THERMALLING

BY VIC SAUDEK

The circling of a sailplane, or of a group of them, is a beautiful and satisfying sight. Each pilot strives to maneuver into a mass of uplifting air, drawing curves in the sky, manifesting his skill, knowledge and personality. He who has played this game knows the rhythm of the control forces, the surge of accomplishment as the climb increases, the alert, wary determination when one sinks, the seeking for favorable position and the adjustments forced by closeness. This is an exciting sport. It can develop into an art form if it has not already done so. As a science we have realized only the first few light scratches on the surface of a deep and promising discipline.

The less than half a million hours that separate us from the almost ten-minute-long flight of Orville Wright in his 1911 biplane glider are all that mankind knows of soaring practice. Much of this knowledge is enclosed in books and magazines on this subject and much of that is well worth review, especially the late Dr. W. B. Klemperer's "Theory of Soaring Flight." The purpose of this article is to put down a few items which, to my knowledge, have not been available in print to date. Insofar as possible I shall try to give some information as to when and from whom I learned some of these details or saw the conditions.

DUST DEVILS

Individual thermals of the column kind are usually rotating. It is not clear if the direction of rotation tends to be left in the Northern Hemisphere and right below the equator or not. The Coriolis Effect is blamed for this difference and it (or something like it) does affect the surface rotation of the much larger high and low pressure areas. It seems that dust devils are not obviously inclined to prefer only one kind of turn direction. I have watched swirling dust of both kinds and am fairly sure that adjacent columns rotate so as to minimize energy loss. They mesh like toothed gears, or else they meld together. On a few occasions it has been possible to look down into a circular group of six closely related dust devils twisting themselves together into a rope around a single central fairly large core thermal. Albert "Red" Slatter called this to my attention about 1940. I have seen it at least twice and Gus Briegleb has noted it more often at El Mirage (Dust Devil Junction).

Supposing the dust devil rotates clockwise, is there a preferred direction to turn? Perhaps it does decrease airflow velocity over my left wingtip to turn left since the left wing moves on a smaller radius, hence more slowly than the right tip. It is obviously not critical at the radius we are required to fly, probably contributing less to rate-of-climb than a number of other factors such as the lack of roundness of the thermal.

Relatively few clouds building a long, visible dust devil are round, yet lift is often reasonably constant almost anywhere under them when they are fairly young. The discrepancy of the visible dust devil diameter and that of the cloud it is feeding is a factor of at least ten. Probably this is affected by the added heat energy available for air expansion at cloud base (from dry adiabatic to wet adiabatic at the condensation level). Perhaps by this energy release more of the surrounding air is entrained. If some of this air is too dry to create condensation this could result in soaring above the base of the cloud but outside of it! Several pilots have done this by putting one wing only into the mist and tracking the cloud's periphery. Once I found myself spiralling alongside a cloud entirely in the clear at least 1000 feet above cloud base.

PRELIMINARY CONCLUSIONS

To sum up the remarks made thus far on an obviously complex subject: Thermals in columns are not simple. They are often not round. They may join up or rotate alongside one another. They may meld together or twist around one another in separate coils. There are thermals with strongly rising cores and others with sharply defined, small, jolting, down-current cores (John Robinson, 1951). Dust devils have been seen to detach from the ground and reattach later after lifting their lower ends quite a distance from the surface. Another configuration is a large diameter, not very tall (say 2000 feet), roundish wall of dust surrounding a relatively dust-free center. This can be a downspout in which I once was dropped from 13,000 to 11,000 feet in less than 20 breathless seconds, some of which were spent in the straps above the seat and a few more of which were used pulling gently out of a steep dive and leaving the scene.

It should be noted that not much has been published in soaring pilots' language about the electrical charge distribution around thermals, of the mechanism of the ground-to-thermal interface, of the temperature distribution, velocity distribution, rotation, or a number of other more subtle but probably significant factors. How, for example, does a vortex pick up energy when it is travelling across the ground? Just how does a thermal get born? Note that the decay mechanism of a dust devil, buckle and fadeout, has not been discussed in any detail, nor what happens at the top of a robust column at an inversion. What we do know is that a judicious soaring spiral in rising air will carry a good sailplane aloft.

FLYING TECHNIQUES

If alone the direction of turn is chosen, ideally, by flying toward the wing that tends to rise. Or, perhaps one has a penchant for turning only in one direction. Frequently pilots do not sit square in the seat and tend to steer toward the low shoulder. One is less sure of turns toward the high shoulder and the ball shows this by its unsteadiness.

When not alone in a thermal one's choice is narrowed. If there is only one other neighboring sailplane and at least 500 feet of altitude separation between them, turns in opposite directions give both pilots more opportunities to observe one another. (From John Robinson via Bill Bowmar, about 1957). Or, if closer, they remain opposite one another so that they can see each other comfortably when both turn the same direction. If three or more converge in one column the accepted procedure is that all should conform to one direction of turn. The first one in, or the top pilot, sets the direction of turn.

In any case, when about to turn into lift (or out of down) a look around is imperative. It is important that one look out alternately on both sides of the cockpit when spiralling so that he will not be surprised by another sailplane.