amounts to 6.0 HP. If the efficiency of energy conversion were only 25% there would result a power gain of 1.5 HP. This is nearly sufficient to sustain Phoenix in level flight. In other words, the glide ratio would be infinity.

If the conversion efficiency were only 10% the Phoenix would enjoy an L/D jump from 40 to 1 to 63 to 1.

Clearly, the potential of dynamic soaring is such that we must at least investigate what gains can be made by such energy extraction schemes as have been suggested. In the past no clear method was available for discriminating the action of this process. However, the comparison flight technique, whereby two sailplanes of identical geometry and wing loading are towed to altitude and flown as a team, does permit a clear delineation of dynamic soaring versus gliding. All one needs do is fly the team in turbulence and measure the relative altitude loss of the two sailplanes. If the one fitted for dynamic soaring stays consistently above the classical sailplane we know the answer. Furthermore by measuring the difference in sinking speeds we know directly how much horsepower is being extracted by the dynamic soaring machine. If, at the same time, the sailplanes carry turbulence measuring instruments one can arrive at a measure of the efficiency of the energy extraction.

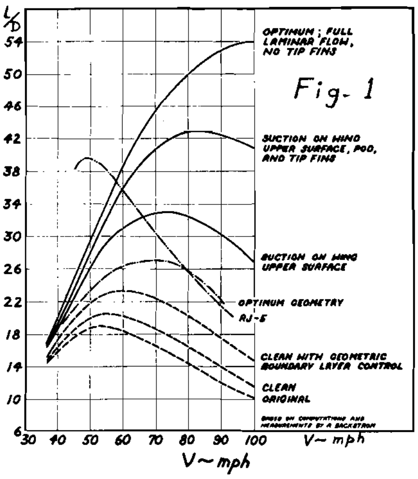
Away From High Aspect Ratios

With the suction boundary layer now fairly well reduced to a practical system we must re-examine our lust for high aspect ratio. In general high aspect ratio yields a high glide ratio at a comparatively low speed for wing loadings found most practical for thermal soaring. Of course, the optimum wing loading will vary with the region in which soaring will be done. However, the current range of wing loading does not vary the location of the best glide peak on the speed scale by more than 10 mph. This being the case we must ask how we can put the peak in glide ratio in the cruising speed regime of interthermal speeds.

The lift coefficient at which best glide ratio occurs is the square root of pi times aspect ratio times parasite drag coefficient. Quite clearly a sailplane which has its best glide ratio at low lift coefficients implies low drag and low aspect ratio.

A typical sailplane of this configuration is the EPB-Plank. However, the extremely low drag needed to make such a configuration useful

POTENTIAL PLANK PERFORMANCE



must be obtained by suction boundary layer control. In Figure 1 are shown curves of glide ratio versus speed for the Plank in various states compared with RJ-5. One can readily see that the low aspect ratio, low drag machine is capable of amazing performance in regions where thermals are strong but not necessarily wide.

Conclusion

The author realizes that this paper suggests many concepts beyond the scope of the average sailplane designer and builder. However we must begin thinking and doing something to break through the 40 to 1 barrier. Perhaps a simple scheme can advance the art of soaring by a large increment. This paper is aimed at inspiring some activity toward such an end.

References

1. Carmichael, B. H., "Possibilities of Drag Reduction on Sailplanes," OSTIV Publication II, 3-13 July 1952.
2. Cornish, Joseph J. III, "Improving Sailplane Performance with Suction Boundary Layer Control," 6th OSTIV Congress, July, 1956.
3. Klemperer, W. B., "Theory of Soaring Flight," SOARING, 1943-44-45.
4. Lettau, H., "Atmosphärishe Turbulent," 1939, Edwards Brothers reprint 1944.

Comments after Dr. Raspet's paper on "New Approaches"

by PAUL B. MACCREADY, JR.

These comments are concerned with some meteorological aspects of the problem of staying aloft without a motor.

Utilizing Conventional Energy

The various energy sources and sinks in the atmosphere make still air a rare phenomenon. Usually there are at least some local vertical velocities on the order of one foot per second, and so a sailplane of very low sinking speed might be able to stay up almost anyplace, anytime. Thus for staying aloft forever, infinite L/D or a zero sinking speed is not required - an ultimate goal of one foot per second sinking speed may suffice, and this goal is obtainable. Improving minimum sinking speed has been rather neglected while glide ratios have steadily been improved. A low sinking speed sailplane can be expected to have light weight, slow speed and poor penetration. It would permit sport soaring practically anytime, and in contests could do a good job in certain tasks.

Creating Upcurrents

Weather modification studies have shown several ways in which man can increase the strength of an upcurrent by employing a trigger method which adds heat to the air. The studies have verified the techniques can work, but have not been accurate enough to make the effects very predictable or show whether they would really be practical. One method is to seed with dry ice or silver iodide when in a supercooled cloud (the cloud particles are colder than zero degrees centigrade, but are still liquid — seeding transforms the water to ice, and releases heat of fusion). This obviously only works in a cloud at heights above the freezing level. The dry ice can be merely set outside the sailplane in an open rack, or it can be crushed to small size or powder and dropped. Silver iodide requires a generator—a flame is usually necessary. It can be released in the upcurrent earlier, while the glider is still at a temperature warmer than freezing, and it will move up with the upcurrent faster than the glider. The seeding effect should occur in 5 to 15 minutes. One effect which may be more important than the extra upcurrent is that a thoroughly-overseeded part of the cloud will not ice up the sailplane — and there is always the chance that the rain or lightning produced by the seeding may slow down a competitor who reaches the cloud after you have left it. Many states have laws against cloud seeding without a license.

The other method, suggested by Dr. Harner Selvidge and others, is to toss out a handful of carbon black (inexpensive, readily procurable, but very messy to use). The small black

(*Concluded on Page* 12)