KOLB'S FIRESTAR DEBUTS

At Sun 'N Fun 85

By Dick Cavin
Photos Courtesy Kolb Co., Inc.

A most pleasing debutante she was, too. The very light airplane crowd at Sun 'n Fun '85 apparently thought so, too. Its good looks and sparkling performance endeared it to a sizable number as the one that filled their bill of particulars.

As a matter of fact, when I first met Homer Kolb he was busily filling out an order for one of his FireStars, with another customer waiting in line with his check in his hot hands. Under the awning of his display Homer had an uncovered airplane there for bare bones inspection by the crowd. It was nearly impossible to get a picture of it, as the obviously interested ones were going over every detail with a fine tooth comb and spending time discussing various features.

These weren't just curious neophytes, either. They seemed to be well informed on construction features and flying qualities of ultralights and, yes, they knew about the deficiencies of various makes, too. The welded steel tube fuselage framework in the pilot's area, integral with the pylon structure supporting the engine, and the solid, machine tapered landing gear legs of 7075 aluminum, was impressive with its ruggedness, as well as its simplicity. It all spelled superb pilot protection.

Kolb's 5 minute wing fold/unfold feature was probably the star performer of the display, although the huskiness of the big tubular spar and the unusual tubular aluminum ribs didn't escape their notice either. The FireStar, as well as its predecessors, the Ultra Star and 2-place Twin Star, all have this ability to fold their wings and be ready to trailer home in 5 minutes or less. It requires pulling 6 pins (3 per wing) and rotating the wing on a universal joint at the spar and walking the wing tip aft until it is parallel to the fuselage. The horizontal tail folds upward alongside the vertical tail by simply removing a wing nut and clevis pin. This allows the airplane to be folded to a 56" wide by 5' 8" high package that's easy to fit on many trailers. It's folded length of 21' 3" also allows it to fit into most one car garages.

The very light airplane buyer is very cost conscious these days — much more so than in the past. They are obviously savvy that the designs that require 15 to 20 minutes for assembly or reassembly are often two man opera-

tions that take closer to 30 minutes, and that Kolb's folding operation could really be done in 5 minutes by one man. Some of those interviewed said they would prefer to fold the wings and share a hangar with half a dozen others. Others preferred putting it in their home garage. One and all agreed that the economics of wing fold storage would enable them to afford to own and operate an airplane without wrecking the family's monthly budget.

Interest also focused on Kolb's control system for the nearly full span ailerons. Most of today's feather-weight airplanes use full span ailerons. In their down position their drag and associated adverse yaw are a serious control problem. The problem magnifies at low speeds and in combination with minimum flying experience can be an accident trigger. Homer Kolb's ailerons are operated via 4130 steel push/pull tubes with self-aligning bearings at each end. He has a most effective differential throw linkage that deflects the up aileron nearly twice as much as the down aileron, which practically eliminates the adverse yaw problem and greatly increases aileron response at minimum airspeed.

Before going further into the construction features, let's see where Kolb's new FireStar comes from and the background of the designer.

First of all you might be surprised to learn that Homer Kolb was one of the real EAA pioneers of ultralight flight, along with Hobie Sorrell, Ray Stits, Bob Hovey and Wilbur Staib. In that he has designed and built 13 designs since 1959 that would fit the ultralight category today, plus a couple of towed floatplane gliders, a foot launched flying wing glider, and a Rogallo wing glider, would certainly put him in the forefront of all others in the variety of his experience.

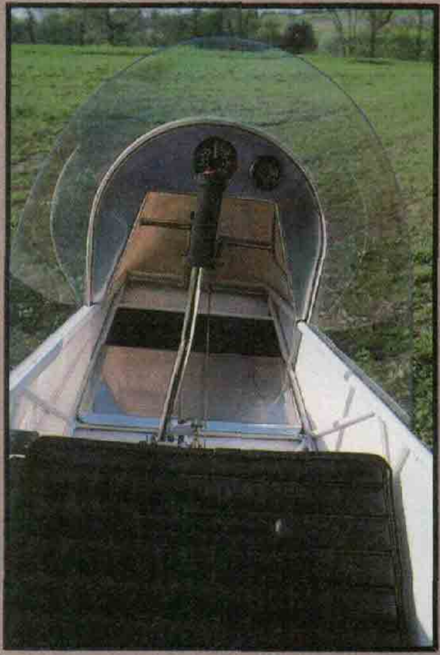
Homer's goal all along was to build an airplane that was no heavier than the man that would fly it and it would be powered with an engine he could hold in one hand. He succeeded in that respect as far back as 1966 when he built his first powered ultralight. It was a 168 lb. high wing monoplane with a T-tail, conventional three axis controls and a tricycle gear — powered by 4 chain saw engines!

If today's engines had been available then, it's conceivable that the ultralight industry would have bloomed nearly 20 years earlier and Homer Kolb's name would have been a household word among EAAers today.

On the other hand, perhaps the world wasn't ready for ultralights and maybe we wouldn't have Part 103.7 and 20,000 ultralights and all else that the media hoopla has generated the past few years. We wouldn't have had multi-thousands senior pilots having problems with their medical, or a whole new generation of bright young people enthusiastically inventing flying all over again, either. Perhaps Homer's conservative, low key and even frugal approach wouldn't have been colorful or daring enough to attract the sensational element of the media in the preceding hectic and frenetic years.

To understand and better appreciate Homer's philosophy and accomplishments, turn the pages of his life back to his childhood as a typical hard working son of a Mennonite farmer in the southeastern part of Pennsylvania, some 30 miles northwest of Philadelphia in the lush Schulkyll river valley, and a few miles south of historic Valley Forge National Park. He built models by the dozens and soon was designing and building his own. At the age of 10 he was the typical airport kid, riding his bike a few miles on Sunday to the Pottstown-Limerick Airport just to look at airplanes and dream.

When he was 13 he got a ride in a J-3 and began taking J-3 dual 15 minutes at a time as he could afford it, which wasn't often. When he was 15 he unofficially soloed after 2 hrs. 15 mins. dual and made it official by the time he was 16.



Things went slowly after that. Mennonites don't believe in excess formal schooling and it was a tradition that when boys were old enough to work, they quit school and helped their parents on the farm and the parents could then get rid of the hired hand. Homer was a straight A student in science and he had a great thirst for knowledge, so quitting his formal schooling was hard for him, but he dutifully obeyed.

Fortune smiled on him, however, in that a friend tied his Cub down on Homer's farm and gave him use of it in exchange and so he was able to get his private license when he was 17. He went on building up his time until one day a windstorm flipped the Cub over and that was the end of it.

In 1950 he took a year out to do missionary work in West Germany, helping Soviet Union refugees build housing there. While he was there he studied every small engine in Europe, with an eye to building his own airplane. He came to the conclusion that chain saw engines had the best power to weight ratio available. It was about this time that he determined the only type flying he could afford in the foreseeable future would be in an airplane he would build himself. It would have to weigh about what the pilot would weigh and fly on miminum horsepower. Of course, it would also have to be very cheap to build and operate. Above all it must fly well, land slowly and be very controllable at low airspeed.

The main stumbling blocks in Homer's quest toward these goals have been the hard facts of farm economics, always a hard fight with a short stick. Homer married at 24 and bought his present 100 acre farm that same year and so his experiments in lightweight, low powered flight had to not only go slowly, but also be done on the proverbial shoestring. He had heard of EAA in 1953 and was quick to join (his EAA number is 378). He has spent most of his Convention time since then in forums, soaking up knowledge of all aspects of airplane building. He also took an aviation engineer course from International Correspondence Schools when he was 20, but dropped out when he mastered the basic essentials that he really wanted to know about.

Homer's designs have been an ongoing evolution from the very first and some of the things he has learned have come the hard way. His second glider was wire braced and when a hardware store turnbuckle on a flying wire let go it dumped him 30 ft. in the Schulkyll River and luckily all he got was a scratched arm. Since then he has used nothing but certified aviation hardware and he also turned his back on wire-braced wings (for several reasons).

One of the things Homer has found out in his many "flying laboratory" experiments is that a low aspect ratio wing is far superior for very low speed flight, contrary to popular opinion. One of his experiments was a motorglider with a 40 ft. span and 2.5 ft. chord and he found that such a wing was fine at the higher sailplane speeds, but that the short chord (low Reynolds number) worked against you when speeds were below 35 mph.

Homer likes low aspect ratio wings for several other reasons, too. He says, "A short span is easier to build, fold and transport. It can be made stronger and lighter, is more practical to strut brace, is less expensive to build, causes less adverse yaw from ailerons, has a faster roll rate, and gives much better spin characteristics." He also said, "It's almost impossible to get into an unrecoverable spin if your wings are short, provided you have adequate altitude, of course."

He says that the non-tapered, low aspect ratio-wing is almost as good as a delta wing at high angles of attack and with the stall invariably beginning at the root, it stalls cleaner and gives the pilot some warning. He also found it essential to position the tail surfaces far enough aft to always be out of wing wake and maintain maximum effectiveness at low speed. Homer even used a T-tail on one of his very early models to do the very thing, although he feels moving the tail further aft is a better solution.

Some of the other features that he has proved in the crucible of actual flight are 3 axis controls, double surface wings, a thrust line on the center of drag line, a very low dihedral angle, a welded steel tube framework and the pusher engine installation.

That isn't all this one man NASA has put under his microscope, though. He's built 'em with 4 engines, 3 engines, 2 engines and now he's settled on a single engine, but even here he's kept the door open for promising new engines that come over the horizon. As for landing gears, he's used his own legs, tricycle gears, a single float, pontoons, a single wheel, taildragger gears and now a four point gear on the FireStar and Twin Star.

Homer found that by moving the main gears a short distance aft he could have the best of both the tricycle and taildragger configurations. No longer was there a ground looping tendency (common to all taildraggers), so Cessna 150 trained pilots can become proficient taildragger pilots in very short order. The short, 3 point landing ability of the taildragger is retained and with the addition of a skid under the nose the airplane can be "pushed over" like a sailplane for a super quick stop without brakes. Also the new gear position allows the tail to be raised to flying position almost instantaneously on takeoff. This not only gets rid of the P-effect of the prop, it also gets rid of the drag of the wing and tail in the high angle of attack position, thus improving acceleration and shortening take-off instance.

The typical rigid tripod (welded steel tube) gear used by many ultralights transmits shock loads to the airframe and is a high drag item. Homer had long admired the well proven Wittman tapered rod gear for its simplicity and shock absorbing capability (in all directions), so he modeled his new gear from it. He lathe tapers a round bar of 7075 T6 aluminum, plugs it into a socket and secures it with a single bolt and now he has a shock absorbing gear that will get along with pretty rough terrain and act as a "fuse"" between wheels and the airframe. Instead of bending the rod at the end to make an axle as Wittman does, Homer attaches a simple welded steel socket and axle at the end and again secures it with a single bolt. He now has a gear that's on a par with any of the "big boys". It not only gives more pilot protection, but also is better suited to absorb the punishment of neophyte pilot landings.

By lowering the tail boom from the wing to the bottom of the fuselage Homer could use a larger diameter prop, which translates to more thrust, less noise, and less prop damage from gravel or debris thrown back from the wheels. A larger diameter prop means less of the prop diameter is affected by rough air eddy currents from structure ahead of the prop, thus more efficiency. He can then turn the prop more slowly for the same amount of "work". Lower rpm means less noise, less fuel burned, less heat, better engine reliability, and longer life. "Little" things can mean a lot. The lowered tail boom also lowers the vertical CG, so stability is enhanced by the increased pendulum effect.

While there is a certain novelty by using a three or four blade prop, their only good reason for being there is to take advantage of restricted room, as the more blades there are the less efficient the prop is. If one can live with increased diameter, the two blade prop is the logical choice, so Homer can increase his blade diameter considerably with the lowered tail boom. He can also save the additional weight and cost of a multi-blade prop.

Homer was one of the first to use a large diameter tube for the tail boom and he also recognized its value as a main wing spar. When compared to a labor intensive, built up I beam, the tubular spar is less efficient if weight is the only yardstick used. The tube spar, though, regains validity when torsional strength and shear resistance are cranked into the equation. All such things are trade-offs, true, but the tube spar enables Homer to use a single lift strut instead of the Vee arrangement or parallel struts. Drag loads are carried by an internal aluminum tube that goes from the wing root to the lift strut attach area.

For the spar Homer uses a 5 in. diameter tube of .052 wall of 6063 T-6 aluminum, an alloy with excellent fatigue resistance qualities. He uses an "H" shaped fitting of welded steel tube that is inserted within the spar tube at the strut attach point. Here it acts as a bushing for the bolt that secures the 1-1/2" x .058 aluminum tube lift strut. The strut itself has a 1-1/4" x .058 sleeve inserted at the midway point for superior compression strength. Machined steel ends are riveted in each strut end.

The FireStar, like the UltraStar, uses 18 nose ribs per side that are riveted top and bottom to the spar and gusseted by pop riveting to the nose tube. The ribs are formed of 3/8" x .035" aluminum tubing and extend well aft of the spar. The 1.7 oz. Stits dacron fabric is glued to the rib tubes plus special pop riveting for a most secure bolt 'belt and suspenders' attachment. Two coats of Stits Polybrush and one coat of color finishes out the fabric.

Homer's airfoil is his own design that's based on a popular airfoil for low speed flight. It has a "soft" leading edge for gentle stall characteristics and it's forward upper third is highly cambered for maximum lift. Its thickness is about 12% of its 5.5 ft. chord. With its span of 27.5 ft. it has 148 sq. ft. of area. This aspect ratio of 5.5 is just about ideal according to Homer, and at the 252 lb. empty weight the wing loading is a miniscule 1.7 lbs./ft. sq. The 35 hp Rotax 377 engine turning a 66" x 28" prop gives it a superb 1200 ft./min. climb rate and a take-off distance of 100 ft. or less in grass.

The moving of the gear a bit rearward enabled Homer to use the rear spar as a pivot point for the wing folding without changing its folded weight distribution and one man can still handle it easily. This folding method allows the wing to be folded with the leading edge down. This makes for a narrower folded width and better protects the wing from the likelihood of handling damage.

The pilot of a FireStar has the option of flying completely "open air", if desired, or partially enclosed in the molded fiberglass enclosure. A completely enclosed "winterized" version is an ongoing option, too. The upholstered seat is very comfortable and also does double duty as a fuel tank and all controls are comfortably located for perfectly relaxed flight.

The FireStar's empty weight of 252 lbs. is crowding the Part 103.7 limit, so if a builder wants to add some of the available options or other items adding weight, he would also have to opt for the higher weight limit allowed by the FAA when a ballistic parachute installation is declared. Wheel pants, additonal paint, etc. are examples of these options.

The emergency ballistic parachute is a dream come true — a dream that dates back to WWI days. One that was tried both successfully and unsuccessfully in the dim past. Airplanes of that day were too big and too heavy and simply couldn't handle the weight and size of chutes of that day. But today the pilot of these featherweight airplanes can have peace of mind while flying over very hostile terrain. With a welded steel cage around them, a seat belt and shoulder harness securing them, it's most unlikely that a parachute descent would bring much harm to them or the airplane in the event of an engine failure. It could even save their skin in the event they blundered into weather (although we hope the chute won't tempt pilots to gamble with weather). Theoretically, recreational flying in the modern, very light airplane should make it one of the very safest of all sports.

Finally is the matter of structural strength. Homer feels that static testing is inadequate proof, so he set out to see how far they could push one of the Ultra Stars past the design load factor of +4 and -2 Gs. To summarize, it took a 50 degree dive to 95 mph followed by an abrupt, full throw control application that registered 9.5 Gs! This caused compression failure of the left drag strut and the wing folded back alongside the fuselage. Parachute deployment to a landing in a tree resulted in no damage

to the pilot and only slight airframe damage. It was an easy fix to stabilize the drag strut under high compression loads, so if a pilot somehow busts the 4 Gs limit he should be reasonably safe if he is gentle. If not, the ballistic chute could still save his bacon.

The tail group members are simply reduced photocopies of the wing structure, except that the tubular ribs go all the way back to the trailing edge. They are wire braced and the horizontal tail is hinged for quick folding. All are cable

operated, with all cables carried inside the tail boom tube where they are protected against damage from disintegration of the prop. Some other ultralights in past years have been severely critized for their vulnerability in such a situation.

The FireStar's 2nd generation ancestor, the Flyer, was built in 1970. It was not built to market, but was Homer's personal airplane only. He flew it for over 200 hours between 1970 and 1980. Friends and neighbors had urged him to refurbish it and display it at Oshkosh '80. He stripped off the old mylar covering and replaced it with Stits Polyfiber and built a trailer for it. He also was changing the powerplant, but didn't quite have time to complete it, so it was a static display only that year. Over 100 Flyer raw material kits (only) have been delivered since then.

The Ultra Star evolved from the Flyer and made its maiden appearance in 1982. Since then its popularity has zoomed and it is estimated that about 400 Ultra Stars are now flying.

If an aviation company had probed into all these experimental configurations in the same time period it would be an outstanding achievement (and an immensely expensive one, too). For one man to do all this alone at miniscule cost is simply incredible.

Homer says he wasn't quite alone. Even though he has done the initial design on all the airplanes, his good friend and distant relative, Dennis Souder, has been his good right hand and Homer says without Dennis he couldn't have done it. Dennis is the junior partner and the company secretary/treasurer and is the one with formal engineer training.

Homer, Dennis and Homer's wife, Clara, still hold down full time jobs, in addition to company duties, which is still another indication of their down to earth, realistic approach to business, as well as research. Homer gave up full time farming 14 years ago when it no longer would support his family and took a job driving a big UPS truck up to NYC and back at midnight each night. Dennis and Clara Kolb are in public service jobs, so management overhead is incredibly low. Homer will retire from UPS in 3 more years and be assured of a living regardless of the fortunes of the company, bright though it is, indicative of his conservative, down to earth philosophy.

Unlike many companies in the industry that have built or rented big and fancy buildings, bought full page color ads in magazines, etc., the Kolb Company operates out of a king size fieldstone barn built in 1732 at the same time his house was. Uncontrolled overhead kills most businesses that go under, but it's apparent that the Kolb Company is not only rock solid solvent, but likely will be from now on.

The FireStar kit is priced at $4995 plus options. It can also be purchased in three separate kits for the budget minded. For more information write the Kolb Company, RD 3, Box 38, Phoenixville, PA 19460, or call them at 214/948-4136.

Even better, come to Oshkosh '85 and meet Homer Kolb in person. I think you'll find him a warm and personable man as I did, with an ever ready smile, a man that looks you straight in the eye, a person you'll instantaneously like and feel at ease with. He comes across as a frank and knowledgeable man with an overwhelming love for things that fly.

In the meantime, stay tuned for a LIGHT PLANE WORLD report soon on the Kolb TwinStar.