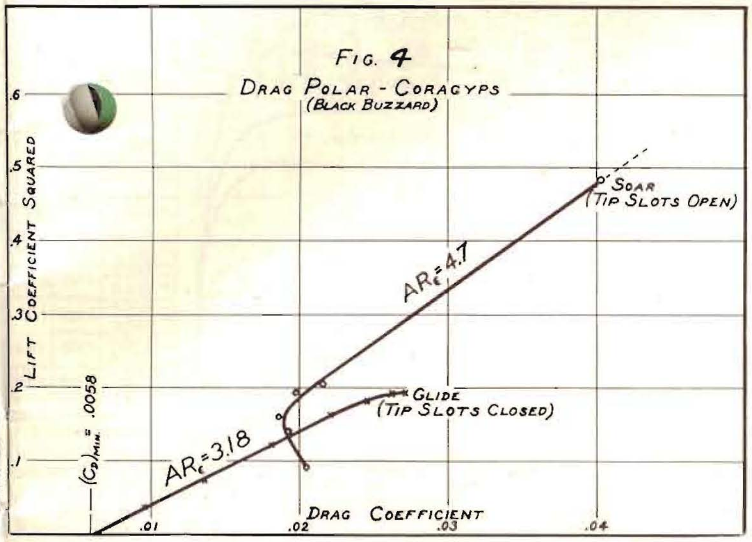

Fig. 4

Drag Polar - Coragyps

(Black Buzzard)

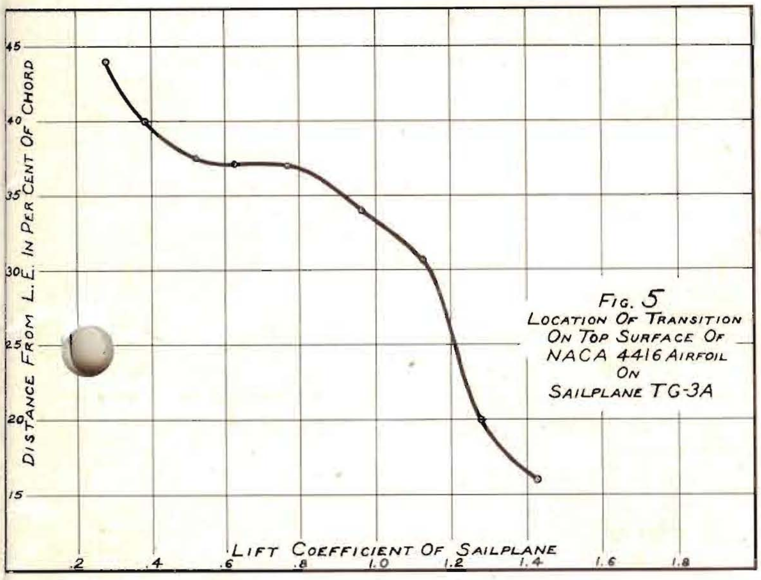

Fig. 5

Location Of Transition On Top Surface Of NACA 4416 Airfoil On Sailplane TG-3A

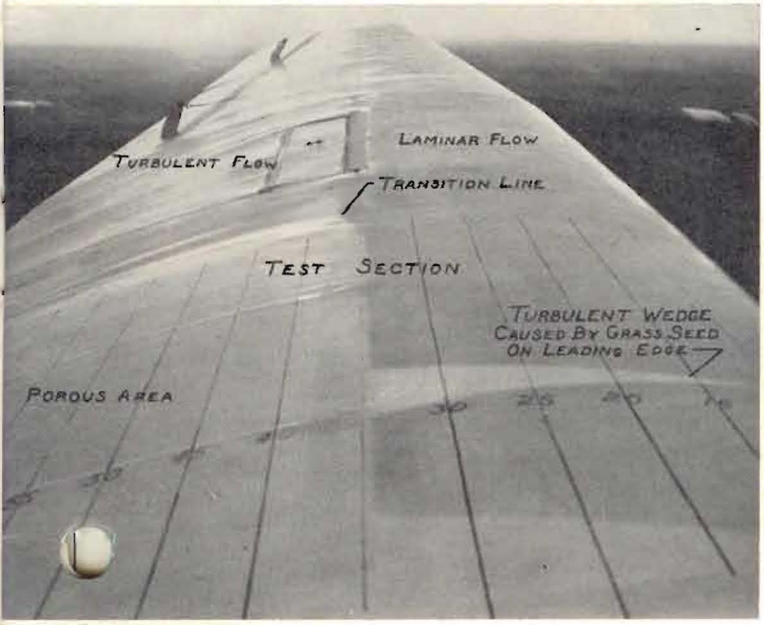

Fig. 6

ever, there are other causes of transition, namely, pressure gradients due to airfoil waviness, to vibration of the surface of the airfoil or to noise in the tunnel. While suitable precautions can be taken in building the model to reduce waviness and the effects of vibration, it is rather difficult to damp the noise of a windtunnel without reducing the flow velocity. It is in this respect that the sailplane provides a unique solution,—tests can be made in an environment in which free stream turbulence and noise are extremely low.

Recently measurements of transition were made on a classical (non-laminar) airfoil on a sailplane. See Figure 5. These measurements show the transition at cruising conditions to be at 44% of the chord from the leading edge. This is proof of the small disturbing influence of noise in free flight measurements made on sailplanes. The wing had been surfaced so that it was wave free to an accuracy of 0.002" measured over points spaced 4% of the chord and therefore transition due to this cause was delayed.

The quality of the flow over a sailplane wing which had not been specially surfaced can be seen from Figure 6. This photograph was taken in towed flight shortly after take off. Dew was allowed to settle on the wing until a thin uniform coat of moisture was deposited on the upper surface of the airfoil. Dew will usually deposit at dawn on every morning except exceptionally dry mornings after a cold front or in desert areas. However, under these conditions moisture can be sprayed on the wing.

As soon as the sailplane begins moving there occurs a differential evaporation of the moisture in the laminar region as compared to the turbulent. The turbulent has a much greater rate of evaporation and as a result a sharp line of demarcation between moist and dry wing results. This is the line of transition.

Near the wing root the reader will see two wedges of turbulent flow caused by grass seeds deposited on the wing during takeoff. These wedges would occur behind any small protruberence on the airfoil be it a rivet head, fly speck or any other discontinuity in curvature.

Inboard behind the leading edge one will observe a region in which the cloth surface has been pricked with a needle to make it porous. If the air is sucked into the wing the boundary layer is stabilized so that it remains laminar but if air flows outward through the holes in the surface the boundary layer is destablizied and transition occuring along the forward edge of the porous section in Figure 6.

In Figure 7 is shown a sailplane fitted specifically for boundary layer studies. The observer is seen in the rear cockpit holding a long tube over the wing. This tube may be moved fore and aft and spanwise over the wing from inside the cockpit. To the end of this tube inside the cockpit is connected the stethoscope which the observer wears. The outer end of the long tube has a probe consisting of a small tube facing into the flow. If the flow is turbulent the observer hears the velocity fluctuations as a loud rushing noise but if it is laminar there is only a weak hissing sound in the stethoscope. This simple instrument is an ideal device for studying the boundary layer. With it transition as well as a separated boundary layer may be detected. One may use in a similar manner probes such as static pressure sondes, boundary layer velocity distribution probes, and acoustic microphones