THE XM-1 TAILLESS SAILPLANE

by JAMES MARSKE

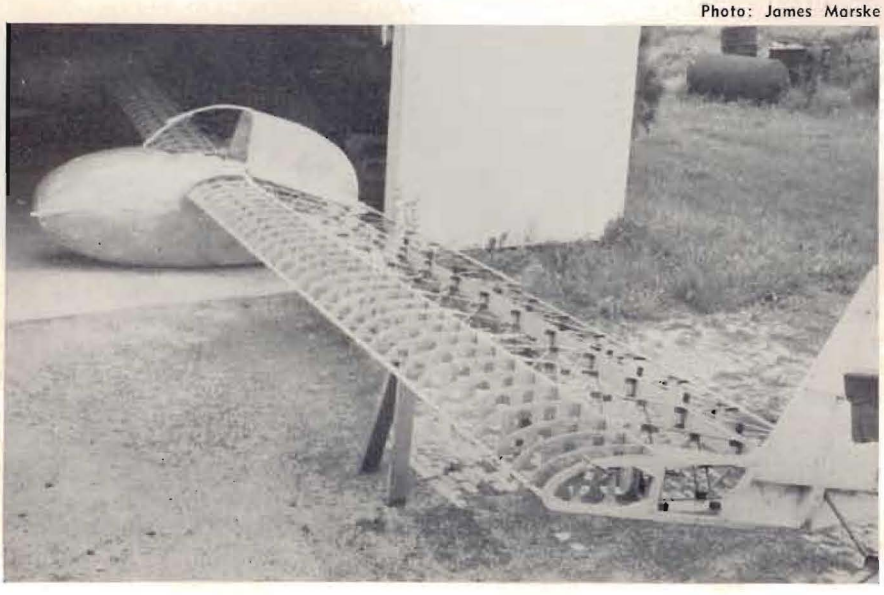
The XM-1, as its name implies, was designed and constructed as a research and development sailplane. This sailplane is intended to be the first of a series to discover the most practical soarer for the week-end flyer. The plank layout was chosen for several reasons. It has simplicity of design, very good performance for its size, forgiving flight characteristics (being stall and spin proof) and light in weight making the ship easy to handle on the ground. Of course there are a few features I myself would like to see in a sailplane so naturally they have been incorporated into the design. A few of these are smooth and flowing lines which not only aids performance but is very pleasing to the eye. Flaps have been installed instead of the usual spoilers to allow a quick take-off on auto or winch tow and they provide a low landing speed. Another advantage of flaps is that the top of the wing is kept clean and eliminates the possibility of water running into the wing if caught out in the rain. Another feature which I am very pleased with is the use of C.G. tow hooks. They have no adverse affect on the aircraft at any time on any type of tow. The correct word for it is smooth. In order that the sailplane may be trailered and stored easily, disassembly of the ship is necessary. Only the wings are removed from the pod and are joined in the usual manner.

The wing has a span of 38 feet, a constant chord of 51 inches and an aspect ratio of 9. Since the aircraft was to have a moderately low wing loading a 14% reflex airfoil was chosen for good high speed performance. In order to keep all lines as clean as possible for efficiency, molded fiberglass is used wherever possible in the structure.

The main wing spars are of laminated spruce tapered in thickness from root to tip to distribute flight loads evenly. The main wing ribs are of standard truss type construction while the nose ribs were sawn from ¼ inch marine plywood. A rear spar is used mainly for fastening fittings, elevon hinges and to transmit drag loads to the fiberglass skin. The elevons are controlled by pushrods throughout while the rudders are cable actuated. Molded fiberglass covers the leading edge D tube and the first five root rib panels aft of the main spar to carry the drag loads. This consists of two laminations of glass cloth secured to the wing with epoxy resin.

The basic structure of the XM-1 as it was being constructed. The fiberglass fuselage shell is just as it came from the mold.

Photo: James Marske



Construction of the fins are quite simple being basically a spruce and plywood frame covered with fabric. During flight tests in 1957, smaller and heavier fiberglass covered fins were used with drag flaps but were discarded due to their ineffectiveness.

All fiberglass sheets were formed on a smooth flat metal sheet that was given a heavy coat of paste wax. One side of the fiberglass sheet thus formed is rough while the surface which was against the metal surface is smooth as glass. The smooth surface is used as the outside finish. When securing fiberglass to fiberglass, or fiberglass to wood, the surfaces that will come in contact with one another must be made rough, in order to give the resin something to cling to. So far, I have found epoxy resin to be the best glueing agent for fiberglass but you must work fast before the resin hardens. The leading edge fiberglass sheets were formed in a jig because a flat sheet of two laminations cannot be drawn around the leading edge.

The fiberglass shell of the fuselage was formed over a built up plaster mold. This shell consists of three to four layers of glass cloth, four layers being used where higher strength is required. Sanding fiberglass by hand can be an exhausting job so a belt sander was rented. A tubular steel frame was welded together to fit into the fiberglass shell. This frame carries all flight, towing and landing loads imposed upon the aircraft. To secure the frame to the shell, all tubing that was to come in contact with the shell was wrapped with strips of glass cloth and given a coat of resin. After it hardened it was sanded down and fitted to the shell. Additional strips of glass cloth were then given a coat of resin and stretched between the shell and the wrapped tubing. When this had hardened it was sanded down and given another coat of resin to give it a smooth finish. The remainder of the shell was strengthened by the addition of two fiberglass bulkheads and reinforcements in the nose.

In the cockpit a control wheel is used rather than the conventional stick. The rudder pedals now operate in a conventional manner made possible by the highly differential bellcranks which allow only one rudder to swing out at a time.

FLIGHT TESTS OF 1957

Test flights were carried out during September and October whenever weather conditions permitted. A few