

14 – ADVANCED TURNING

SPL Syllabus: Exercise 14 Advanced Turning

(i)	Steep turns (45° or more)
(ii)	Stalling and spin avoidance in the turn and recovery
(iii)	Recoveries from unusual attitudes, including spiral dives

INTRODUCTION

Once the trainee has mastered co-ordination at moderate angles of bank to a reasonable standard, introduce the skills needed to maintain steep turns, as are needed for thermalling. Ideally the stalling and spinning exercises will have been completed, so that spin avoidance can be concentrated on here.

THEORY BRIEFING

The stalling speed of the glider increases in the turn and that this increase is non-linear: at small bank angles it is negligible but as the bank increases beyond 45° or so, it becomes significant. To turn tightly, we must have the speed to do it.

The wing has to produce more LIFT to counter the increase in weight due to the load factor. There is consequently, an increase in the stalling speed. The speed to maintain the turn should be increased in proportion - see the table below.

The formula for calculating the increase in stalling speed is:

$$\sqrt{n} \times VS$$

where n is the load factor (same as G) and VS is the normal unaccelerated stalling speed.

Table of typical stalling speeds at given angles of bank

Bank angle °	G loading (n)	Stall speed kts
0	1.00	36
10	1.02	36
20	1.06	37
30	1.15	39
40	1.31	41
45	1.41	43
50	1.56	45
60	2.00	51
70	2.92	62
80	5.75	86

The radius of turn is related to both the airspeed and the angle of bank. A steeper turn at the same airspeed will result in a smaller turn radius. It may not be so immediately obvious that allowing the airspeed to increase will widen out your

turn. This is important when thermalling with others – if you are being “caught up” by a glider behind you in the thermal turn, then increasing airspeed will make it more likely they will disappear from view as they come close to your tail or even cut inside you. To ‘get away’ you must increase the bank.

Up to this point in the training, the trainee has been taught that at the required angle of bank, return the controls to neutral. However, at steeper angles of bank, most gliders will require a little out-aileron to maintain the bank and considerably more up elevator than the trainee will be used to. This outer wing is moving faster in a steep turn, and hence producing more lift, which tends to increase the bank if not “held off” with out of turn aileron. If you are over-ruddering at the same time then the controls will be crossed, with the stick well back as you reduce the airspeed. If the glider is allowed to reach the stall it will roll in and depart with very little warning.

AIR EXERCISE BRIEFINGS

The aims of the exercise are to teach trainees to fly steep turns accurately, with good lookout and situational awareness, and secondly to ensure they understand the potential threats from mishandling. A busy thermal is one of the main situations where someone whose lookout is sub-standard and whose handling is not instinctively accurate will come to grief, endangering others as well.

TEM

Threats:

Collision
Spin or spiral dive
Violent “flick” entry

Mitigation:

Lookout
HASSLL check first
String in middle, especially > 50°

Errors:

Stalling in turn
Running out of height for appropriate circuit

Monitor airspeed
Monitor height & position

Brief the trainee, that you will be practising more steeply than they have probably been used to i.e. aiming for 45 degrees. They should reach a standard where they can maintain attitude (and hence airspeed) and bank angle and fly without slip or skid, i.e. with the string in the middle.

It is common for trainees to overestimate the angle they are at. Conveniently, it is easy to judge the angle by picking any instrument with screws at the four corners. When you are at 45° the diagonal will be parallel to the horizon.

More elevator input is required to maintain the correct pitch attitude at higher angles of bank and out of turn aileron will be needed in steeper turns to maintain the bank.



MANOEUVRE DEMONSTRATION

For part (i) of the exercise you should demonstrate a steep turn – usually starting at 45° is good.

The speed to maintain the turn must be increased as the bank angle is increased. However, it is easier to stabilise the required speed before rolling into the turn, so demonstrate this, and the new attitude taken up by the glider.

Then:

- Look out for other traffic, especially in the direction of the intended turn.
- Look back over the nose.
- Roll the glider to 45° bank. Point out that the diagonal screws on the instruments are now level with the horizon.
- Point out that considerable up elevator is needed to maintain the correct pitch attitude.
- Out of turn aileron will be needed as the angle of bank increases, to maintain that angle of bank.
- If the nose is allowed to drop the speed will build up rapidly.
- If the speed is excessive, first reduce the angle of bank with aileron and rudder, then reduce the speed with the elevator. When the speed is correct, increase the angle of bank again.

Demonstrate that the rate of roll can be varied, by moving the controls more quickly. There are situations where a rapid roll is essential.

For part (ii) of the exercise, allow the glider to come close to departure and demonstrate that the stall can be avoided by simply relaxing forward on the stick (or moving the stick slightly forward if fully trimmed).

Demonstrate the different effects of over-ruddering (skid) and under-ruddering (slip). In the latter case, you will add a little “top” rudder (i.e. out of turn rudder), and the string will be slightly out of the turn. Allow the trainee to feel that the glider is more “comfortable” like this, and contrast with how it feels if you change to bottom rudder. If you attempt to stall

with even a small amount of sideslip, the nose will have to be high before the stall, and the glider gives plenty of warning.

TRAINEE ATTEMPTS

Allow the trainee to practice each part of the exercise, over several flights if necessary.

Depending on your trainee, you may choose to start with “easy” turns, at about 30° of bank, and build up gradually to steep turns. You should re-demonstrate if you want them to try very steep turns, at say 60°. Draw attention to the G force they will feel (2G at 60° of bank).

When they can maintain a turn at a given angle of bank, get them to vary the bank angle during the turn.

For the stalling parts of the exercise, it is important that trainees feel for themselves how the glider behaves when it is very close to the stall.

DE-BRIEFING

The debriefing should emphasise the importance of lookout and situational awareness. The trainee’s understanding of how stalling speed increases in a turn should be checked, along with their appreciation of the effect of slip or skid, and how to recover if the glider is near the stall.

This is a challenging exercise for the trainee and, if they have found it hard going, they should be reassured that that is normal, because it requires a high degree of co-ordination skills, whilst still maintaining a really good lookout. Remind them that mastering these skills will make them a much better thermal pilot, which is a reward worth striving for.

COMMON DIFFICULTIES

Failure to lookout before rolling into the turn is extremely dangerous. Take control to prevent this happening. In a thermalling situation the pilot must check it is safe before every change of bank angle. This requires a lot of practice. Aim to bring your trainee to the point where they *cannot* move the controls without looking out first.

Bank increases in the turn and the ailerons need to be slightly “out of turn” to prevent the bank increasing.

Varying the bank angle whilst maintaining airspeed takes patient practice and may produce basic co-ordination errors.

If the trainee is having trouble maintaining the airspeed they may be focusing on the ASI instead of the horizon. Covering the ASI can work wonders.

Bear in mind, and point out to the trainee, that in a thermal, the airspeed will vary as the glider moves through differing rates of lift. This can be ignored if you are just trying to perfect turns, or it can be used to help you centre better. They should fly by attitude.