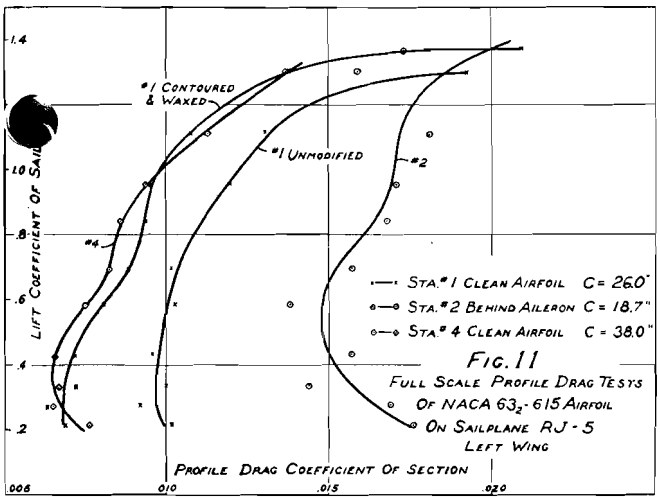

FIG. 11
Full Scale Profile Drag Tests Of NACA 63_2-615 Airfoil On Sailplane RJ-5 Left Wing

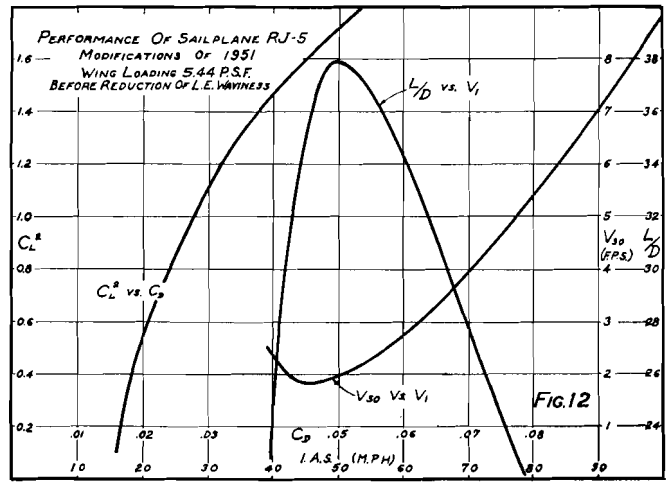

FIG. 12

smoothed to be even more wave-free. It is estimated the maximum L/D of RJ-5 is over 40 as a result of this smoothing.

Because the polar in Fig. 12 is not a straight line as is usual with sailplanes with conventional airfoils, the standard practice of finding the minimum drag coefficient by extrapolating C_L^2 vs. C_D to zero lift could not be followed. For this reason the minimum drag shown in Fig. 12 appears higher than that of previous tests. This means that non-linear polars cannot be treated analytically by Oswald performance method.

In the following tables the results of the variations on the sailplane RJ-5 are summarized:

TABLE I

Configuration	Efficiency Factor	L/D	min.
Wavy L.E., sperical bubble canopy	62%	30.3	0.0122
Smooth L.E. spherical canopy, gaps sealed	52%	33.3	0.0108
Smooth, full contour canopy	62%	35.3	0.0104
Smooth, full contour canopy spoilerons sealed (1950)	70%	36.5	0.0104
Smooth, full contour canopy flap 5°, gap open (1950)	74%	35	0.0128
L.E. Contoured, trailing edge ribs replaced with high accuracy ribs (1951)	98%	37.9	0.0120
Minimum profile drag coefficient flap gap sealed as of 1950			0.0088
Minimum profile drag coefficient flap seal open as of 1950			0.0097
Minimum profile drag coefficient L. E. smooth 1951			0.0062
Minimum profile drag coefficent behind aileron			0.012

CONCLUSION

As a result of flight measurements and systematic modifications based on these measurements the Sailplane RJ-5 has been improved so that its maximum glide ratio rose from 30.3 to a little over 40. This performance may class RJ-5 in the ultimate performance category but it is not. There is still room for improvement:

a. The aileron gaps and elevator gaps can be covered or a new hinge line designed which has no gap.
b. The skid can be made retractable and the release placed inside the fuselage in order to make the forward section of the fuselage free of protruberances.
c. A camber changing flap could be designed which has no sharp break in upper surface contour. This flap would permit moving the laminar bucket of the airfoil to lower lift coefficient for high speed cruising.
d. A hand-rubbed finish would reduce the viscous shearing even where the flow is laminar.

When all these improvements are made the minimum drag coefficient of the sailplane should drop to 0.009 and the maximum L/D should be 46. On such a sailplane even a small increment in drag is profitable, for example on RJ-5 an increment of drag coefficient of 0.0005 results in a gain of maximum L/D of one.

It is the author's hope that these results describing the stepwise trend toward minimum energy loss flows around a particular sailplane will be of general interest to all aerodynamicists and that some of the tools, facts or technique may be of use to these interested people in their work.

The author is greatly indebted to R. H. Johnson, who not only made his sailplane available for these measurements, but also did all of the precision piloting in making the measurements.

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RJ-5—1951

Measurements
Span 55'
Length (Overall) 30' 9"
Height (Overall) 4' 9"
Fuselage Width (Overall) 1' 9½"
Fuselage Height (Overall) 3' 4"

Areas
Fuselage Cross Sectional Area 4.54 sq. ft.
Wing Area (With Aileron) 125 sq. ft.
Aileron (Total) 6.0 sq. ft.
Flap (Total) None
Spoilers (Total) Dive Flaps 8.1 sq. ft.
Stabilizer 6.35 sq. ft.
Elevator 6.35 sq. ft.
Horizontal Areas 12.70 sq. ft.
Fin 3.94 sq. ft.
Rudder 7.26 sq. ft.
Vertical Area 11.20 sq. ft.

Weights (pounds)
Empty 492
Pilot 180
Extra Equipment 20
Total 692
Pilot/Empty 366
Wing Weight 380

Wing
Wing Platform Straight Taper
Sweepback: Slight Forward Sweep of 25% Chord Line
Dihedral 1½°
Gull: None
Root Chord 3' 6"
Half Span Chord 2' 3"
Tip Chord 1'
Aspect Ratio 24
Taper Ratio 3.5

(Continued on Page 25)