# SPEED WITH ECONOMY

## EXPERIMENTAL AIRCRAFT PERFORMANCE IMPROVEMENT

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*CHAPTER I*

# *BUILDING MY MUSTANG II*

*Is there a more satisfying expression of your creativity than flying an airplane which you built at home?*

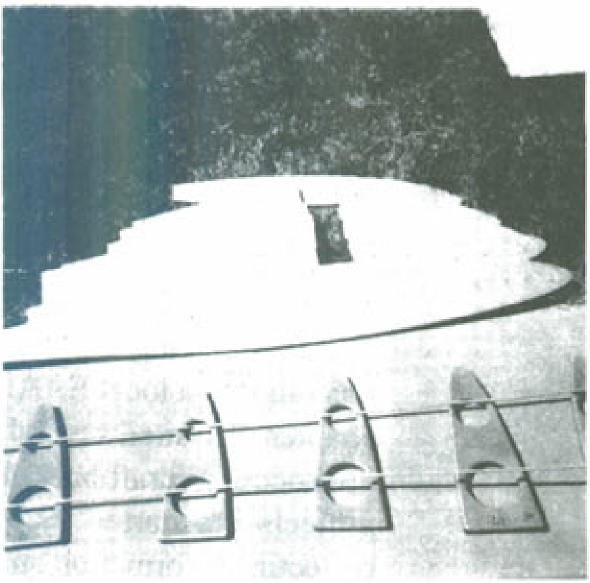
In January, 1967, I watched the first flight of a homebuilt airplane, an all-wood Piel Emeraude. I had earned my Private Pilot License earlier, in 1964. however, I didn't have much hope of buying my own aircraft. I was a young engineer concentrating on developing my engineering career. I had four young children and a large home mortgage payment. There just wasn't much money available to spend on something as non-essential as an airplane. At that time, I didn't know that the FAA allowed people to build their own aircraft. So, witnessing that successful first flight at our local airport (Columbine) was a real revelation to me. I was absolutely awestruck with the idea of building my own aircraft in my garage! I had built two hot rod cars as a teenager, and knew enough about myself to realize that I really enjoyed working with my hands on all kinds of building projects. I had worked part-time as a welder while going to school for my Aeronautical Engineering Degree, but did not know how to rivet. Nor did I have much sheet metal forming experience. As I found out later, these additional necessary skills were not very difficult to acquire.

*Kent Paser, 8 years old, at the controls of his first experimental/ homebuilt aircraft.*

I joined the Experimental Aircraft Association (EAA) and started attending the meetings of a local EAA chapter. I visited several in-process aircraft building projects and started collecting information and performance data on available experimental aircraft designs. I knew that a 2-seat design was a must, and I wanted cross-country capability with maximum cruise performance. I considered Steve Wittman's "Tailwind" design and John Thorp's "T-18" design. But Bob Bushby's "Mustang II" design had better performance specifications and its appearance seemed to strike a responsive chord in my psyche.

So, I sent off for the "Mustang II" plans. I was somewhat dismayed when all that arrived was the plan sheets for the outer wing panels. Bob and his draftsman had not yet finished the plans for the remainder of the design. However, I was enthusiastic enough about Bob's prototype aircraft that I believed Bob would complete the drawing set for the design.

I erected the wing jig in my single-car garage, and bought a 4' x 12' sheet of 2024T3 .025" aluminum stock from a local supplier.



*Wing rib form blocks.*

I made the wing rib wood form blocks from ⅝" thick shop plywood and started buying tools that I knew I would need:

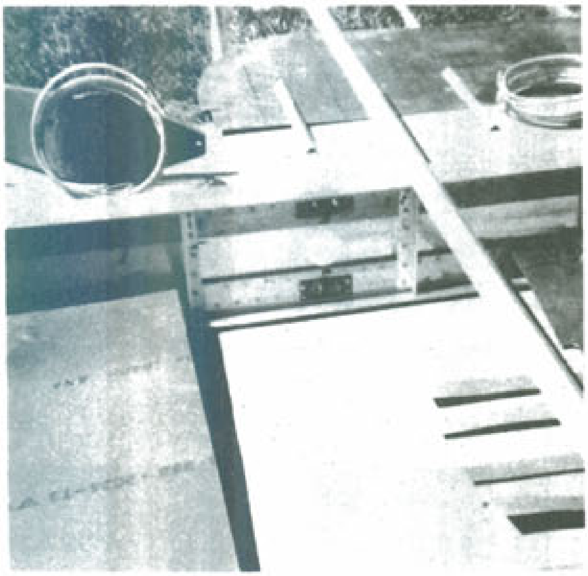
- right-hand and left-hand double action aviation sheet metal shears.
- an adjustable hole fly-cutter.
- assorted files.
- a drill bit set and 3/8" capacity hand held drill.
- I had a ½" capacity drill but needed a stand to convert it to a light weight drill press.
- a ½ horsepower air compressor.
- a vinyl/plastic forming mallet.
- a paint spray gun.
- a rivet gun and rivet sets.
- Cleco sheet metal temporary fasteners.

I made several tools:

- a disc sander.
- a 12 ½" capacity bending-brake.
- flange-forming pliers.
- flute-forming pliers.
- several rivet bucking bars.

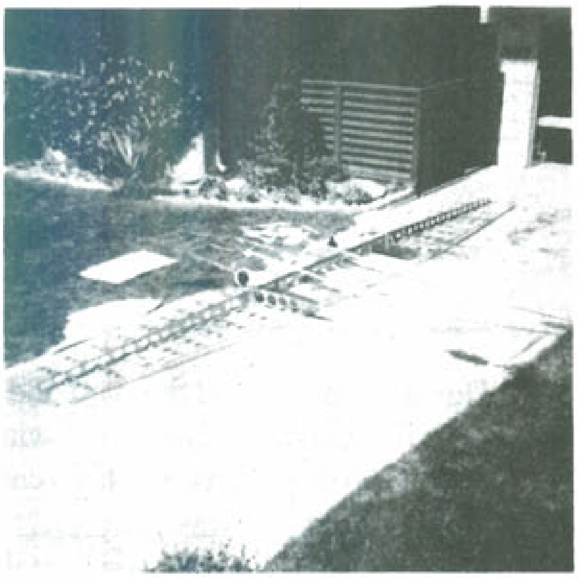
*Formed aluminum wing ribs.*

The first parts to be formed were the outer panel wing ribs cut from the .025" 2024T3 aluminum sheet, formed over wood form blocks, straightened with fluting pliers and flanged with hole hand-flanging pliers.



*Wing center section spar and other parts and materials.*

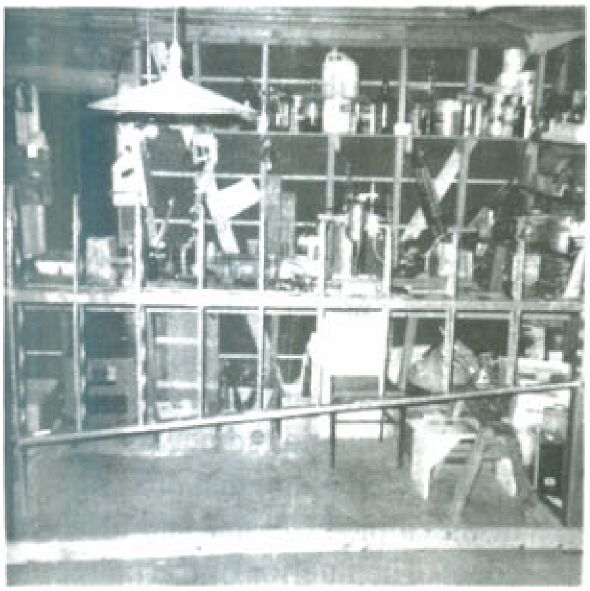
I then fabricated the main and rear wing spars. This is where I learned to rivet.



*Wing spars, ribs and other materials.*

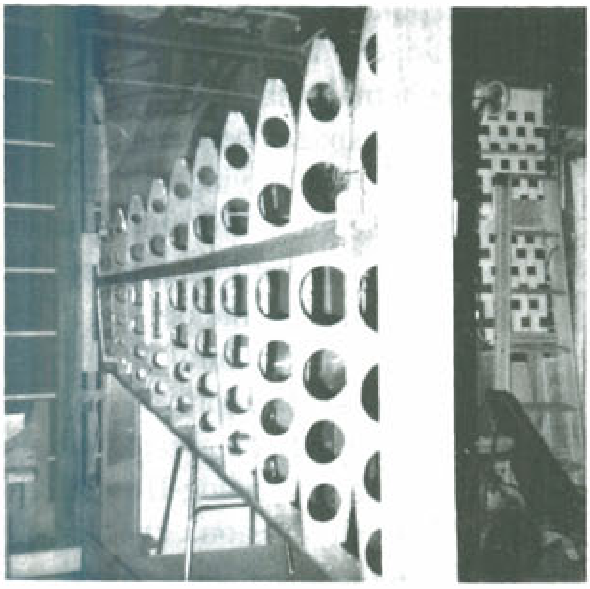
The wing main spar caps are laminations of 1/8" thick aluminum strips, all riveted together on the .040 thick spar shear web.

At this same time, I was working on the NASA Skylab Program and spending a lot of time at the NASA Johnson Space Center near Houston, Texas. During that time, I visited several local airports, and saw first-hand the effects of humid (somewhat salty) air on unprotected aluminum aircraft. I saw a disassembled Cessna-150 fuselage tail-cone. The interior of the tail-cone was bare aluminum and where the fuselage formers had been riveted to the aluminum skin, the corrosion was so bad that you could poke through the aluminum with your finger. This corrosion was caused by the humid salt air being drawn into the minute air spaces between the riveted surfaces (called faying surfaces) by capillary action. This type of corrosion is insidious in that you don't see it until it breaks through to the outside of the skin or has caused structural failure. Since I was getting a lot of pressure from NASA to move to Houston at that time, I wanted to protect my Mustang-II's airframe from that type of corrosion. I coated all aluminum surfaces with zinc chromate primer. I also coated all faying surfaces with military specification faying compound during assembly. The faying compound fills in the minute air spaces between the faying surfaces and prevents the capillary-action retention of moisture. This is especially critical for the wing main spar cap strips and all other



*Right wing in the jig in my cluttered one-car garage.*

*Ribs and spars are riveted together for both outerwing panels.*



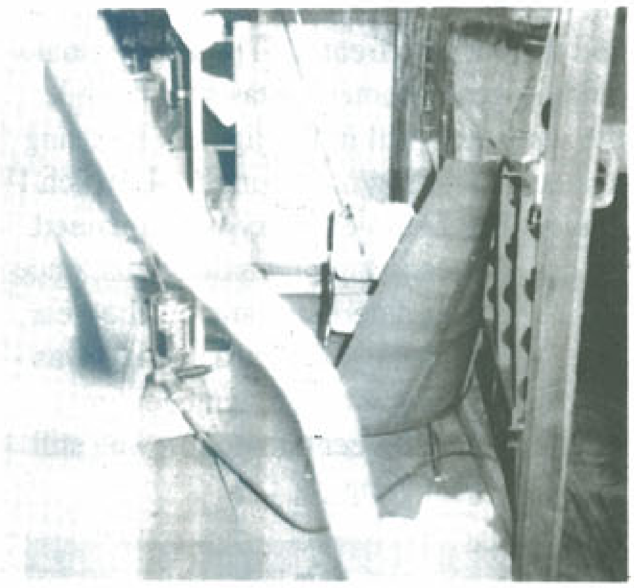
*The wing jig puts in the right amount of wing twist.*


*Ready for the wing skin on both outer wing panels.*

primary-load carrying structure.

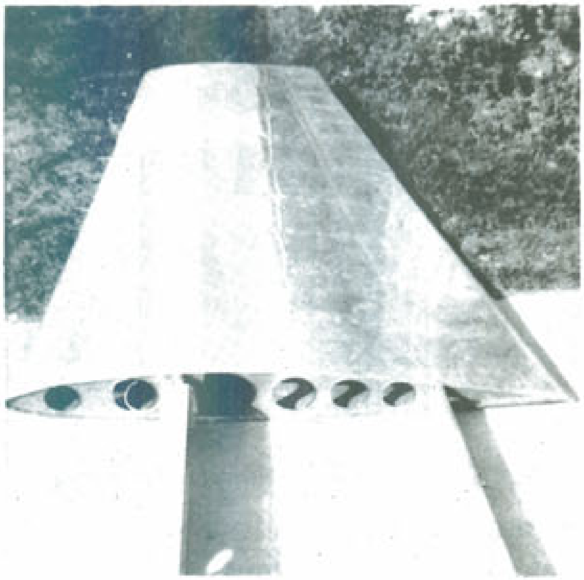
Once the wing spars were assembled, the spars and ribs were assembled in the wing jig and the wing skins were fitted and trimmed.

The skins were then dimpled and flush-riveted. During closure of the wing forward wrap-around skins, my ten year old daughter, Christine, was the only family member who had a forearm small

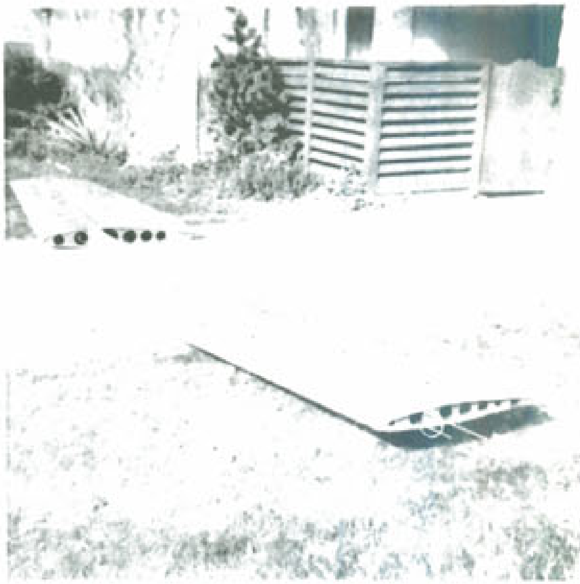


*Riveting the skin on an outer wing panel.*

*The left wing panel is completely skinned.*



*The right wing panel is completely skinned.*



*Both outer wing panels are now skinned and fitted to the center section spars.*

enough to reach through the smaller spar lightening holes to buck the rivets. She did a good job, too! Once the outer wing panels were completed, I stored them in a frame along an inside garage wall.

Then, the wing center section spars and ribs were assembled and fastened in the wing jig. The wing center section skins were fitted and trimmed. But before final skin closure, the landing