MINIMUM RADIUS TURNS

Where and why do we need to make a minimum radius turn? The minimum radius turn means making a turn in the smallest possible ground area, for example if we find ourselves in a valley in deteriorating weather and we need to make a 180 degree turn to come back out.

If possible turning into the wind will help to reduce the turn radius over the ground, however be mindful of slip and skid illusions and make sure you keep the aeroplane in balance (keep the ball centred) and keep the turn co-ordinated.

Next question: What is the safest way to execute the turn? A lot of pilots will advocate a 60 degree angle of bank steep turn but as the old song says "it ain't necessarily so". What they fail to understand is that the radius of the turn increases as the square of the airspeed. For example if you fly a medium level turn, say 30 degrees angle of bank at 50 knots, then if you flew the same angle of bank turn at double the airspeed, (100 knots), then the turn radius would be four times more than the original turn.

So in order to reduce the turn radius we need to either increase the bank angle or reduce the speed or maybe both. Problem: as we increase the angle of bank we also increase the load factor which in turn will increase the speed at which our aeroplane stalls, not something we want to happen if we are close to the ground in a tight corner. If your aeroplane stalls at 50 knots in straight and level flight it will stall at around 70 knots in a 60 degree angle of bank turn. However in a 35 degree angle of bank the stall speed would only go up to around 56 knots which would give us a much more comfortable margin over the stall. So we can now fly our turn slower without risking inadvertently stalling the aeroplane.

What else can we do to increase our safety margin above the stall. What do flaps do? They increase lift and they increase drag. The first stage of flap mainly increases lift which is what we want, without much drag, which is what we don't want. The first stage of flap also reduces the stall speed which is also what we want so we can fly slower without stalling. So let's put out a stage of flap to execute our minimum radius turn.

So let us have a look at some figures and see how we can tie all this together. In order to make a 180 degree turn we need to double the radius to get the diameter which is effectively how much room we will need to execute the turn. If we were to fly a 60 degree angle of bank turn at 90 knots we would need around 300 metres in which to make the turn. If our aeroplane stalls in straight and level flight at 50 knots this gives a margin over the stall of 20 knots. So let's now slow down and take a stage of flap and say the stall speed is reduced by 5 knots to 45 knots straight and level. If we were to fly a 40 degree angle of bank turn at a speed that is 20 knots above the stall ie. 70 knots we would still only need around 315 metres to make the turn.

What about if we reduced the bank angle to a very comfortable 30 degrees where most of us could fly much more accurately and we were prepared to fly at just 10 knots above the stall how much room would we need? At 30 degrees angle of bank the stall speed would increase by a mere 7% to say 54 knots clean or 49 knots with flap. If we flew the turn at 60 knots we would need 330 metres to turn the aeroplane 180 degrees.

The question is: Is it worth going full power, with increased G loading and the extra stress of trying to a make a high speed co-ordinated manoeuvre for the sake of 30 metres.

<u>TURN DIAMETER</u> *(Room to Turn 180 degrees.)*