THE SAILPLANE "SISU-I"

by LEONARD NIEMI

A new sailplane design which is to be built by an individual necessarily becomes a compromise between what the designer would like to design if unlimited facilities were available and what can be designed considering the limitations of home workshop equipment, time and money. The overall design objectives of the "Sisu I" sailplane were simply to create a new design which would exceed the RJ-5 in overall performance and at the same time include as many new features as these limitations would allow.

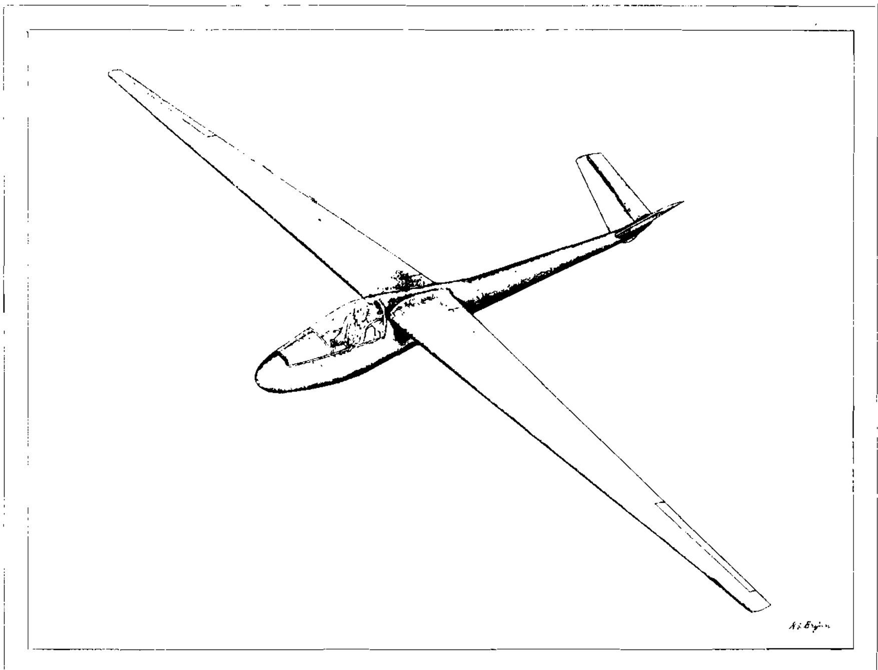
As seen in the 3-view (Figure 1) the general outlines of the ship exhibit no new aerodynamic concepts. However, careful attention was paid throughout the detail design to insure that the given theoretical aerodynamic properties of the layout would be fulfilled. This is achieved mainly by the generous use of heavy gage skin to provide a stable buckle resistant surface upon which the necessary aerodynamic smoothness can be added and maintained. A swept forward wing planform was selected in order to obtain the effect of a slight aerodynamic twist without the drag increase associated with actual twist. An added benefit is brought about by the wing root assuming a position entirely behind the cockpit which simplifies the wing-fuselage connection.

The performance shown in Figure 2 is given as shaded bands instead of the usual sharply defined curves. The side of the band showing the best high speed performance is based upon "Tiny Mite" parasite drag characteristics; the other limit is based upon "RJ-5" parasite drag data. Wing drag characteristics were assumed to be theoretical N.A.C.A. values corrected to account for variations in Reynolds Number along the span due to taper and velocity. It is presumed that the performance of "Sisu I" will fall somewhere within the limits shown.

Special aerodynamically clean camber changing flaps extend to the ailerons. These are expected to lower the velocity at minimum sink 8 to 10 mph. without appreciably raising the minimum sinking speed. This should result in enough gain in spiraling efficiency to offset the rather high wing loading of 6.58 psf.

THE AUTHOR

Leonard Niemi, the designer and builder of "Sisu I," spent four years in a technical high school in Buffalo, New York learning the trade of an aircraft mechanic, then 6 years mastering the trade at the old Bell and Curtiss plants in Buffalo. The following years include a stretch in the army, 4 years at the University of Michigan getting a B.S. in aero engineering, and 4 years as a stress analyst and design engineer at Bell Helicopter. He is presently working as a designer on a 4-engined cargo-passenger transport at the recently organized Frye Corporation in Fort Worth, Texas.



All of the structure in the ship is built from 2024 Alclad sheet. The framing of the forward fuselage consists of formed 0.51 in. frames of channel and zee sections capped with heavy extruded sills at shoulder level to form a parting line for the canopy. Light angles are placed on a line approximately at seat level.

Skinning is .040 Alclad forward and behind the cockpit with 0.51 gage used around the cockpit itself. The cockpit area is also planked with balsa covered with fiberglass to form a compound curved transition between the conical sections ahead and behind it. Except for the added planking, the cockpit area follows standard Schweizer practice which, because of its ruggedness, is considered excellent life insurance.

The tail cone is almost completely monocoque. There are no frames between the tail attach points and the butt splice where the cone joins the forward fuselage. Figure 3 shows a typical cross section. As the illustration shows, the upper skin of 0.40 Alclad has lipped angles formed along each edge. A lower sheet of the same gage is riveted to these angles. Since the skins are not rolled prior to assembly, lateral tie angles are necessary to prevent the skin between the frames from trying to assume a circular cross section.

External rivets are machine countersunk in place except at a few of the more highly loaded joints where dimpling was resorted to. The ability to use machine countersunk holes instead of dimpled holes is one advantage of heavy gage skin when flush rivets are used. All of the skin joints