6 - COORDINATED ROLLING TO AND FROM MODERATE ANGLES OF BANK

SPL syllabus Exercise 6: Coordinated rolling to and from moderate angles of bank

(i) **Look-out procedures**

(ii) **Further effects of aileron (adverse yaw) and rudder (roll)**

(iii) **Coordination of controls**

(iv) **Rolling to and from moderate angles of bank and return to straight flight**

INTRODUCTION

All flying accuracy relies on good, coordinated flight, including straight flight, take offs, turns, and landings. Coordinated flying coupled with a good lookout starts from these first exercises and subsequent encouraging monitoring.

THEORY BRIEFING

Further effect of ailerons - aileron drag

This briefing may be helped by the use of a model. Include an explanation of basic aerodynamics to include the idea that increasing lift also increases drag, and conversely reducing lift will reduce drag.

Relate this to the motion of the ailerons i.e. moving the stick to the left raises the aileron on the left wing, effectively reducing the camber and therefore reducing the lift on that side. Whilst the aileron on the right wing goes down increasing the camber and hence increasing lift on the right side. The down going aileron creates increased drag on the right wing.

This effect causes adverse yaw, causing the nose of the glider to move the 'wrong way' to the direction of the applied bank. This can be corrected by applying rudder in co-ordination with aileron input. i.e. '**stick right rudder right – stick left rudder left.'**

Rudder – induced roll

If the rudder is applied on its own e.g. right rudder, the nose will yaw to the right. The left wing moves forward relative to the other wing, therefore generating more lift causing the glider to bank i.e. roll to the right.

AIR EXERCISE BRIEFINGS

These are upper air exercises. Remind the pupil about the secondary effects of the ailerons i.e. adverse yaw and secondary effect of the rudder i.e. roll. Check they understand the theory. Encourage and reinforce good lookout throughout the exercises.

TEM

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

EFFECTS OF CONTROLS

Secondary effect of ailerons

MANOEUVRE DEMONSTRATIONS & LESSONS

ADVERSE YAW AND COORDINATION - Demonstrating adverse yaw shows the trainee the secondary effect of aileron and why we need to use the rudder. Have the trainee follow through on both stick and rudder.

- *Have a good look out, particularly in the direction of stick movement then look over the nose.*
- *I am going to use the ailerons without using any rudder, I want you to tell me which way the nose moves first.*
- *Look what happens when I move the stick to the left without using any rudder*
- *Which way did the nose move? I wanted to go to the left/right, but what happened first?*

Your trainee may be surprised, even puzzled, that the nose of the glider swung the wrong way initially. Most trainees will benefit from a second demonstration. Tell them what the effect is called and, briefly, why it occurs. Then demonstrate how coordinated use of the ailerons and rudder overcomes adverse yaw. Reinforce coordinated use of the rudder by making two or three turns and reversals without altering the heading by more than 20° or 30°.

The trainee should try two or three turns and reversals. The exact amount of rudder for accurate coordination is a matter of practice. Reference to the yaw string helps, though this is something else which the trainee may fixate on and forget everything else. The purpose of the air exercise is to give the trainee some practice in moving the stick and rudder together rather than independently, to achieve coordinated flight. It is also useful in teaching the trainee to recover from a banked attitude, which implies a turn, back to straight flight, this in turn makes it easier to teach turns in subsequent sections. Make sure prior to the flight that the nature of the exercise is understood, and that this is preparation for coordinated straight flight.

Remind the trainee that the first priority is always a good lookout before making any manoeuvre in flight. Refresh the trainee with the salient parts of each further effect of controls to be demonstrated, finishing with the statement. **Coordinated flight is achieved by using stick and rudder together.** Also impress on the student that the initial lookout before an exercise is to check that it is clear to proceed, and throughout the exercise the scan cycle is continued because things change quickly in the air.

EFFECTS OF CONTROLS

Secondary effect of rudder

MANOEUVRE DEMONSTRATIONS & LESSONS

Roll from rudder alone

In this part of the exercise having looked out again tell the trainee to look ahead and tell you what happens when you apply only rudder. Say 'I am moving the rudder to the left/right, tell me what happens to the bank angle.' Again, do it several times in both directions until the trainee appreciates what has happened.

EFFECTS OF CONTROLS

Exercise – rolling about a heading

MANOEUVRE DEMONSTRATIONS & TRAINEE ATTEMPT

Co-ordination

Demonstrate that if both controls are moved together the secondary effects of controls can be balanced.

Ask the trainee to identify a point straight ahead and follow through lightly on the controls. Apply stick and rudder together from one side to the other reasonably quickly and ask the trainee to tell you what happens to the position of the nose (It should not move).

If you demonstrate moving the controls out of sync, then ask them what happened to the nose position this time. (The nose should swing from side to side).

The stick and rudder should be used together as a final demonstration, repeating the coordinated part of the exercise. The trainee should practice the coordination exercise, with prompting as necessary.

MANOEUVRE DEMONSTRATIONS & LESSONS

Recovering to straight flight from moderate bank angles

Patter the recovery from a moderate banked turn (20 -30 degrees) and then recover to straight flight, then repeat in the opposite direction and back to straight flight, with the trainee following through.

DE-BRIEFING

Reinforce the point of the exercises and check your pupils understanding. Comment positively on good practice and give suggestions for improvement.

COMMON DIFFICULTIES

The major difficulty is usually over-zealous use of the stick compared to the rudder.

Tense legs will result in lack of movement of the rudder. When the trainee is 'following through' you will feel this because you will have difficulty moving the rudder.

