Circling in Thermals

The best rates of turn for circling in thermals of various strengths and diameters can, of course, never be exactly laid down. This article only indicates the general effect of varying the rate of turn in several possible thermals. The conclusions arrived at are not exact, but are merely a general guide that happens to check fairly well with practice.

Thermals, like rivers, flow faster in the middle, and it is often reckoned that it pays to do very tight circles in order to fly in the stronger up-current and so climb faster. The rate of climb of a sailplane is the difference between its sinking speed and the strength of the up-current, and in a thermal this gets more complicated because, although the up-current gets stronger in the middle, the sinking speed of the sailplane increases as the circle get tighter. The sinking speed of the rates of turn, and it is feasible to "guesstimate" the lift across an ideal thermal, and so concoct a reasonable idea of the best angle to bank under various conditions.

The sinking speed increases as the circle gets tighter, because the stalling speed increases due to the higher wing loading caused by centrifugal force. It is most efficient to fly near the stall for minimum sinking speed when flying straight, and the same applies when circling. Curve "A" of diagram shows how the stalling speed varies with bank angle, from 28 m.p.h. in level flight, 33 m.p.h. in a 45° bank turn and so on. That helps to explain why so many crashes occur through stalling on a turn. The spin is accentuated because the natural reaction is to hold off bank as soon as the wing drops, which lowers the aileron of the inner wing, not only thoroughly stalling that wing-tip, but also increasing the drag, thus swinging the plane into a spin—the fate of too many DAGLINGS.

The actual figures are typical of a plane of the GRUNAU BABY or BOWLUS BABY ALBATROSS type, but as stalling and sinking speeds are important when circling, not the best gliding angle, they roughly apply to all types. All curves assume perfect turns with no slip in or skid out.

Curve "B" of diagram 1 shows the speeds just above the stall that give the minimum sinking speeds at various angles of bank, and actually represents pretty slow flying. All the curves are based on the flying speed according to curve "B," which represents a constant lift coefficient or angle of attack. Curve "C" of diagram 1 shows the rapid increase in the minimum sinking speed as the bank increases from 2.7 f.p.s. in level flight to nearly 4.5 f.p.s. in a 45° bank turn, and 20 f.p.s. in a 75° bank!

Curve "D" of diagram 2 depicts a cross-section of the circle, and shows how the sinking speed varies as the radius of turn. The positions on the surve that correspond to various bank angles are shown by a head-on view of a 45-ft. span sailplane drawn to scale at the correct bank angle. So it will be seen that up to 30° bank, 106 ft. radius, the circle is tightened without a great increase in sinking speed; but around 45° bank, 85 ft. radius, the curve takes a bend, so that over 60° bank the sinking speed increases rapidly without much decrease in the radius and the plane is really doing a tight spiral dive.

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