FLIGHT TESTING THE HP-8

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During the month of February, 1959, the Schreder HP-8 was at the Engineering and Industrial Research Station, Aerophysics Department, of Mississippi State University, State College, Mississippi, for the purpose of modification and flight testing. When the aircraft arrived it was in an "as completed" condition. That is to say, while it was obviously the product of careful engineering and excellent workmanship, its wing surfaces had not been finished in fine detail. For such a program as was contemplated for the HP-8 it is important that the basic design and construction be of high quality as it is foolish — even though quite widely practiced currently in the soaring world — to expend a great deal of additional time and money improving a design that is characteristically incapable of what is accepted today as high performance.

Three of the four weeks effort was expended on removing the irregularities in the contour of the airfoil with some attention also being devoted to the fuselage and empennage. A report on the materials and techniques employed to improve the finish will be written by Richard E. "Dick" Schreder, designer, builder, owner, and pilot of the HP-8.

This paper will serve only as an interim report as other factors prevented complete evaluation of the aircraft at the time these tests were conducted.

Following the completion of the finish work mentioned above, a static system was installed for the airspeed system. (Previously, cockpit static had been used). The initial flights were devoted to calibration of the airspeed system. It cannot be emphasized too strongly the importance of accurately accomplishing this step as almost all subsequent information is related to or computed from the airspeed. For this program, two Kollsman helicopter airspeed indicators were calibrated with a Betz manometer prior to installing them in the aircraft. One airspeed indicator was connected to the ships' pitot and static system. The static side of the second indicator was attached to a trailing bomb static source. (The static bomb was fabricated at the Aerophysics Department utilizing the dimensions of the Prandtl Static Tube[1].) The pitot side was attached to a Kiel tube total pressure head which had been taped to the nose of the sailplane. The Kiel tube was employed to reduce the effect any skidding or slipping would have on obtaining the correct pressure. The combination of the Kiel tube and the static bomb was utilized to obtain the calibrated airspeed. It was necessary to install additional volume in the pitot system to insure that the dynamic response of the pitot and the static systems was the same. (The extra volume required in the pitot system was made of several small "tin" cans soldered together to form an appropriately sized cylinder to permit the pitot source to be routed through this extra volume. To ascertain whether or not the proper volume had been selected, the static bomb, total pressure head (Kiel tube), all necessary tubing and the balance cylinder were all connected. The entire assembly was placed in a container with the final lengths of tubing for attachment to the airspeed indicator being routed through the side of the container. The airspeed indicator was attached. Through another hole in the container, a lung-full of air was blown in a rapid steady manner. If the volume to the pitot system is correct, the airspeed indicator will not move from the zero position. If the volume added is inadequate, the indicator will show a movement toward increased velocity and, conversely, if the volume is too great, the needle of the airspeed indicator will fall below zero. As mentioned previously, once the volume — actually the resistance — on each system is balanced the airspeed indicator will remain at zero with perhaps a few rapid fluxations or vibrations, but essentially holding zero.)

Also before conducting flight tests, a radio transceiver was installed, with the antenna being taped inside the generous, fixed, forward section of the canopy. A battery powered eccentric was mounted above the instrument panel to vibrate the airspeed indicators, hence preventing any false indications being caused by friction in those instruments' mechanical linkage. The trailing bomb was suspended outside the cockpit by tubing which was routed through a notch in the canopy; the remainder of the tubing being coiled between the pilot's legs for the take-off and the landing. With the pilot and his parachute aboard, the aircraft was weighed in the configuration outlined. After these preparatory steps had been completed the flight testing was started.

Initially, two flights were conducted to determine the "position error" of the airspeed system. In determining the position error the assumption is made that the pitot portion of the airspeed system on the aircraft is correct and that any error in the sailplane's airspeed system is due to the location, or 'position,' of the static source. During the flight the observed airspeed on each of the two indicators was radioed to the data recorder. (The data recorder was stationed at the ground radio where he made all of the necessary notes as well as recording all the data; the pilot thus being able to devote all of his attention to maintaining precise data points). Following the flights, both readings were corrected for instrument error. The difference between the two readings, over the speed range of the glider, was then plotted against the measured airspeed. The measured airspeed being the sailplane's indicated airspeed corrected for instrument error. The results are presented in Figure 1.

Flights were then made to determine the L/D curve, or lift — drag coefficient polar; that most popular yardstick of performance. The data required for this curve was obtained from "Sawtooth Glides," that is, a series of glides, each at a specific airspeed, covering the entire speed range of the sailplane. For these tests the sailplane was towed to approximately 10,000 feet. The outside air temperature was recorded by the tow pilot during the climb or descent. Data was not utilized if a temperature inversion occurred at any of the test altitudes. These flights were conducted "by dawn's early light" so there existed no possibility of thermal instability. Upon releasing, the sailplane pilot would establish the test airspeed — which was held to

[1] C. B. Millikan, *Aerodynamics of the Airplane* (New York: John Wiley & Sons, Inc., 1941), p. 26.