The LAISTER SAILPLANE

by Jack W. Laister

photographs by the author

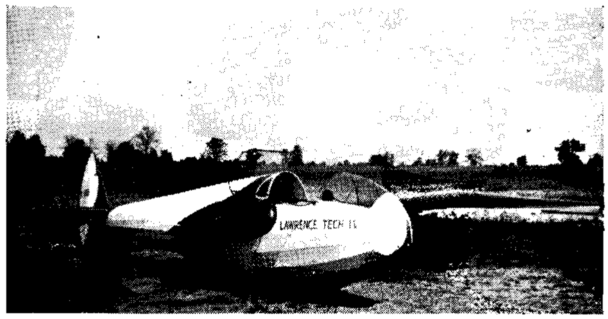
For several months, I had been making sketches and jotting down ideas for a sailplane that I thought the average soaring enthusiast would like to own. If possible, I wanted this sailplane to have lines more attractive to the eye and performance excelling anything else previously built in this country or abroad. It should be a small ship for good maneuverability in the air and convenient for two people to handle on the ground. I desired ruggedness, so for this and other reasons to be explained later, a chrome-moly welded steel tube fuselage would be employed. Then out of a beautiful cumulus sky President George E. Lawrence, of the Lawrence Institute of Technology, called on me to design and supervise the construction of a sailplane for them. His request—"the best you can give me"—with certain cost restrictions, was right up my alley. Hence, the Laister Sailplane started to take concrete form on paper.

The specifications arrived at were as follows:

Gross weight: 470 lbs.	Span loading: 10.01 lbs./ft.
Weight empty: 285 lbs.	Design top speed: 125 m.p.h.
Wing area: 135 sq. ft.	Design load factor: 10.6
Wing span: 46 ft. 6 in.	(Using a 30 ft./sec. gust speed)
Aspect ratio: 16	
Wing loading: 3.48 lbs./sq. ft.	

This load factor resulted in a very stiff wing, having a vibration frequency of nearly 250 per minute as compared to what is considered the minimum permissible of 160 per minute. The wing is of mono, box spar, spruce construction with spruce ribs. The drag loads are transmitted conventionally through a monocoque leading edge and a short drag spar. The aileron is hinged from the main spar and controlled internally to eliminate parasite drag. The aileron chord is increased to 50% of the wing chord at the tip for a greater effective rolling movement and to prevent any possibility of reverse effect through wing twisting. Spoilers are hinged at the top surface of the wing. They are small and quite effective but will be increased in size for greater effectiveness on future ships. As in the Ross "Ibis", they will also be interlinked with the brake so that the pilot will be able to hold the ship on the ground when beginning to apply the brake.

The N.A.C.A. 4400 series airfoil section is used with a 16% root and a 9% tip section. A five degree geometrical twist is also employed to aid the simultaneous stalling of root and tip sections. Particular attention was paid to the shape of the fuselage nose because herein lay the possibilities for the fuselage drag qualities being good or bad. Being constructed of tubing which could be formed into smooth curves, it was not necessary to have short, broken sections perpendiculiar to the direction of the airflow as is usually the case in monocoque construction. In profile, the nose is an airfoil section which lends itself to low drag and comfortable seating arrangement. That is to say, it permits the lowering of the rudder pedals with respect to the pilot's hips with the pilot sitting low in the ship. The back of the seat is adjustable for flying with or without a back pack chute.



Front view with right wing removed.

The mid-wing design was, of course, adhered to; that position already having proven itself the most efficient in past designs and in N.A.C.A. wind tunnel tests. It also lends itself very nicely to a light fuselage construction, there being no primary structure above the top of the wing. A wide center section was employed to permit the fabrication of smooth, permanent fillets. External root fittings also make for easier field assembly. It was necessary to heat treat the main truss of the center section holding the root fittings of the wings, to carry a design stress at the root pins of a little over 27,000 pounds. A built-in fin and horizontal tail center section with fabric fillets also add to the extreme cleanness of the ship. You have perhaps already noticed the high ground clearance under the rear portion of the fuselage and under the elevator, which in turn reduces the wear and tear on those parts. The tail design of placing the horizontal surfaces ahead of the rudder and making the vertical tail approximately symmetrical about the center line of the ship does three major things aerodynamically. (1) It gives a more effective rudder. (2) It lowers the center of pressure, making roll moments caused by the vertical tail negligible and therein improves inherent stability. (3) It does away with blanketing of the vertical surfaces by the horizontal surfaces when the ship is spinning, and thereby adds to quicker recovery from

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