Experiment in HIGH ASPECT RATIO

by Lyle Allan Maxey

THE basic purpose was to design a glider that could soar in all but the weakest thermals, and yet, under good conditions, set records. It should attain its best gliding ratio at speeds over 60 m/h, yet have fairly low minimum forward and sinking speeds. Forward speed is probably the more important, for it determines the turning radius in any given angle of bank and thus the smallest thermal that can be worked.

To satisfy the first requirement, a high wing loading and an airfoil with maximum L/D at low CL are necessary. For a given size ship, the former makes more weight available for structure, thus allowing the use of very high aspect ratio.

To satisfy the second requirement of low minimum speeds, some high-lift device had to be incorporated which did not increase the drag excessively. A semi-span slotted flap filled the bill, and was quite simple to build. Full deflection of 60° is obtained by 10 turns of the opening crank.

Specifications and performance:

Span . . . 40 ft.	Taper Ratio . . . 3: 1
Area . . . 80 sq. ft.	Design Airspeed...140 m/h
Aspect Ratio . . . 20: 1	Ultimate Load Factor . . . 12
Wing Loading . . . 5 lbs./sq. ft.	Aerodynamic Washout . . . 2°
Gross Weight . . . 400 lbs.	Airfoil . . . NACA 23018 to 23009

Maximum Gliding Ratio . . . 28: 1 @ 65 m/h (0° flap)
Minimum Sinking Speed . . . 3.5 ft./s @ 45 m/h (15° flap)
Stalling Speed . . . 36 m/h (60° flap)

The structure throughout is more or less conventional. Fuselage is semi-monocoque wood. Skid is faired with rubber and wheel is retractable. Release hook is on level with C. G. for aero-towing ease.

In flight, the ship feels a little "hot," but has no vicious traits. The flaps are well worth their keep, and large spoilers provide good glide path control. The ship approximates the designer's aims. It was first flown at the 13th Annual National Soaring Contest, held at Twentynine Palms, California, June 23 to July 8, 1945.

What's that you say? Well, I can dream, can't I?

Atmospheric Turbulence

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one possessing an appreciably less-than-adiabatic lapse rate) is forced bodily to ascend a mountain side by a wind blowing nearly perpendicular to the ridge, until the crest is reached, while (1) clouds attended by precipitation have formed during the transit up the slope, with (2) a less-than-wet-adiabatic lapse rate persisting throughout the process, and (3) the air arriving at the top still potentially colder and denser than the air on lee side at the same level, due to the expansional cooling and despite the heat liberated by the condensation. After the crest is reached the wind tends to overrun the warmer air in the valley, due to inertia, but drags on the underlying valley air and so is deflected downward, sinking by virtue of its greater density. The wind then collides with great force on the lower slopes or valley floor.

Sinking of the air causes warming by compression, hence dissipation of the clouds. This is followed by heating at the dry adiabatic rate which averages nearly twice as much as the wet-adiabatic rate effective in the clouds on the windward side. Inasmuch as the air has already lost moisture by precipitation on the windward side, this heating renders it unusually dry.

The momentum of the descent may carry the air below its equilibrium level, whereby it acquires an abnormally high temperature and rebounds upward due to lowered density relative to that of the surrounding air. A cumulus cloud often forms the head of the rebounding column.

The different areas at which the chinook strikes experience extremely great turbulence and gustiness as a result of the impact of the wind with the rough surface and its own intrinsic irregular motions. Within the valley, too, powerful sweeps of turbulent air may be encountered by an airplane where the chinook current is thrusting out from the crest or rebounds from some slope. For these reasons, it is best for airmen to avoid the locality when strong chinook winds prevail.