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EXPERIMENTER

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A vintage homebuilt

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Keeping Up a Family Tradition

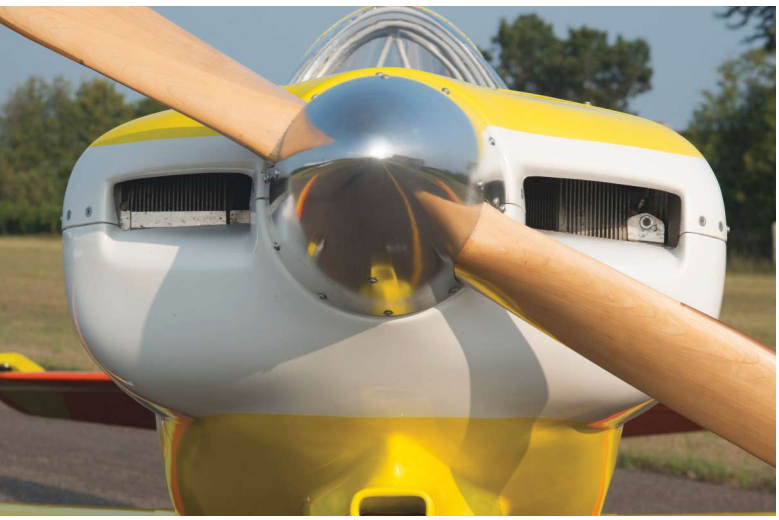
Randy Weselmann and his Piel Beryl

BY BUDD DAVISSON

Photography by Tyson V. Rininger

The wing and tail planforms of the Beryl are very recognizable as being shared with the Piel Emeraude and the certified Cap 10.

IT'S HARD TO BELIEVE that EAA is more than 60 years old and that we're seeing second- and third-generation homebuilders following in the footsteps of parents who built airplanes. To the average person on the street, building an airplane sounds preposterous, but to someone who grew up with an airplane in his family's garage, it sounds perfectly normal. Doesn't everyone have an airplane in his garage?



The cowling is a Randy Weselmann original, since the plans didn't address the cowling in detail.

Randy Weselmann of Bainbridge, Indiana, would say, "Yeah, we had an airplane in the garage, so why not build one myself?"

Randy's dad was an aeronautical engineer who worked for General Electric and Boeing, among others. However, in the early 1960s he decided to set up his own airplane factory and bought the plans for a Thorp T-18. Being small, Randy was the official crawl-inside-the-fuselage-bucking-bar holder.

He said, "I don't know where the urge to work with my hands came from, but certainly watching and then helping my father take flat sheets of metal and turn them into an airplane had a lot to do with it. It must be in my DNA because the urge bit me early. I started on my A&P license while still in high school and eventually went to work with United Airlines in their sheet metal and machine shops. I wanted to build an airplane, but I wasn't making enough money to go the normal homebuilt route. So I built a Mitchell B-10 flying wing ultralight."

It would be easy for another homebuilder to look down on the concept of building an ultralight, but Randy has the last laugh.

"I have put over 400 hours on it and have gone through three engines. I still have it but haven't flown it for a while because of the Beryl."

The Piel Beryl caught his eye because he liked "the Spitfire look" that the wing had. Also, the advertisements for it said

The Beryl was Claude Piel's aerobatic version of his better known, side-by-side design, the Emeraude.

Photography by Tyson V. Rininger

The Lycoming 0-320E2D was a totally disassembled basket case that Randy found on Barnstormers.com. In the course of rebuilding the engine, Randy added a Silver Hawk fuel-injection unit and a Christen inverted oil system.

it was designed for aerobatics, and that really appealed to Randy. He said, "The wing is essentially the same as the two-place, side-by-side Emeraude that Claude Piel had designed earlier, except that it is a bit shorter and slightly beefed up. The fuselage, however, is totally different in every way."

What he's referring to is that, besides featuring tandem seating, the wood fuselage of the Emeraude was replaced by a conventional steel tubing truss unit in the Beryl like so many other aerobatic airplanes.

Randy said, "Claude Piel was a professional engineer and didn't give too much thought to the limited aircraft building experience the builders of the airplane would have. The Emeraude was designed in the early 1950s, the Beryl in the '60s, so the homebuilding movement was still quite young. Claude approached the airplane as he would any other professional airplane design, so some parts of it are—if not difficult for an amateur to do—at the very least challenging and/or time consuming.

"The fuselage, for instance, is not a conventional tubing box like a Pitts or Skybolt where you build the sides flat and then stand them up to put the crosstubes in. The firewall station is square, but from there back, the fuselage is trapezoidal and sweeps up. So you build the top of the fuselage first, then construct a three-dimensional jig that holds the bottom two longerons in the right place and start putting in the side tubing. The side trusses have few 90-degree crosspieces. It's

The aileron balance weights hang out into the wind.

a Warren truss, so most side pieces are running at angles in the shape of warped W's, and because the wing runs through the bottom of the fuselage, rather than attaching on either side, there is a big discontinuity in that area. Further complicating things is that the bottom truss is highly unusual and irregular plus the longerons aren't one piece. They are multiple pieces of different sizes getting smaller as they go back where the strength isn't needed.

The fuselage of the Beryl is much more complicated than most tubing structures of the type because it isn't square, so the sides can't be laid out and then stood up. Plus, the longerons are made of numerous sizes.

Randy says wheelpants may be installed someday, but he's having too much fun flying to put them on.

"The truth is that I didn't get serious about the fuselage until I was about 15 years into the project. I started out building small pieces of both steel and wood because they looked so good hanging on the wall; and I was polishing my skills as I went. I learned to weld in A&P school but hadn't welded in years, so I practiced on the small pieces until I had the time, money, and space to attack the fuselage."

The project was further complicated because Randy said the plans only addressed about 75 percent of the airplane. A lot of things such as forming sheet metal and cosmetic details were left to the builder's imagination and creativity. Plus, there was no building manual, so there, too, the builder had to think far ahead while figuring out how to jig and build the different components.

He said, "One thing about the plans is that they were very professionally drawn. But there were a lot of them, and you had to do some head-scratching to figure out how things related to one another. Plus they were written in French with rough English translations. Also, they were all metric, which was actually no problem. In some ways, I like working with metric better. For the most part, I made no effort to convert measurements. I just used metric and had the right measuring equipment."

Randy constructed the big parts last due to space considerations, and that applied especially to the wing. Typical of wood construction, the parts count of the wing is extremely high, and to make matters worse, most of the parts are only repeated twice because of the shape of the wing. Randy explained, "You didn't get a rib template; the shape of the wing, with every rib being different, made it impractical for Claude to do templates. So he gave you the X/Y coordinates and you plotted the airfoil yourself, which is no problem and is probably more accurate than working with

Photography by Tyson V. Rininger

something like a paper template. But like everything else, it takes time. Especially since you had to calculate the airfoil and draw it full size for every rib station.

"The ribs are built-up trusses, and only those between the spars in the center section are the same. So after you calculated the airfoil for each station, you had to build another rib jig that would only produce two ribs. Then you trashed that jig and made another one. I really like variety, but it gets tiresome after a while. However, it worked well for my situation at the time. I didn't have the time or money to really dive into the project, so every so often I'd make up a pair of ribs, then work on something else."

One of the major space hogs in the project was the wing because it is one piece. Also, it is complex, and because it's a cantilever wing, everything on the spar has to be perfect. This includes laminated spar caps that have to be jigged to match the airfoil change as it goes out the wing. To further complicate the life of a builder who is short on space, the spar (hence the wing) is more than 25 feet long.

Randy said building the worktable was a project in itself, not only because it was so big but also because it had to have a perfectly flat, true surface. "I built the spar lying flat as if it were a gigantic rib with a similar type of jig," he said. "This let me get all the angles exact. However, when I started actually building the wing, because of the dihedral, I was back to constructing another very stout three-dimensional jig. I had to be careful; because even though the spar was quite strong, being that long, it had a little flex and you had to be careful to keep it true. So it was jigged everywhere that I could attach the jig to it."

The original CP.30 Emeraude wing, on which the Beryl is based, continued to evolve until the Emeraude melded into the certified, French CAP 10 aerobatic trainer. As originally designed for the Beryl, the wing was plywood

The canopy was the biggest, most difficult single part of the airplane to build.

Randy's panel reflects the trend toward glass cockpits in almost any kind of airplane. And the iPad is becoming the most popular navigation add-on.

AIRCRAFT SPECIFICATIONS

Top speed (V_{NE}): 183 knots
Cruise speed: 120 knots at 2,300 rpm
Full throttle speed: 149 knots at 2,650 rpm
Landing speed: 60 knots
Takeoff roll: 1,000 feet
Rate of climb at gross: 800 fpm at 95 knots
Range at 65% estimated: 3.5 hours
Range at 50% estimated: 4 hours
Empty weight: 1,174 pounds
Gross weight: 1,700 pounds
Useful load: 526 pounds
Fuel capacity: 26 gallons
Wingspan: 26 feet, 6 inches
Wing area: 117 square feet
Length: 22 feet, 9 inches
Cabin width: 24 inches
Cabin length: 84 inches, rudder pedals to rear seat
Engine: Lycoming O-320-E2D
Prop: Sterba 70-by-68, wood

sheeted only forward of the main spar. This formed a torque box that carried all of the various loads the wing would experience. Behind that, it was fabric covered. When Randy did his wing, he went one step further and sheeted the entire wing, like the CAP 10. In fact, he copied a number of changes that were made in the CAP 10 wing.

He said, "I wanted the wing to be not only stiff but also smooth as well. So I continued 1/16-inch birch ply from the spar to the trailing edge. When I finished it, I used boat cloth over the ply, which is really thin fiberglass with resin. With very little filling and some sanding, you can get a nice, smooth surface.

"I also changed the wing incidence from four degrees to two degrees and took the dihedral from five degrees to three degrees and used electric actuators for the trim and flaps."

The tail is also wood and the structure mimics that of the wing but much smaller. Its trailing edge is laminated like a tip bow to provide the requisite curve. The one-piece skins are very gentle compound curves, which Randy accomplished by forming them in place when wet. As with the CAP 10, he also balanced the elevators and inset the elevator trim in the left elevator.

The basic structure had a few complexities, which Randy worked out with no problem, but as is often the case with airplanes, some of the lesser assemblies caused as much or more headaches. In this case, it was the canopy.

Being a tandem airplane, the canopy is a visual focal point of the design and one of the areas that took a lot of work to get right. The tubing structure itself was complicated enough, but the Plexiglas covering was a story unto itself.

Randy said, "I hadn't anticipated how tough doing the canopy and windshield was going to be. I would have actually preferred to buy the canopy, but by the time I got that far, I was looking at each new part as a challenge to see if I could do it. And the Plexi work definitely fell into that category. I didn't want to go with some sort of one-piece, flat-wrap canopy. It would be too angular and would conflict visually with the rest of the airplane's lines. I wanted something with just the right shape, and the only way I was going to do that was to do it myself.

"The first thing I did was study a section in [Ladislao] Pazmany's building book that addressed forming Plexiglas. Then I made a big wooden form and covered it with flannel. To heat the plastic, I built an oven, and the Plexi sheet was suspended from a telescoping, overhead rail that could be extended. I could bring the whole sheet up to temperature, then roll it out. I had five other guys over, each with gloves and welding vise grips. We grabbed the hot sheet and stretched it down over the mold.

"I'd be lying if I said it worked the first time. I ruined a few sheets of Plexi [while] learning, but it was something I wanted to try to do. The entire process covered a couple of years, but I'm glad I went that route. I'm proud of having done it."

We would be remiss if we didn't delve deeper into Randy's do-it-yourself oven; a lot of builders would benefit from his experience. He explained, "The oven is made from galvanized steel sheet and metal 2-by-4's, with fiberglass insulation. The heaters are eight electric resistance elements with switches on the outside for each element. Once I got it hot, I shut two or four of them off. There is a fan to circulate the air, also. I had a thermocouple in the center of the bottom edge of the sheet, and when the temp hit 320 degrees, we got it on the mold as quickly as possible. When the Plexiglas gets too hot, it bubbles and is ruined.

"The pieces of Plexiglas were different sizes, depending on which part of the canopy was being done; the canopies are 1/8 inch and the windshield is 3/16 inch. The back canopy was the largest but was quite a bit smaller than 4-by-8.

"I tried to get the room as warm as possible because, at the most, you might have a couple of minutes to work with the hot Plexiglas. When the first windshield worked out, it was a beautiful thing!"

When it came time to cover the airplane, Randy went with Ceconite with nitrate, then butyrate with Randothane over it.

"Painting was difficult," he said. "I had to do some parts twice because the yellow just didn't cover. Next time, if there is a next time, I'll know that, if I'm painting yellow

or light colors, to put down a coat of white first. But then, that's what the building process is all about: learning stuff you didn't know before."

The engine was a Barnstormers.com find: an O-320 that was completely disassembled. He sent the case, cylinders, rods and crank out for inspection and reconditioning and assembled it himself with a new cam, lifters, oil pump, and pistons. Since the Beryl was to be his aerobatic mount, he added Silver Hawk fuel injection and a Christen inverted oil system. A T-18 spinner and nose bowl finished off the nose, and the prop is a Sterba 70-by-68.

He said, "With that combination, it gets off the ground quickly and climbs out at around 800 fpm at 100 knots. It'll cruise at 120 knots at 2,300 rpm and 7 gph, which is throttled well back.

"On landing, I shoot for around 80 to 85 knots on final and 75 knots over the threshold. It is sensitive to having too much speed and will float like crazy. If that happens, I usually just wheel it on. It is super stable on the runway, about like a Decathlon or Citabria, which is to say it's nice!"

In total, the project took 24 years, but Randy said, "I knew it was a big project when I started, but I never considered not finishing it, even when I wasn't able to work on it for long stretches. The lowest point of the project was toward the end. The wing fuel tanks on the plans were welded aluminum with two center ribs that were spot-welded. I didn't know where to get that done; so I made a test with welding over a rivet head and it worked great. So I riveted in the ribs and welded up the rest of the tanks—they were looking great. Then I went to weld over the rivet heads on the center ribs, and I hadn't considered that with everything else welded up, the heat on the skin in the middle buckled and broke the rivets. Three months work ruined! I briefly wished I'd never heard of a Piel Beryl, but it soon passed. I borrowed my brother's RV-4 plans and riveted and sealed the tanks the way the RV guys do, and they turned out better than welded ones would have."

Now that the airplane is finished and he has more than 300 hours logged in it, he said, "This was the perfect airplane for me in so many ways. I absolutely love building things, and with this airplane, I got to work with every conceivable type of material: wood, steel, fabric, fiberglass, Plexi, and aluminum. More than that, it flies exactly the way I hoped it would, so this has been a win-win project from the very beginning."

Another that's another happy homebuilder: Life is good! EAA