CATCHING THERMALS

By EMIL KISSEL

A thermal is a rising column of air that is approximately circular in cross section. The thermal source may produce a continuous or intermittent stream of rising air. The diameter normally increases with altitude and the top of the thermal usually has spotty lift as indicated by the convolutions on the top of a cumulus cloud. Circular thermals are very common and a novice will have the most success in using them to gain altitude.

The problems of utilizing thermals for soaring are: first to determine if there are thermals, secondly to locate them, and third to use them to gain altitude. We shall assume that airplane tow is to be used and therefore there is no limit to the altitude or length of time that we are towed. The simplest way to determine thermal activity is to send a soaring pilot up in a lightplane with a variometer. He can quickly determine the diameter, strength, and frequency of thermals by techniques described later in this article. From the ground a soaring pilot can guess at thermal activity by the following signs; dust devils, clearing of haze, formation of cumulus clouds, birds soaring, light variable winds, and meteorological information such as lapse rate, inversions, air mass characteristics and of course ground heating which ultimately produces all thermals. The CAA is very cooperative in broadcasting special meteorological data over their range beacons and if a forecaster is available he can give information such as; "at about 11 A.M. when the ground temperature reaches 93° F. convection will reach 11,000 feet."

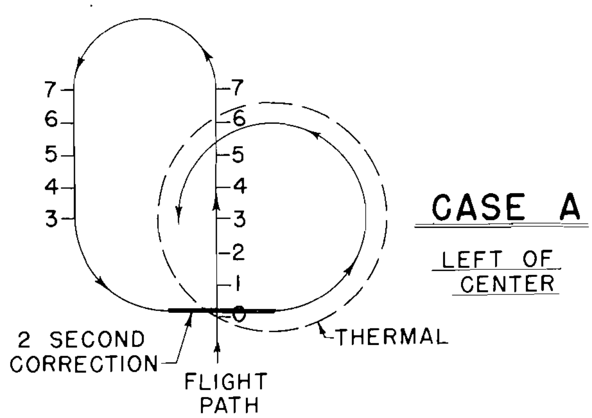
Our second problem is to locate these thermals. Airplane tow simplifies this problem compared to winch or auto tow but is not superior to the powered sailplane. With an established rate of climb at a constant airspeed, and the sailplane in the same relative position to the towplane, a thermal is indicated when the towplane rises suddenly in your field of view. Allowing for a time interval you feel the vertical acceleration of the sailplane as it enters the thermal, with accompanying airspeed fluctuations and turbulence. After passing through the thermal, the towplane will drop lower in your field of view, and the sailplane will experience a negative acceleration shortly thereafter. Briefly that is what a thermal feels like when you remove all irrelevant sensations. It is easy to be fooled. Horizontal guests of air, horizontal rolls, zooming by the towplane, tightening of the towrope are all liable to feel like thermals, but a little experience will distinguish these false thermals.

Now we come to the hard part, using the thermal to gain altitude. A thermal has to be large enough to spiral in and strong enough to carry the sailplane up. First we must know the smallest diameter circle our sailplane can spiral at a safe airspeed.

Once the diameter required for spiraling is known, it is simple to determine how many seconds we must fly through a lift area so we can be sure that the thermal is large enough. Suppose our sailplane can spiral in a 600-foot diameter circle. With a tow speed of 65 MPH we can say roughly that we travel 100 feet a second.

This means that in six seconds we have covered the 600 feet required. As we enter the thermal we count off the seconds 1000-1, 1000-2, 1000-3, 1000-4, 1000 5, 1000-6. At the same time we determine the strength of the thermal as follows. We have found the rate of climb of the towplane-sailplane combination in calm air to be 5 feet a second and notice the rate of climb in a thermal to be 15 feet a second. 15-5 equals 10. The strength of the thermal is about 10 feet a second. Our sailplane sinks 4 feet a second in a spiral so we should climb at 10-4 equals 6 feet a second when we center the thermal. "Centering" a thermal means we fly in constant lift all the way around a circle. To do this we have to visualize where the thermal is. Since we can't see most thermals, we have to work out a system for locating them with respect to the sailplane.

Suppose we have gone through the thermal for six seconds as previously mentioned and on the seventh second we feel negative acceleration and see our variometer dropping rapidly. We have already decided that we would release in a six second thermal of sufficient strength. Immediately after release we do a tight 180° left turn to head back for the thermal. With more experience we may be able to determine if the thermal is to the left or right by the wing going up nearest the thermal. In the beginning, it is best to adopt a standard pattern and improve on that.



A highly successful pattern is the one described. This pattern depends on constant size spirals which depends on constant airspeed and angle of bank. Take the three possible conditions of entering the thermal; left of center (a), through center (b), and to the right of center (c). In each case we have six seconds of lift and in the seventh we hit the downdraft..

We turn 180° sharply to the left and on rolling out fly straight counting 1000-7, 1000-6, 1000-5, 1000-4, and 1000-3. In case A we are still in downdraft, case B the lift is increasing and case C gives us a good wallop. From these observations we can usually tell where the thermal is and fly accordingly. (A) requires a 90° turn and 2 seconds straight and then spiral. (B) requires the spiral to start at 1000-3 then one second straight which should center the thermal nicely. (C) encounters a downdraft soon after the spiral starts at 1000-3. Continue spiral through 270° then straight for one second