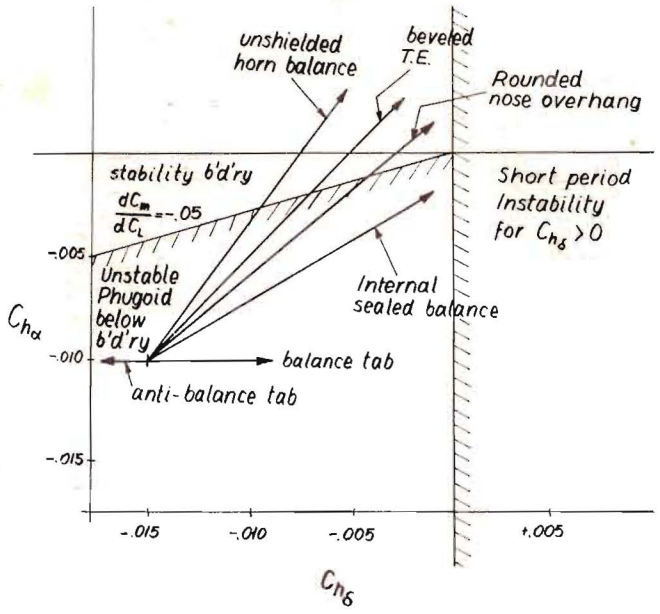

Fig. 4. Stability boundary with elevator free and effects of balancing devices.

Note: this figure is the one referred to near the end of Part 1 in the paragraph which begins "One method . . . "

reduction in roll rate worse. The aileron adverse yaw can also worsen this effect. The cure is to keep C_{N_β} high and C_{L_β} as low as possible consistent with the spiral stability requirements.

The sailplane rudder must be powerful enough to allow large steady sideslips for landing and to counteract aileron adverse yaw in turn entries. The pedal forces should be kept as low as possible. At low speeds or high C_L a large amount of sideslip is needed in combination with a small bank angle for steady sideslips. A phenomenon called rudder lock may occur usually for fins of high aspect ratio. This is a rudder free directional instability at large sideslip angles usually caused by stalling of the fin. Dorsal or ventral fins have proven quite effective in eliminating rudder lock. These fins reduce the fuselage destabilizing contribution at high sideslip angles and may even make the fuselage stabilizing for large sideslip angles. The floating of the free rudder can be treated analogously to the free elevator. Freeing the rudder can change the directional stability and yaw damping.

There is a need for a flight test program to establish some goals that the designer can aim for regarding the lateral directional stability and control characteristics. It is clear that the Dutch Roll should be well damped and of moderate period. The rolling performance needed for satisfactory soaring characteristics is not clearly established.

Summary

1. Positive static stability is not always sufficient to insure good damping of the short period or even stability of the phugoid.

2. Freeing the elevator can destabilize the aircraft.

3. Close aerodynamic balance of the elevator and static friction can cause porpoising. Positive values of C_{h_δ} can cause divergent short period oscillations.

4. Bobweights will improve phugoid damping but downspring can either aid or make things worse.

5. All moving tails must be designed with care. Must use anti-balance tab or similar device. *Never* use slab tail alone or with springs.

6. Aerodynamic trim devices should be used wherever possible.

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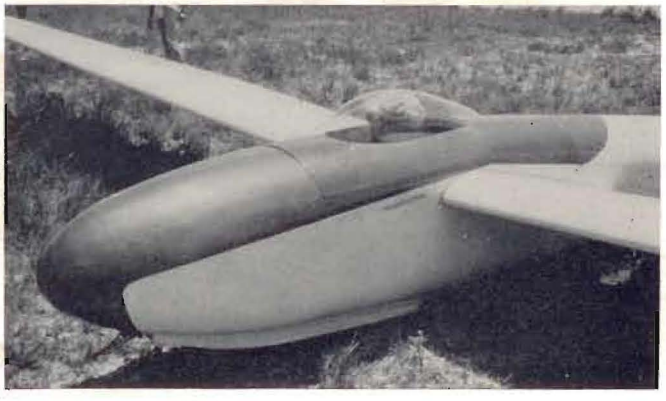

The flat-topped Schweizer 1-23 now owned by John Williams of San Diego, Calif. Modification was made by M. A. Hofmann of Maimi, Fla. Ship was originally owned by Kim Scribner.

Photo: M. A. Hofmann