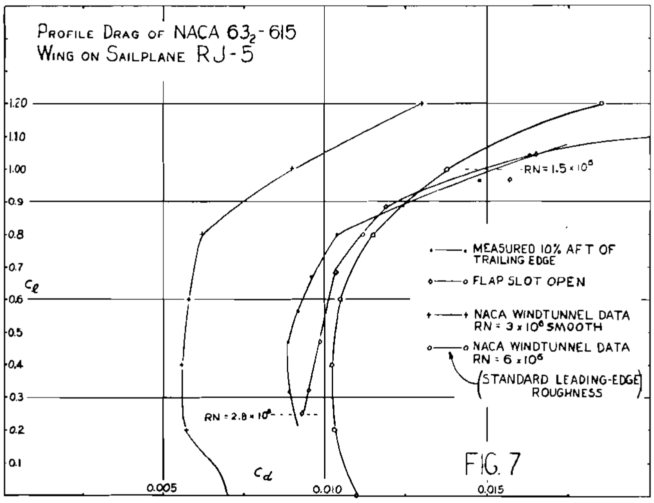
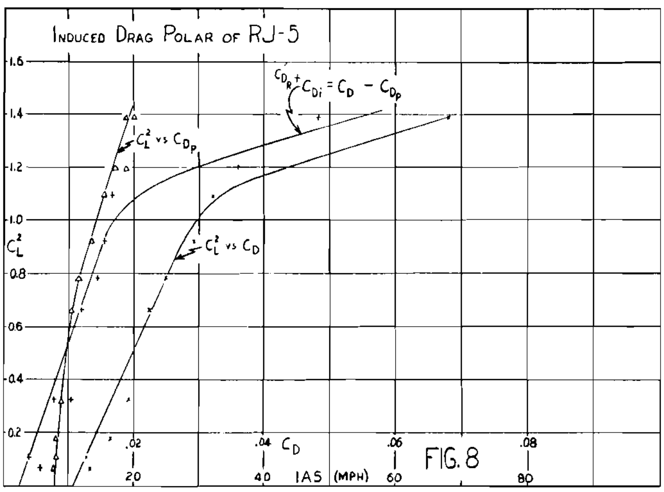
• Drag Studies RJ-5

(Continued from Page 19)



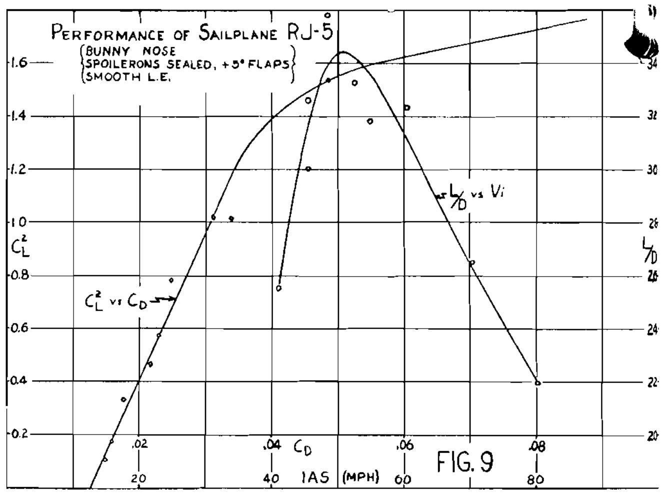
sign (Ref. 4). In Fig. 7 are shown the profile drag measurements so made. Also shown on the same illustration is the profile drag of the airfoil with the flap gap not sealed. An increment in profile drag of about 0.001 is apparent. When the profile drag, C_{DO}, is subtracted from the total drag, C_{DT}, as shown in Fig. 6 there is obtained a curve $C_{DPAR} + C_{DI} = C_{DT} - C_{DP}$, where C_{DPAR} is the parasite drag.



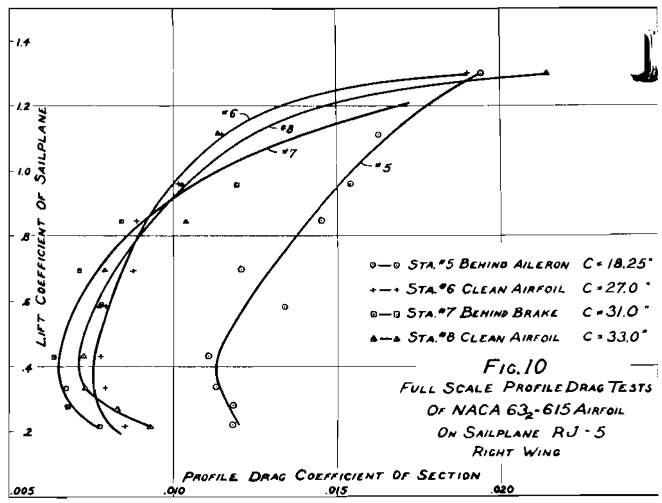
This curve is shown in Fig. 8. The effective aspect ratio, ARe, obtained from the slope of this curve is 24. In other words the efficiency factor is 98%. This behavior clearly explains the relatively low overall efficiency factor as displayed in the results of Fig. 6.

In order to observe the influence of a flap on the profile drag of this airfoil the flight performance was measured with the flap gap seal removed and the flap deflected 5°. This measurement is displayed in Fig. 9. It will be seen that the minimum drag rose to 0.0128. About 0.001 of this can be attributed to the gap and 0.0018 to the increase in camber and possible early transition on the top surface. It is evident from this measurement that for a flap to be effective on a sailplane it must be designed with a smooth change in curvature rather than with a sharp break as with a normal flap.

Since the profile drag measurements showed a high drag, 0.0088 compared to that expected from wind tunnel results, 0.0056, Johnson, during the winter



of 1950 51 checked the contours of this airfoil in order to see if the inaccuracies were of such a size that the high drag could result. On finding divergences as large as + or — 0.2 inches he undertook to rebuild the wing completely using wood trailing edge ribs of high accuracy. He also filled in the leading edge so that the contours were true to + or — 0.02 and waviness was of a much smaller value. When this was done the profile drag was measured at four stations on each wing. The results are shown in Figs.



10 and 11. It will be seen in Fig. 11 that by further reducing the leading edge waviness the profile drag at station 1 was reduced by an increment of 0.002 at most speeds and by 0.003 at the lift coefficient 0.4.

Examination of the profile drag curves for stations 2 and 5 (behind the aileron) shows the high cost in drag of an open gap type of aileron. The bottom of the aileron is open with the top hinged in a piano hinge.

In Fig. 12 is shown the polar of the sailplane taken in the early summer of 1951. This polar is the average of six independent flight measurements at each speed. It will be seen that the maximum glide ratio is 37.9. This figure places the RJ-5 in the position of having the highest measured glide ratio of any sailplane so far measured either here or abroad. Since this polar was measured, the wing leading edge has been