Soaring) established in Darmstadt to take its place, with Hans Jacobs, a former assistant to Lippisch, in charge. Jacobs had already designed the Rhönadler (Figure 18), the Seeadler (Figure 19), and the Rhönbussard (Figure 20): he now produced the Rhönsperber (Figure 21), a type that in many ways paralleled the Minimoa, representing a trend towards a cheaper high performance glider suitable for series production. It was a small sailplane with simple wing and fuselage, and a simple wing root juncture. Very popular, the same basic design appeared in many versions, notably the DFS Kranich (Figure 22) two seater and the DFS Habicht (Figure 23) aerobatic sailplane.

In 1936 Kurt Schmidt won the Rhön contests with the Mü-13 Atalante (Figure 24), built by the München club. It was chiefly interesting as one of the few gliders with steel tube fuselage to be built in Germany. The wooden cantilever wing was in two parts as usual, but divided at the side of the fuselage instead of on the center line.

The well known DFS Reiher (Figure 25) appeared first in 1937, although it did not show up to best advantage until the next year after some modifications had been made. This highly developed sailplane has been exhaustively described by Shenstone in recent issues of SOARING.

The Darmstadt D-30 Cirrus (Figure 26), which appeared in 1938, had an extremely high aspect ratio (33) and a section thickness/chord ratio of only 12%, so that a steel box spar was necessary. The dihedral of the outer portion of the gull wings could be varied in flight by means of a crank in the cockpit. In spite of a very good gliding ratio of 1:36, the Cirrus did not perform as well as the Reiher in the 1939 competitions.

The only high performance sailplane to be built since the start of the war is the tailless Horten IV (Figure 27). With an aspect ratio of 21, this craft had a glide of 1:37 and a minimum sinking speed of 1.65 f.p.s. It was fully described in an article in *The Aeroplane* for August 5, 1943. It is understood that a further development of this type, the Horten VI with an aspect ratio of 32, was under development in Germany, but no performance figures have been released. These tailless sailplanes are part of a series of tailless aircraft built by the Horten brothers of Bonn, which included a large six engine transport plane and a twin jet fighter.

Design Trends

The general trend of the design of sailplanes since 1920 is shown graphically by Figures 28 to 32, on which the characteristics of the gliders of Table I have been plotted. The principle aerodynamic parameters, plotted on Figure 28, show a steady increase in wing loading from about 2 lb./sq. ft. in 1920 to 4 lb./sq. ft. today. This would indicate an increase in speed of about 30%. The effective span loading has decreased from 0.32 to 0.20 lb./sq. ft. contributing to the reduction in sinking speed, and the parasite loading has increased from 100 to 400 lb./sq. ft. The latter parameter is of particular significance, in view of its powerful effect on the speed range, and some of the latest sailplanes have achieved a parasitic loading of nearly 500 lb./sq. ft. It is anticipated that every effort will be made to increase this still further in the future.

It is evident from Figure 29 that increased parasitic loading has been due less to reduced parasitic area than to greater weight, which has increased nearly 100% since 1920. Actually, the parasite area of successful sailplanes has fluctuated so much that it is difficult to determine a definite trend. Figure 29 also shows that there has been little change in average wing area.

Span, aspect ratio and cantilever ratio are plotted on Figure 30. It is evident that the importance of large span was realized early. There has been little change since 1924 when it was found that a span of 62 ft. (19 m.) provided the best compromise between low induced drag and maneuverability. There has been no such unanimity of opinion regarding aspect ratio, and in this case the points are quite scattered. There appears to be a general upward trend, however, and recent successful types have had aspect ratios between 18 and 20. The cantilever ratio, or ratio of semi-span to root thickness, has been plotted for the cantilever winged sailplanes only.

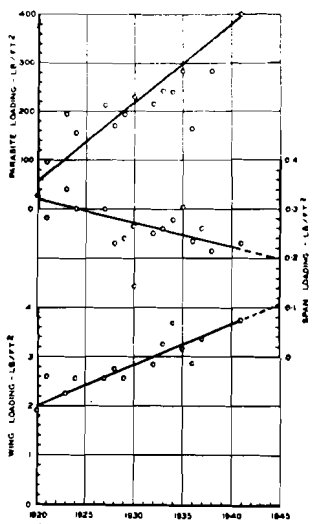

Figure 28.
Trend of Aerodynamic Loadings

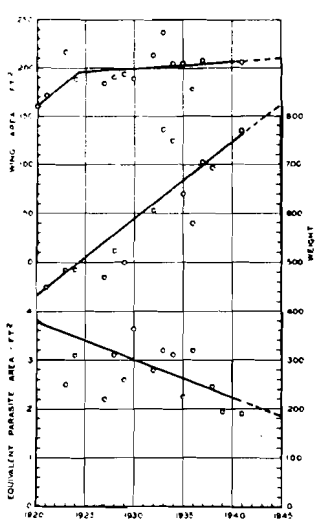

Figure 29.
Trend of Weight, Parasitic Area and Wing Area

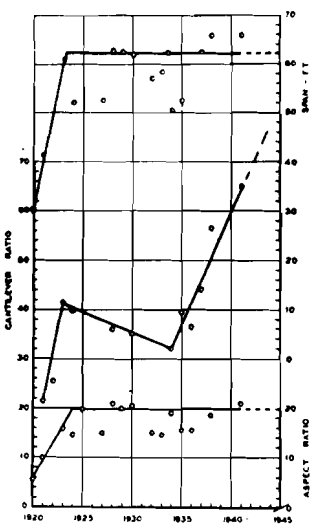

Figure 30.
Trend of Span, Aspect Ratio and Cantilever Ratio

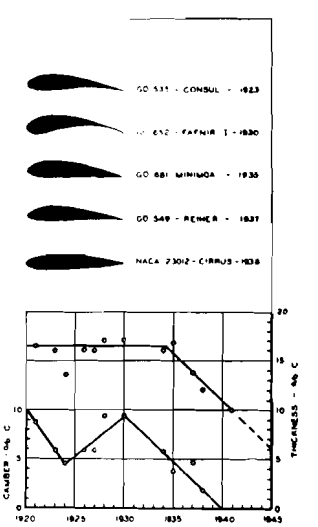

Figure 31.
Trend of Wing Section, Thickness and Camber