ANGLE OF BANK

Many references show the effect of the angle of bank on the rate-of-climb in a thermal. Since a very strong thermal may be small in diameter (most are smaller near the ground) it is clear that there are instances where small circles pay off. The reduction of diameter from a 45 degree bank to a 60 degree bank is quite small, but the rate-of-sink increase is disproportionaly great due to the higher wing loading, the higher airspeed and the consequent high lift coefficient condition which increases the induced drag enormously. One must be careful if he advocates more than a 45-degree bank for any conditions other than adjusting one's position in a thermal. For most conditions a 30 to 40-degree bank is most rewarding.

The span and wing loading of a sailplane being flown will influence the optimum bank angle to some degree, but is still wise to try to stay at less than 45 degrees of bank unless the diameter of the thermal being flown simply will not support the machine at larger radii. This does not speak well for the heavier, small-span designs.

When leaving a thermal some pilots increase their speed for the last turn, then straighten out on course with extra velocity so that the usual surrounding down current can be penetrated with less loss of altitude (Graham Thomson, about 1962). In some instances one rolls out on course only to fly in lift for a considerable distance. It won't be easy to solve some of these anomalies.

THERMALS IN HIGH WIND CONDITIONS

Thermals either drift with the wind (i.e. the point of contact with the ground travels with the wind) or they lay over (i.e. the source is fixed but the upstreaming air is carried away downwind). There is more to this problem, of course, for the atmosphere is subjected to a great many conflicting forces. It is not wise to limit thermal configurations to simple forms. Dr. Joanne Starr Malkus ("Cumulus, Thermals & Wind" *Soaring*, Sept.-Oct. 1949), shows other mechanisms, some over the oceans, that depend on wind velocity primarily. Some of us have seen and described thermals that rise with sharply etched dust content, then arc over in a long, graceful conical spiral, the axis parallel to wind direction, to touch the ground a mile or so downwind, then rise again in a still larger well-defined arc and sweep downward to the ground and off again into the distance! I have seen this twice, once from a DC-6 above a carbon black plant in Texas, and again at El Mirage in the dust form described above.

Once, when being blown back as I climbed so that when I penetrated into the wind the same yo-yo dance was repeated with no net distance or altitude gain, a lucky shift of position permitted a near vertical climb to 11,000 feet in the same strong wind! This may have been shearline action. I described this condition to Dr. Joachim P. Kuettner and was rewarded by hearing of an identical experience that he had had in Finland, except he was over water and fighting strong off-shore winds!

STICK THERMALS

These can be very bad. They are the simplest and most obvious way one can fool oneself, for all it requires is an inability to recognize that one is trading too much speed for altitude. The result may be a stall from which further complications can follow. Instructors are justly afraid of students who do not understand that the elevators are for controlling speed only, not for changing altitude — except within certain limits.

In considering such questions soaring knowledge can be developed. One is dealing in the finer field of developing judgment, a feel of control forces, of pattern and rhythm of turbulence, sifting and sorting ideas, arriving at decisions which pay off or fail in a bewildering confusion at first. It is when the pay-offs bring real profits in a kind of predictable manner that thermal sense is generated, to be annealed and tempered over hundreds of hours of practice. Eventually he will so understand this situation that, on a speed dash, a pilot will be able to sweep into a chandelle from a 100-mph drive, roll out into a thermal for a quick draught of altitude, then hurry off again on course. He has computed in his mind the trade-offs of airspeed, altitude, time in the thermal (if he centers it effectively) and when to charge away again. It is a thrilling sight to see and it's a shame it is usually performed over desolate terrain, for few have seen it from the ground. It is, of course, more thrilling for one to experience this pirouette in an exciting flight. Note, however, that the chandelle is *not* a stick thermal (a good total energy variometer would not be fooled). It is, instead, a well-drawn maneuver designed to optimize cross-country speed, and it is for experts only.

CONCLUSION

These few words on thermalling are meant to give some background to Sunday soarers and students. The references noted are by no means exhaustive nor must they be read to understand the subject as it is presented here. It should be appreciated that long chapters of a book on thermalling would include many other points which are barely touched in this summary. Such details are a part of a more exhaustive treatise that should some day be written.

New Board Member

Major General Brooke E. Allen, whose assumption of the post of Executive Director of the National Aeronautic Association was announced in the January, 1966, *Soaring*, has been designated as an S.S.A. Director-at-large, representing the N.A.A., by terms of an agreement which requires the exchange of directors between the two organizations. An invitation has been extended to General Allen, by S.S.A. President John Ryan, to attend the July, 1966, Directors' Meeting at Reno, the closing banquet, and as much of the National Soaring Championships as time will permit.