Field of Dreams . . .
Aviation Style

Back in 1990 I was working in a corporate aerospace environment feeling like a small cog in a big wheel. Designing computers and software for advanced fighter jets was certainly interesting, but ten years seemed like enough. I wanted a real, personal project, and the idea of building my own aircraft struck me as exciting. I have a B.S. degree in Aerospace Engineering, but had never applied it to designing airplanes.

The ultralight category seemed like a breath of fresh air. Here one can design, build and fly a real flying machine with less government interference than it takes to drive a moped. Designing an airplane is no small task, so to give it justice I quit my job, sold the house and moved the family into an old farm house in southwest rural Iowa (rent was very cheap!). The nearby small town of Corning turned out to be rather progressive. The city fathers had built a beautiful new airport with a concrete runway and an eight-stall hangar with Wilson doors. However, with the near-death of general aviation, the airport was the quietest place in the county.

As my intentions become widely known in the small community, I had to listen over and over to the ultralight accident stories of the past. It seems a couple of farmers had brought their new ultralights out to the airport, accidentally took off while taxiing and destroyed their machines trying to get them back down.

Out back of the house we were renting was an old hog shed with the stalls and straw still intact. After taking apart the stalls and a good hose down, I had a free 24 x 50 foot shop. Two stalls got new insulated walls that became the design office. The office was equipped with a new PC and work began. Starting from a blank computer disk, it would be more than two years later that a flying machine would emerge.

Aluminum appeared to be the ideal medium for an ultralight. With the huge volumes of research data by NACA on aluminum structures, it should be straightforward to design an aluminum ultralight structure. The advantages of aluminum appeared overwhelming, but my professional aerospace training may have biased me. To this day, I can't figure out why there are not more aluminum ultralight designs.

Early on a monocoque low-wing configuration was chosen to avoid the weight of a high-wing cockpit structure. I tried really hard to come up with a cantilever wing but gave up after building and testing a complete

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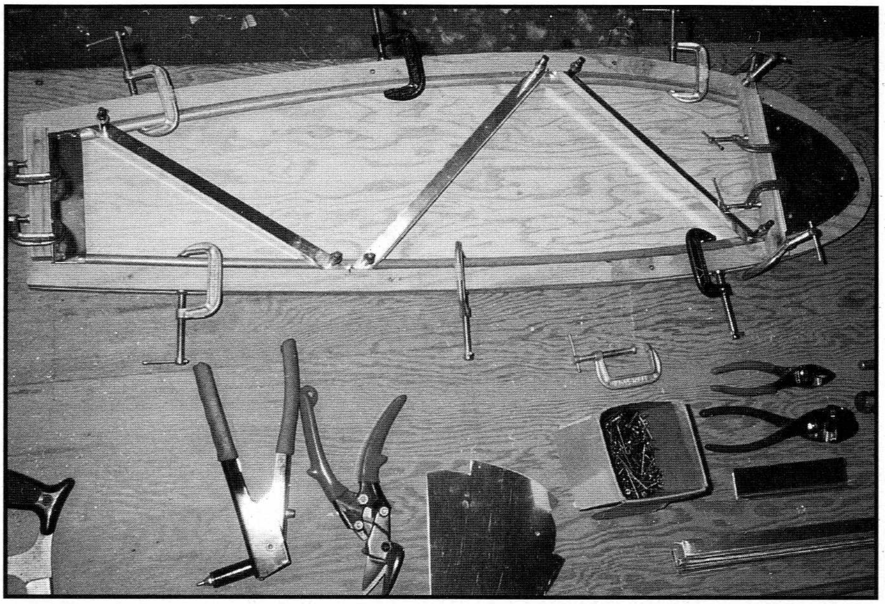
Above -- No, this isn't heaven -- or Iowa, it's EAA Oshkosh '93 where Frank Griffith displayed his mostly metal -- except for the control surfaces -- ultralight. Right -- Instrumentation is basic on the CA-2, the model designation he's given this machine, to keep things light. The machine weighs in at just over 250 lbs.

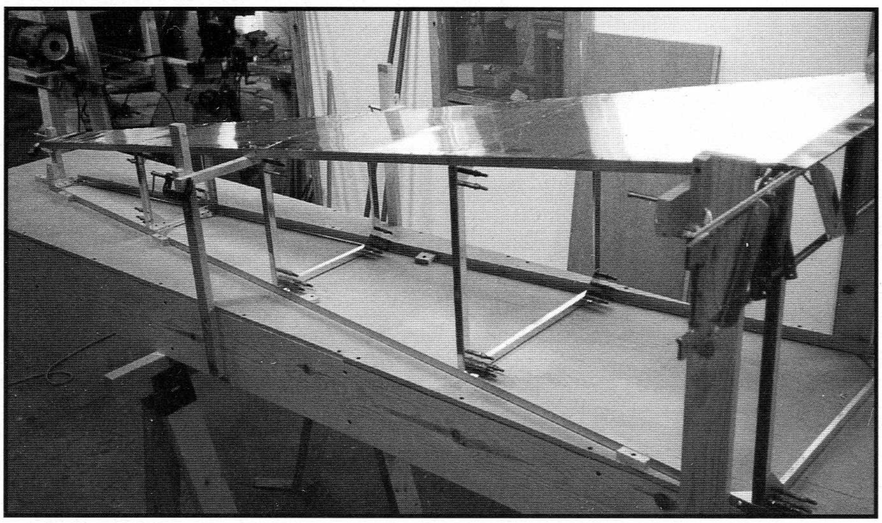
wing. The main spar would weigh too much and the fuselage attachment was too messy. That left a strut-braced approach with the strut running down to the main axle. Another pet idea I had to give up was the tri-gear which was several pounds heavier than the conventional taildragger.

Actually, I built a complete ultralight with a cantilever wing and tricycle gear. Halfway through I realized it wasn't going to work out, but I completed it anyway for the experience to



Frank Griffith

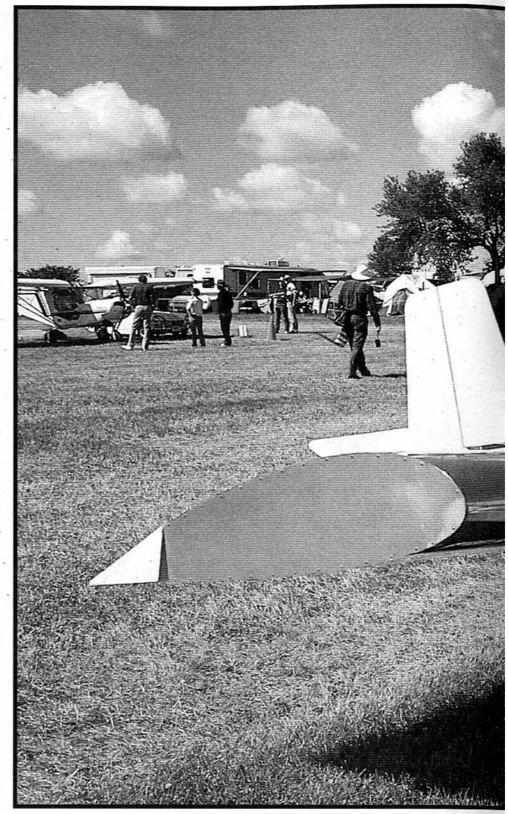
Ribs for the CA-2 are formed from 1/2 inch tubing and a solid nose rib. Below -- The stressed skin fuselage takes shape on the table. Griffith uses 0.016 skin for the fuselage, wing skins and leading edge, and 0.012 for parts of the tail cone.



Frank Griffith

The CA-2 uses a thick airfoil designed by Harry Riblett, the 30-UA-318, which provides a high lift coefficient and a gentle stall.

Frank Griffith



Above — Power for Griffith's CA-2 is the single cylinder Rotax 277 engine. While the machine bears some resemblance to the miniMAX or Fisher FP-303 designs, Griffith says there's no similarity in the aerodynamic structures. Like the miniMAX Griffith uses the solid gear system with the tires being the main shock absorbers.

be gained. In January of 1991 I took this ill-fated contraption to the airport to see what could be learned from taxi tests. The landing gear was weak, the controls sloppy, the wing too weak for the weight, and worst of all, the nose gear sheared off destroying the front end of the fuselage and what was left of my dignity. As I pulled the pieces off the runway, I noticed a Beech Baron in the pattern; it was just my luck that a fancy aircraft would land at our little airport when I was in my predicament!

The real design was now clear; it would be a stressed skin, strut-supported low, wing, tractor-propelled, conventional-geared, pushrod-controlled ultralight! A LOTUS spreadsheet contained a running weight and balance estimate of each major component. Small computer programs were written to estimate the load and stress on the wing, to estimate the static stability with varying CG locations, and to perform various bits of structural analysis. Numerous spreadsheet programs were set up to solve the various

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design equations. I used the conventional design methods as taught to aerospace engineers in the early 1970s. The PC was used as the primary tool, with all preliminary construction drawings done with a CAD program.

Construction started in March of 1992 and the machine was ready for flight on the fourth of July. The fuselage was assembled upside down on a flat table. Four 3/4 x 1/16 inch longerons run down the corners with 0.016 sheet everywhere except for 0.012 on the top and bottom of the tail cone. First, the top longerons are assembled into a unit with gussets. Then, the bottom longerons with sheet and gussets are assembled into two components. The top longeron unit and the two bottom units are assembled into a box on the flat table. Frame pieces, control system components and the cockpit items are installed with the fuselage still on the table.

The wing has a field tension beam main and rear spar with 3/4 x 1/16 inch angle caps for the main spar. A Harry Riblett 18% thick turbulent airfoil was chosen for the high lift and gentle stall.

The ribs are made up from 1/2 inch tubing and a formed nose rib. A wood jig holds the spars in position while the ribs and skins are put in place. Each wing took one day to skin. The leading edge sheeting is 0.016 with 0.012 used for the rest.

Tube and fabric construction was used on the control surfaces to save weight. A Rotax 277FC engine with an Ivo Prop propeller was installed for power. A five-gallon Rubbermaid gas can became the fuel tank.

The first flight was made in July of 1992 and took a big leap of faith to commit. I picked a perfectly calm evening when I was the only one at the airport. At that time, I had only 25 hours in a Cessna 172 and no ultralight, low wing, taildragger or open cockpit experience. The aircraft climbed well, but I noticed the airspeed was stuck on 65 mph regardless of what the aircraft was doing. I climbed high to 2,000 feet above the runway and gradually began checking out the feel of the aircraft. Then, I slowly reduced power until a slow descent was set up; I kept that up until I was back down at the airport.

With the CG at 28%, the machine was stable but a little light in pitch. I moved the CG to 25% and that gave good control harmony. The aircraft now has 14 hours on it, and I am happy with the way it handles and flies. Several ideas have come up for improvements in the structure and construction methods, but aerodynamically it seems to be a good performer.

After I started flying it, other individuals have expressed an interest in the machine, so a set of plans and a manual were completed. The plans are 35 pages of CAD-drawn, B-sized drawings. The manual is 63 pages with diagrams, step-by-step instructions, and a parts list. EXP