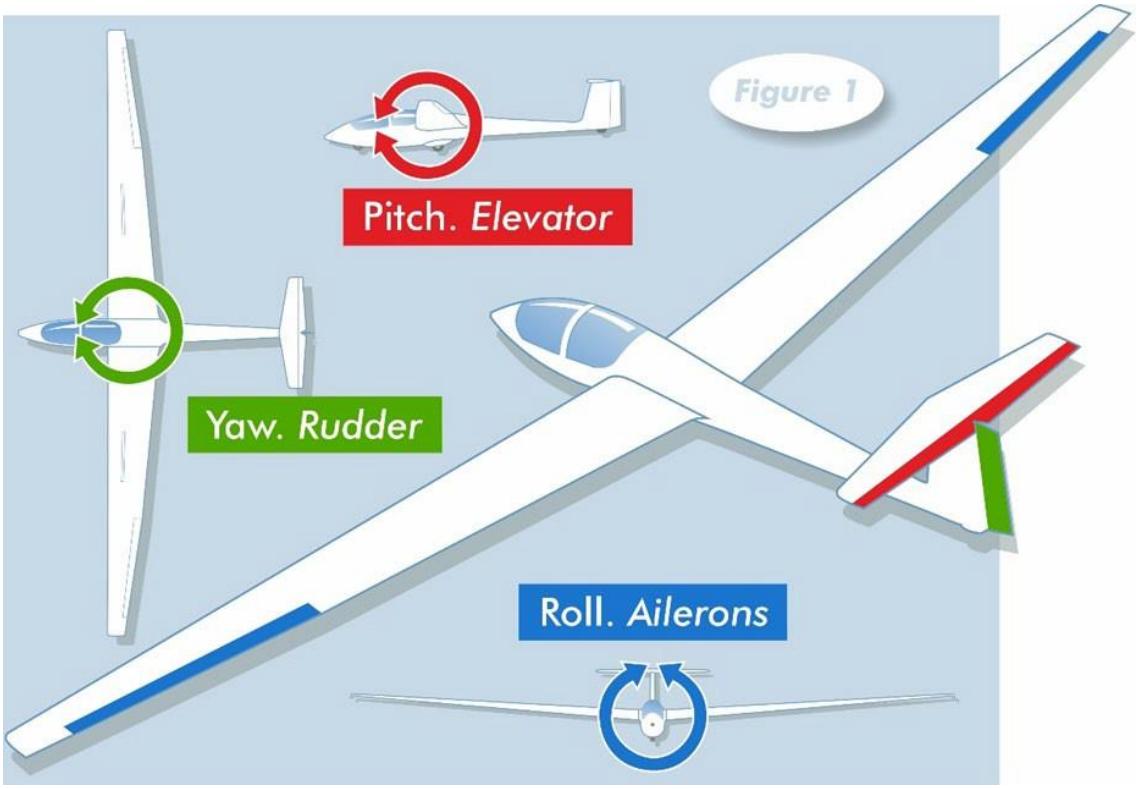
- an introduction to how an aerofoil works
- introduction to the terminology and concept of axes and the rotation around them by pitching, rolling and yawing
- how the elevator, ailerons and rudder achieve this.

It is prudent to mention that the elevator is usually the most responsive and sensitive of the controls and that the force required to operate all the controls vary with speed and glider type.

Elevator – When the elevator is moved down by moving the stick forward, the increase in lift at the tail lowers the nose, reduces the angle of attack of the wings, and hence the lift, and as a result the glider will fly faster. Moving the stick back reverses the effect, but only up to the point where the wing stalls.

Ailerons – the ailerons move in opposite directions. Moving the stick sideways will cause one aileron to go down, hence increasing the lift on that wing. The other aileron goes up simultaneously reducing lift on that wing. This causes the glider to roll. Whilst the stick is held to one side the aircraft will continue to roll further until the stick is brought back to the centre.

Rudder – the rudders effect is to counter adverse yaw and keep the aircraft flying accurately into the airflow. i.e. increasing lift on one wing will increase drag on that wing and hence cause a yawing movement. Using the rudder can counteract this force. The yaw string enables the pilot to assess the amount of yaw.



PRIMARY EFFECTS OF CONTROLS

AIR EXERCISE BRIEFINGS

AIR EXERCISE BRIEFINGS

Note: Demonstrating effects of controls in very rough air will be of no benefit to the trainee because they will not be able to detect the move you are demonstrating, if the controls are twitching about just trying to keep the glider level.

- Prior to the flight, confirm that the trainee has had the appropriate long briefing and ask some questions to check their understanding.
- The trainee must understand the control handover i.e. 'I HAVE CONTROL' 'YOU HAVE CONTROL' and 'FOLLOW ME THROUGH' and what is expected of them.
- Remind them what pitch, roll and yaw are, which controls affect them and how they operate those controls.

TEM	
Threats:	**Mitigation:**
Collision	Maintain thorough Lookout
Errors:	
Running out of height for appropriate circuit	Monitor height & position

The Flying

Before flight:

- ensure the trainee is correctly strapped in, comfortable and can move the controls fully without straining. Sometimes, poor progress in flying can be traced to poor seating and restricted control movement especially with very short or tall individuals.
- Ensure they hold the controls correctly, not too tight a grip or so loose that when following through they let go and that they have feet properly on the rudder pedals.

Remind the trainee that being in the air requires a good lookout and that they should be always helping you with that.

The demonstrations should be un-hurried, with clear positive movements and say the patter just ahead of the movement so the trainee can see action and reaction. Give the trainee time to notice the effects under consideration and repeat the demonstration if they appear unsure.

Adopt normal gliding attitude whilst pointing in the most useful direction (normally into wind). Considering the height available, start the exercises you can comfortably fit in, taking care to maximise time for each exercise.

For each of these exercises ask the trainee to follow through for the demonstration.

PRIMARY EFFECTS OF CONTROLS

Elevator

MANOEUVRE DEMONSTRATION

Elevator – Settle into the normal gliding attitude and trim the glider accurately.

Ask them to note where they see the horizon relative to the nose of the glider: this is the normal gliding attitude. It remains constant.

Move the stick forward to show a definite change of attitude and speed. Point out that the glider is in a new attitude and that the airspeed has increased. You may notice that the airflow over the glider gets noisier.

Then raise the nose above the normal attitude pointing out that there is less ground in view, it is quieter and the speed decreases.

Return to the normal attitude, pointing out that it is the normal attitude, and that the speed has returned to its previous value.

TRAINEE ATTEMPT

Handover control to the trainee. Make sure they confirm that they 'have control'

Prompt them to move the stick forward to the desired attitude.

Then prompt them to move it back to return to the normal attitude. They may try this movement several times.

Ensure that you formally take back control and they confirm 'you have control' when they let go of the stick.

PRIMARY EFFECTS OF CONTROLS

Ailerons

MANOEUVRE DEMONSTRATION

Ailerons – Remind the trainee that the lookout must be thorough. First, look away from the proposed direction of turn, then as far round in the intended direction as possible. Ask them if they see any other aircraft. When certain that it is clear in the direction of the turn, the trainee should look back over the nose.

Show the trainee the normal picture with the wings level. It is possible to detect when the wings are level without having to look down each wing, by noting that the cockpit edge is symmetrical with the horizon. Demonstrate this by banking the glider both left and right.

Describe the movement of the stick to the right or left whilst rolling the glider to a bank angle of 20 to 30 degrees, (Use the rudder to eliminate adverse yaw, because you are only trying to show the bank angle). The aircraft will continue to roll until the stick is 'centralised' - normally slightly beyond the aileron neutral position, at which point the glider stops rolling, stays at the new bank angle, and continues to turn. A slight backward pressure to the stick is required to stop the nose from going down. This introduces the need for coordinated use of the elevator with the ailerons.

Now demonstrate how to return the glider to wings level. Lookout first to check no other aircraft are in the vicinity, then roll the wings level and explain that back pressure on the stick has to be relaxed when the wings are level. Point out that you have returned to the normal attitude.

TRAINEE ATTEMPT

Hand control back to the trainee.

Ensure they do a lookout before manoeuvring the glider. Let the trainee use the ailerons, turning two or three times each

way, while you operate the rudder to maintain balanced flight. Make sure the formal handover is correct.

It is important that the trainee appreciates and understands that the glider will roll, and continue to do so, if the ailerons are not neutral. Allow limited practice at rolling into a turn, centralizing the stick to maintain the bank, then rolling out and centralising the stick to keep the wings level.

The use of outside references, looking over the nose, to check what is happening needs emphasising to avoid complications later in training. You as instructor should make sure the glider is properly trimmed, so there is no residual pressure on the stick when wings level flight is regained.

PRIMARY EFFECTS OF CONTROLS

Rudder – demonstration only

MANOEUVRE DEMONSTRATION

This exercise demonstrates to the trainee that the rudder is a yaw control: it does not turn the glider, i.e. with the wings held level, the rudder only swings the nose left or right and when the rudder input is removed the glider resumes its original heading. **The rudder is a yaw control** *(rudder left, yaw left, rudder right, yaw right).*

Remind the trainee to maintain a good lookout whilst manoeuvring the glider.

Identify an object directly up or downwind and fly directly toward it so the trainee can clearly see what you are demonstrating. The trainee should follow through lightly on the rudder, but with hands off the stick. This helps avoid any confusion as you will have to use the other controls to prevent the glider gradually rolling/pitching.

Apply rudder but keep the wings of the glider level using the ailerons, so that the glider's track remains along the chosen line. Draw attention to the fact that the glider is flying sideways but still moving in the same direction of travel – **not the direction it is pointing**. This may not be immediately obvious to the trainee.

Now centralise the rudder and allow the nose to swing back to the original heading. This shows the trainee that the rudder yaws the glider but does not turn it. This is a demonstration exercise only and it is not necessary for the trainee to try it.

DE-BRIEFING

In the debrief you will need to elicit responses from the trainee. To ensure that the main objects of the lesson have been learned. In this case they are: -

- Lookout.
- Handing over control 'you have control, I have control.'
- All attitude references (pitch and lateral) are outside the cockpit.
- The effects of the use of all the controls have been achieved.

COMMON DIFFICULTIES

Good lookout must be encouraged from the start, because rectifying lack of lookout later is very difficult, especially if the trainee is only concentrating directly ahead. It slows progress early on, but as muscle memory improves, when carrying out the lookout cycle, and confidence in the aircraft grows, a better and safer pilot will be the result.

The use of the controls by a trainee, can vary between overconfident, or too timid. Timid pilots need encouraging whilst over-confident ones need encouraging to use the controls more gently.

Some trainees may hold the controls too tight in the mistaken belief, that if you hold the controls very still the aircraft will not move. An explanation that the air is always in motion and job of the pilot is to guide the aircraft through it like sailor guiding a boat on an ever- moving sea, is a useful analogy. It sometimes helps to demonstrate that the glider will fly well hands off and the pilot is there to guide it in the required direction.

Stiff legs, due to tension, can be detected in the effect of the rudder exercise, because you will find the rudder extremely hard to move.

Ensure that left-handed trainees are using the correct hand on the stick, it will cause major problems later in training if not caught early.

Over-controlling can be lessened by encouraging trainees to fly with their forearm resting lightly on their thigh. Stick movement can then be made using wrist and/or forearm movements. Using the entire arm can lead to coarse and jerky movements. In this respect it is important that their seating position is correct before they take-off.

Hang-glider or weight-shift micro-light pilots who take up gliding come to it with an in-built set of control responses which are exactly the opposite of those needed to fly a conventional aircraft. To turn left, for example, a hang-glider pilot swings the control bar to the right, and to dive they ease it back. in an emergency, such as a cable-break, or any other occasion when the workload is unusually high, they may revert to their previous habitual response. The only way to replace the initially learned responses is by rigorous re-training.

