8 - TURNING

SPL Syllabus: Exercise 8 Turning			
(i)	**Lookout procedures**	**(vi)**	**Faults in the turn (slipping, skidding & speed control)**
(ii)	**Demonstration & correction of adverse yaw -see Chapter 6**	**(vii)**	**Maintaining appropriate look-out procedures**
(iii)	**Entry to turn (medium turns)**	**(viii)**	**Turns on to selected headings and use of compass**
(iv)	**Stabilised turns**	**(ix)**	**Use of instruments (ball indicator or slip string) for precision**
(v)	**Exiting turns**		

INTRODUCTION

The ability to roll the glider quickly and efficiently into well-controlled turns is fundamental to basic flying confidence. Since gliders spend much of their time in circling flight, failure to develop turning skills inhibits the development of a successful soaring pilot. In addition, stalling and spinning accidents are often associated with poorly coordinated turns.

Experienced glider pilots with hundreds of hours often appear on soaring and/or cross-country courses, only to find that their major problem is poor turning technique. Their instructors taught them to 'circuit standard', but not to the higher standard required for rapid progress into soaring and cross country flying.

Analysing And Correcting Turning Difficulties

Turning requires skill in coordinating all three controls together, and needs repeated practice, combined with the ability to recognise mistakes, their causes, and what to do about them. The instructor's job is to provide both the handling practice and the necessary help in recognising and correcting poor coordination. Practice whilst thermalling is of tremendous value, providing extra time on the controls, and the basis to become a good soaring pilot.

The trainee will not recognise a poorly coordinated turn entry unless they look over the glider's nose as it enters the turn and exits the turn. The view over the nose provides continuous information about:

- the attitude, and therefore the speed
- the direction and rate of yaw
- the direction and rate of roll
- the bank angle
- any slip or skid.

THEORY BRIEFING

Basic Turning

The glider is turned by rolling it so that some of the lift force created by the wings produces the required 'pull' (acceleration) in the direction of the desired turn. Because this 'tilt' reduces the vertical component of lift supporting the glider's weight, an appropriate back pressure is needed on the stick to increase the AoA to make up the difference. This increases both the into-turn component and prevents the nose from dropping.

Key points for the trainee:

Lookout –before entering a turn look both outside and inside the turn to check that the airspace you will be entering is clear and will remain so.

Look over the nose as you start the turn to check the attitude, the roll rate, the angle of bank, and any yaw

Rate of roll is determined by the amount of aileron applied. The larger the stick deflection, the faster the roll rate and the more rudder is required. the greater the bank angle, the faster the rate of turn.

The ailerons are centralised to stop the roll continuing once the desired bank angle has been reached

The rudder the rudder is applied in the direction of the turn. and has two functions:

- to overcome the adverse yaw (aileron drag) created by the ailerons when they are deflected, and
- to keep the nose of the glider pointing into the airflow as the glider changes direction.

The amount of rudder applied is proportional to the aileron input but compared to the stick movement, the rudder movement is relatively large when rolling out of the turn.

During a turn the natural tendency is for the glider's nose to go down. If no action is taken both the rate of descent and the airspeed increase, so back pressure on the stick is required to stop the nose from dropping.

During a turn, the outer wing traces out a larger diameter circle than the inner wing, so its airspeed is greater and it produces more lift. For this reason, the ailerons almost always need to be slightly 'out of turn' to prevent the bank increasing ('holding off bank').

Continued lookout during the turn is important. Once the roll into the turn is complete, look out again. Set up a regular pattern of looking out for other traffic, then looking over the nose to check the attitude, the instruments, the angle of bank and the yaw string.

After any correction to maintain the bank angle, the ailerons and rudder are returned to their original positions; ailerons approximately central, and the rudder deflection reduced to a small amount in the direction of the turn.

Rolling out of the turn is the reverse of rolling in

- look out to ensure it is clear
- look back over the nose
- apply coordinated aileron and rudder

As the wings come level, centralise the ailerons and rudder and maintain the attitude by reducing the back pressure on the stick.

AIR EXERCISE & 'BY GLIDER' BRIEFINGS

Give the trainee a pre-flight briefing going through the intended exercises as well as the key threat and error check.

TEM

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

EXERCISE DEMONSTRATION

The trainee should follow through on the controls.

Going into the turn

- *before turning to (e.g.) the right, look out, first to the left and then round as far as possible in the direction of the intended turn, particularly behind the wing*
- *if it is clear, look back ahead over the nose*
- *roll the glider using aileron and rudder together*
- *as the bank increases, maintain the attitude with a slight backward pressure on the stick.*

When the desired bank angle has been reached, use the ailerons to prevent it increasing any further, and reduce the rudder deflection.

- *the glider is now established in the turn*
- *now, look out again.*

The trainee's initial practice is to copy the demonstration, and establish the routine of when to lookout, when to look over the nose to check the attitude, what to look for, and to practice coordinating the controls.

Staying in the turn

- *notice how the nose moves steadily around the horizon*
- *keep the bank constant, making any corrections with coordinated aileron and rudder*
- *continue to maintain a good lookout, particularly in the direction of the turn and along the horizon.*

Coming out of the turn

- *first check that it is clear to straighten up, especially ahead of and below the higher wing:*
- *take off bank using coordinated aileron and rudder*
- *relax the back pressure to maintain the attitude*
- *when the wings are level, centralise the ailerons and rudder.*
- *re-trim if necessary.*

BASIC TURNING PRACTICE

Turning exercises

If the turn is taught as one continuous demonstration, then the order will obviously be 'going in', 'staying in and lookout', and 'coming out'. However, opportunities for teaching turning often occur when the instructor has, say, established the glider in a thermal, so the order to teach shown below may be the most appropriate.

- **Staying in and look out in the turn.**
- **Coming out.**
- **Going in.**

The order recommended above may seem slightly strange, but trainees usually find continuous turns easier than the going in or coming out phases. It is also easier if they can fly straight and turn reasonably well before they try to join the two together – which is where most of the coordination problems arise. Trainees may learn more easily if they start by restoring the glider from turning flight to straight flight: a state they are hopefully more familiar with. Whatever the order, considerable practice is required.

Slip and skid

The opportunity to point out when the glider is slipping or skidding in a turn, is usually while the trainee is flying. If the trainee seems unsure of what you are talking about then demonstrate what is happening.

Slip (i.e. under-ruddered turn)

Notice that.

- the yaw string is deflected towards the outside of the turn
- the slip ball is deflected into the turn
- the nose is higher than normal
- there may be a feeling of sliding into the turn.

Correcting slip

- the glider is slipping towards the lower wing, and needs more into-turn rudder
- apply sufficient to straighten the yaw string and/or centre the slip ball
- the bank angle and, indirectly, the attitude, are almost certain to be affected so make the necessary adjustments to keep the bank and attitude constant
- the turn is now balanced and there is no feeling of slipping into the turn.

Skid

- the yaw string is deflected into the turn
- the slip ball is deflected out of the turn
- note that the nose is lower than normal - looks safe, but it is not
- notice that there may be a feeling of skidding and sliding out of the turn.

Correcting skid

- the glider is skidding towards the raised wing, and needs less into-turn rudder
- reduce the amount of rudder to straighten the yaw string and/or centre the slip ball
- keep the bank and attitude constant using the ailerons and elevator respectively
- the turn is now balanced and there is no feeling of skidding out of the turn.

Varying angles of bank at constant speed

Further practice in the kind of coordination needed for thermal centring can be gained by trying to keep the speed constant while varying the bank angle.

Varying rates of roll

High, controlled rates of roll may be needed for thermalling, and for collision avoidance. Asking the trainee to roll quickly into turns will show up any poor coordination.

Turn reversals

Turn reversals improve coordination and use little height. As well as the aileron/rudder coordination required, there is the smooth relaxation and re-application of backward pressure on the stick to keep a constant speed.

Regaining a heading

This is a repeat of the straight glide exercise but includes a gentle turn to regain the original heading. Brief on the following:

- **regaining the heading** by choosing a feature to turn towards, using small angles of bank and coordinated controls
- **rolling the wings level** just before the feature is directly ahead**. (**The need for anticipation when straightening up soon becomes apparent, but the degree will depend on how quickly the glider is rolled wings level.)
- **continuing in straight flight**, using the scan cycle.

For trainee practice prompt rather than demonstrate. Take control, identify a distant ground feature or cloud ahead, and then introduce a heading error. Hand back control to the trainee and ask them to return to the previous heading.

When the trainee can reliably turn onto a heading, then a briefing on use of the compass and turning onto compass headings should be introduced.

DE-BRIEFING

As always - the debriefing should cover the exercises covered in the flight, but lookout is always a priority to either commend or stress the need for improvement if it is poor. Re-iterate any specific faults identified and how to eliminate them or improve. Always end on a high.

COMMON DIFFICULTIES

Failure to lookout before rolling into the turn is extremely dangerous. Emphasise the importance of lookout by taking control immediately and preventing the turn.

Looking down the wing as the glider starts to roll is common, unnecessary, and often results in poor coordination and speed control. If this tendency is established early – it will become a habit that is difficult to correct.

Failure to look out before rolling out of the turn is no less dangerous than failing to look out before rolling in. Same remedy as before.

Very slow rates of roll and/or under-banked turns can be achieved smoothly and with apparent accuracy even if the pilot's coordination is poor or non-existent. Do not accept slow rates of roll, or bank angles of less than 30°. Uncoordinated turns are both inefficient and potentially dangerous. Nervous trainees will require your patience and encouragement to help them overcome this problem.

Bank varying in the turn. In straight flight trainees have difficulty recognising when the wings are not level, and while turning can find it difficult to perceive small changes in the bank angle, which may be partly or wholly the problem. Bank can also vary if the trainee is over-controlling the glider.

Bank increases in the turn. Ailerons almost always need to be slightly 'out of turn' to prevent the bank increasing ('holding off bank'). If the bank becomes very steep, it may not be possible to check under the raised wing whether it is clear to roll level, or not.

Bank reducing in the turn - may be due to holding off the bank too much, or a thermal core lifting the inner wing. In either case it is necessary to recognise what is happening and then take action to prevent it. As the bank reduces, trainees may attempt to maintain a steady turn rate by ruddering the glider round. Allowing the bank to reduce, and over-ruddering can sometimes be a result of nervousness about steeper turns - look for the trainee leaning out of the turn.

Speed varying - is the result of poor elevator coordination and has several causes:

- the horizon not clearly visible during part or all of the turn
- not appreciating the need to maintain the attitude when rolling into the turn, or when established in it
- not noticing the attitude change by failing to look over the nose during the roll into or out of the turn
- failure to maintain the necessary back pressure on the stick when aileron input is required
- not re-trimming in a continuous turn
- chasing the ASI
- failure to monitor the speed sufficiently often, along with almost any of the other faults.

Guessing with the rudder - indicates that the trainee does not understand what is required, or how it is achieved.

Over-active yaw string. Before assuming 'guessing with the rudder.' try flying the glider yourself. The location of the yaw string on some canopies can make it incredibly over-sensitive. If it is, try moving it to a less critical position. Learning to ignore the yaw string is negative training.

If the attitude remains constant the transition to stronger or weaker lift produces short term changes in speed. It is an advanced technique to maintain constant speed and milk the most energy from these surges. Be satisfied if the trainee is maintaining the attitude. Explain to them why the speed changes even though the attitude remains constant.

Speed and bank increasing in the turn is the start of a spiral dive. To recover, reduce the bank, bring the speed under control, and then resume the turn. The initial cause of the problem may be over-banking, or a failure to correct a sideslip, either of which results in the glider weathercocking. A common reason for unwanted roll is leaving on too much in-turn rudder.

