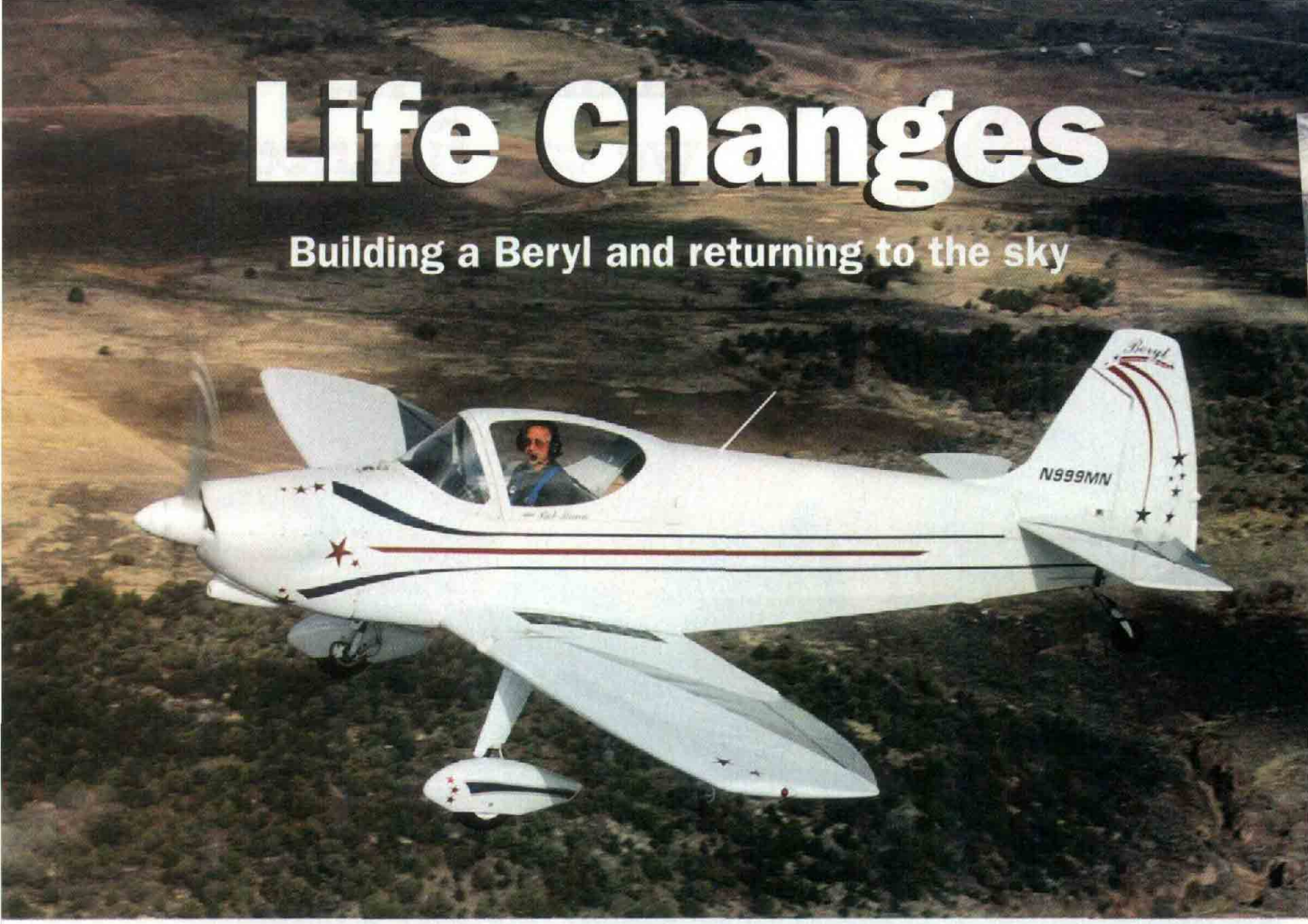
Life Changes

Building a Beryl and returning to the sky



STORY AND PHOTOS BY ROBERT MANN

To test-fly one's own airplane is an experience that cannot be bought, duplicated, or adequately described. I suppose if I were to do another test flight, it would not match that thrill. There is only one first."

I wrote these words in the back of my logbook on Saturday, August 26, 1978, after test-flying my Piel Super Emeraude. That thrill was matched almost 20 years later when, on another Saturday morning, I test-flew my Piel Beryl, which had been three-and-a-half years in the making.

My Emeraude was and still is a beautiful airplane, but life changed in 1983, and I sold her. I quit flying at the same time and tried to disinterest myself in airplanes. However, old habits are sometimes impossible to break. Every time an airplane flew overhead I just couldn't quit looking up.

Life changed once again, and in 1994 I started flying again. And, at the same time, I started teaching an aerospace class at my high school. One of the videos I recorded for the class was *Our Century: Air Racing*, which featured Steve Wittman and his Tailwind making a low pass and climb-out over a runway. Although I replayed that segment repeatedly, once was enough. I decided it was time to build another airplane.

It was easy for me to rationalize it and tell myself that I needed a large project to keep my brain active. No one can dispute that a good hobby is good for the mental and physical condition of a person. In my case, I love to build things, and an aircraft is at the pinnacle of that love.

In searching for an airplane to build I did the usual; I ordered information packs and even three sets of plans. For some reason, I'd been saving a photo of a Piel Beryl since 1978. I sent for the Beryl information and wrote Tony Bingelis, with whom I'd corresponded while building my Emeraude. My decision to build the Beryl was set in concrete when Tony sprinkled holy water on my idea.

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Like the Emeraude, the Beryl was designed in the late 1960s by Claude Piel of France, and Gene Littner of Canada sold the plans, which he translated into English, but left the dimensions in metric. I quickly learned that most folks into homebuilding and those who sell aircraft materials have never heard of the Beryl (I believe my Beryl is the sixth presently listed on the FAA registry). My best description of the airplane was to describe the Beryl as a tandem, two-seat version of the CAP-10. The two airplanes have the same wing, but a different fuselage. Both are aerobatic aircraft, but that was not a requirement for me.

Since the plans have been on the market, not many people have built a Beryl. It's a fine, but overlooked, design. It is a homebuilder's airplane, and one that is a challenge to build. When I chose the Beryl, I was looking for a challenge, not a quick way into the air.

Construction

Typical of this type of aircraft, the Beryl has a stout steel tube fuselage and a wood turtledeck, and its wings, ailerons, flaps, and tail feathers are all wood. Typically, engines up to 160 hp power it, but I know of two with 200-hp IO-360 Lycoming engines and constant speed propellers. My Beryl wears a 150-hp Lycoming O-320-E2D with a fixed-pitch Sensenich 74DM7-64 propeller.

The Beryl has a one-piece laminated box spar that is 26.5 feet long, 7.25 inches fore/aft, and 7 inches deep. I believe that the spar's design scares many people away from the Beryl. Its construction is labor-intensive but not difficult, and it's definitely rewarding when complete. It takes time to build the spar bench, but if you use one-piece BCI beams, the construction time is considerably less. You can also use the same bench to construct the steel tube fuselage.

After completing my Beryl spar, I built an Emeraude spar for a fellow homebuilder in less than three weeks. The Emeraude spar is only 4.25 inches fore/aft compared to the Beryl's 7.25 inches. I used Sitka spruce for mine and Douglas fir for the Emeraude spar. Even though the Emeraude spar was smaller, it weighed more, and my wallet weighed less than his. If I were to do it over, I'd still use spruce.

Throughout my project I used T-88 epoxy glue. After 20 years the T-88 on the Emeraude I built is still as solid as day one. Is there any better criterion?

Thoughts started creeping into my mind about the time I mated the fuselage to the partially completed wing. I've always loved single-seat aircraft, and I wondered what my Beryl would look like if I left out the back seat. The plans called for two 9-gallon wing-root fuel tanks and a 15-gallon cowl tank. When the wing tanks were 75 percent complete, I was unhappy with them: I needed more fuel than just the front tank, so I installed an 18-gallon tank in the rear seat position.

By making my Beryl a single seat, I saved the weight of the rear seat

The author's Beryl has a 150-hp Lycoming O-320-E2D up front swinging a fixed-pitch Sensenich propeller.

controls, instruments, panel, and seat. At the time I guessed that my changes would keep the airplane's center of gravity (CG) within limits, and luckily my guesses were in the ballpark. At weigh-in time the CG worked out perfectly.

One Beryl feature I didn't like was the window crank/jackscrew flap operation. Several builders have installed electric flaps, but I'm a manual type of guy. With the help of one of Tony Bingelis' books, I designed a lever and ratchet system that works wonderfully. I must mention that I referred to all of Tony's books extensively during construction. I don't think I could have completed as good an aircraft without them.

Construction took me three-and-a-half years. It should have been less, but I remade many parts when a better idea came to mind. For instance, I bought and installed a set of Cessna-type rudder pedals, decided I could do better, and then made my own. I also made a J-3 Cub-type carburetor air box and later bought one of Van's carburetor air boxes, which works great and makes for a better-looking cowl. Remaking parts got to be a standard joke among my friends.

Also, I teach full time plus one night a week, carry on a social life, keep house, and cook for myself. In other words, I didn't work on my project night and day. I did, however, try to do something every day. I'm an early morning person; my best and most productive time was between 3 a.m. and 6 a.m., before I went to work. Of course, having a three-month vacation in the summer also helped.

Compound Challenge

One cannot readily buy a Beryl canopy or cowl, so builders must resort to traditional homebuilding methods. To heat the Plexiglas, I made an oven 5 feet high, 4 feet wide, and 15 inches deep out of plywood, with an outdoor gas grill burner as a heat source and a small squirrel cage fan to circulate the air.

The molds were made of plaster and then smoothed, varnished, and overlaid with fiberglass. After discarding the plaster molds, I attached the fiberglass to a wood frame, used body filler, and block sanded them flat. I took these extra steps to have lightweight molds for future use, if needed. Over these molds I draped the heated Plexiglas.

My plan was to demonstrate this at my monthly EAA Chapter meeting because the extra hands could help me drape the Plexiglas over the mold. It was a disaster because the Plexiglas wouldn't take the mold's compound curve. I went to bed depressed and hardly slept, but I had a solution by morning: fiberglass to the rescue. Since my hair is getting thin and I'm getting sunburned in places I have not before, I made an 8-inch-wide canopy top that eliminated the compound curves; all I had to make were the side windows. It's a great canopy, and I'm proud of the optical clarity of both the canopy and windshield.

Making the oven, a heat source, and the Plexiglas pieces, not to mention the problems encountered when building the wood/fiberglass canopy itself, put my brain into overtime. And these things fulfilled my desire

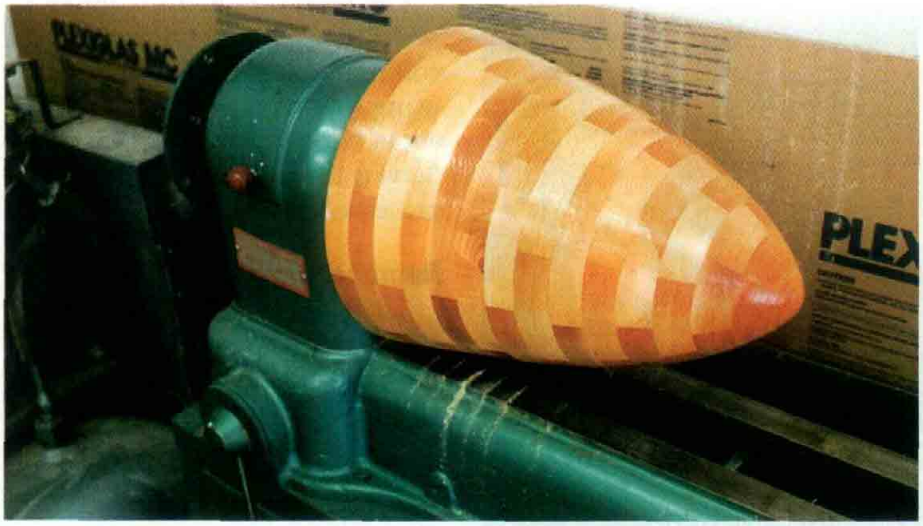
for a challenge and for something to rejuvenate my problem-solving capabilities. I love to tell people that I made the canopy, cowl, etc.

Blocking the engine with foam to build the fiberglass cowl was the only chore I didn't like about the project. Plastering over the foam and the final shaping went well, and when it was time to lay up the fiberglass cowl, I could see my efforts taking shape and enjoyed the job. This was my first experience using epoxy resins, and I prefer them to polyester. Van's has a preformed cowl air inlet to fit its carburetor air box, but I chose to make my own. Following Tony Bingelis' recommendations for the cowl's inlet and outlet sizes, my engine cylinder head temperature is where it should be.

Another change I made to my Beryl was skinning the fuselage sides from the firewall to the wing's trailing edge in aluminum. They are removable for maintenance, such as inspecting the control cables that run along the belly, and for cleaning.

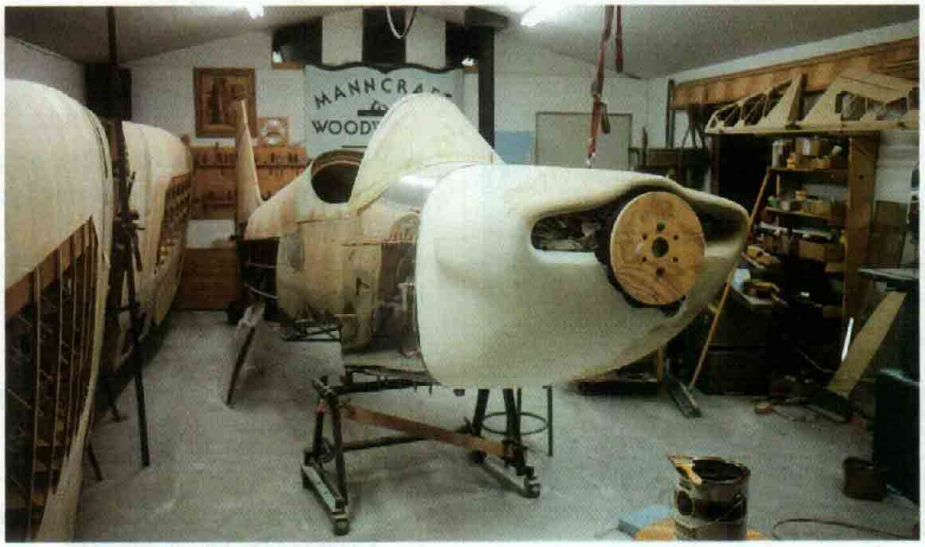
In Waterford, Pennsylvania, I have some good friends, the Geherleins, who repair sailplanes for a living and

The compound curves of the custom Beryl canopy proved tricky for this scratch builder, but a cleverly-designed centerline canopy top solved the problem and provides some solar protection on sunny flights.



Turned on a lathe, the wooden plug for the Beryl's spinner yielded a fiberglass part that cost the author a fraction of what a salvage yard wanted for a Piper Warrior spinner.

Since T-88 epoxy worked so well on the author's previous project—an Emeraude—he used it as the adhesive of choice on the Beryl's wood wings.



The variety of materials used in the construction of the Beryl was part of the challenge. Steel tube, wood, aluminum, and fiberglass all contribute to the aircraft's structure.

The Piel Beryl has a skeleton of steel tube with a wooden turtle deck. The fuselage sides and the wing's trailing edges were skinned in aluminum.

are homebuilders par excellence. While visiting them one day, I told Rod Geherlein that I wanted a spinner from a Piper Warrior but didn't like the price that the salvage yards wanted. Rod had made a spinner out of fiberglass for his Baby Bullet, and with his information, I purchased the front and rear spinner plates from Aircraft Spruce & Specialty. On a lathe I turned a segmented wood plug sized to the spinner plates.

After varnishing and waxing the plug, I laid up four layers of RAE cloth with epoxy resin, exercising great care to get even layers. When complete, I returned the plug to the lathe and sanded the fiberglass smooth. With the help of Tony Bingelis' book, *Firewall Forward*, fitting the spinner to my prop was an easy task. When running the engine for the first time, I was more concerned about how true the spinner tracked than anything else. I'm very happy with my homemade spinner; it's new and very inexpensive.

With the success of my spinner, I couldn't imagine buying wheel pants, so I made a set of molds from borrowed Piper Cherokee wheel pants. After laying up the two halves, I laid up and installed a rear bulkhead and then joined the halves with fiberglass tape. The whole process was fast, inexpensive, and worth the time I spent.

I enjoyed making the composite pieces of my Beryl, but I know that I could not build an entire airplane using this medium. The nice part about building an airplane like the Beryl is the variety of materials and processes a person uses.

Approaching Flight

The Beryl prototype flew with a 115-hp engine, and the plans called for a wing incidence angle of 4 degrees, 10 minutes. Norm Taylor, the

first American builder to complete a Beryl, suggested a 2.5-degree incidence angle for higher horsepower engines, and I took Norm's advice. But this change required other changes, which I was able to work around. It did, however, create a few anxious moments the first time I connected the wing to the fuselage.

When I built my Emeraude, I used Piper Cherokee landing gear struts instead of those in the plans. The Emeraude and Beryl plans call for the same struts, and the gear design uses a long and short coil spring that is separated by a piston in the strut leg of 2.75-inch 4130 steel tube. Finding the springs was a challenge, and I soon discovered it wasn't wise to mention the word airplane when looking for someone to manufacture the springs. I also found a big difference in price. One firm wanted almost $700 for the four springs; I paid less than $150, and the springs are perfect.

Building my strut legs almost to the plan specs, I lengthened each strut 1 inch because I wanted to use a 74-inch propeller and an 8-inch Scott tailwheel, both of which are larger than the plans specify. The gear is the finest of any that I have landed upon, and I'd describe it as smooth and forgiving. Like the wing spar, assembling the Beryl landing gear looks like an awesome task, but it is not. Because of the possibility, more like the probability, of warping the main tube, I had a friend heliarc weld the tube to the spar attach plates.

I made one other change to the landing gear struts and may change it again in the future. The scissors were to be made of flat 4130 steel, with the sides bent 90 degrees. I made nicer-looking and stronger pieces by wrapping flat steel around a small diameter rod and welding the opposite side. However, I'd like to make new scissors out of 2024-T3 aluminum and bush the bolt holes with bronze oilite bushings.

The main wheels are 7 feet, 10 inches apart, a wide track for an air-

The author left out the Beryl's rear seat, and instead, added an 18-gallon fuel tank. Now a single seater, he saved the weight of the rear seat controls, instruments, panel, and seat and at weigh-in time the CG worked out perfectly.

plane with a 26.5-foot wing span. Wide gear translates into good handling on the runway, and after my 11-year absence from the cockpit, and only flying Cessna 172s when I began flying again, I appreciate the Beryl's ground handling.

Prior to test-flying the Beryl, I received about four hours of dual in a Luscombe 8A. I tip my hat to those who can fly these beasts; I never got a handle on it. After each lesson terrible thoughts about my tailwheel ability ran around my head, until I made 10 takeoffs and landings in a friend's Super Cub. I like to wheel land, and the Beryl is a fun airplane to land. In my 25-hour test period, I made more than 120 landings, and I believe it is easier to land than a Super Cub.

What worked when building my Emeraude I tried to duplicate when building the Beryl; it is difficult to argue with success. My plan was to find a healthy first-run engine and fly it until I became comfortable with the airframe. Ten hours of flight time sounded good, but I was having too much fun flying her to stop and overhaul the engine. When the wheels touched the ground and the tach displayed the magic number of 25, which signaled the end of my test phase, I decided it was time for an overhaul.

Under the watchful eye of my friend, Delvin Gregg, an airframe and powerplant mechanic with an inspection authorization (AP-IA), I disassembled my engine. This was a first-ever experience, and I wanted to learn what was inside that gray case. After all the parts came back yellow tagged, we weighed everything to balance the moving parts as much as possible. The engine shop balanced the rods and crankshaft. Our effort was well worth the time—the engine is now very smooth. Delvin and I reassembled the engine, and I have an engine that will probably outlast its owner.

I often hear homebuilders talk about using auto engines because of their lower cost. I paid $5,000 for my 1,900 hour almost-run-out Lycoming. It cost me less than $3,000 for parts, inspections, cylinder welding, work, etc. We cut no corners, and I have a first class overhaul. Most of all I have the reliability of a Lycoming O-320 for $8,000. Pretty reasonable in my book.

We could have increased my O-320-E2D's horsepower to 160, but I felt the $1,000 cost would not be worth it. The E2D has a two-piece front bearing that requires machine work and an STC, in addition to new pistons. At Colorado altitudes I wouldn't have obtained the extra 10 hp. Besides, my Beryl performs well from a field elevation of 6,700 feet, and I like burning 7 gallons per hour. At 2500 rpm and 8,500 feet, my Beryl cruises at an honest 150 mph.

After the first flight I added a 1-by-6-inch wedge to the rudder's trailing edge to center the ball with my feet off the rudder pedals. Otherwise she needed no changes.

I estimate the total cost of my project to be $35,000 after the engine overhaul, and I built her with all new or overhauled components. In my case, building another airplane would have been out of the question had I needed to lay out a large sum of money to get started. The reward for my work is a one-of-a-kind airplane, and not just one of many with a different paint scheme.

With an N number of 999MN, I couldn't let 9/9/99 pass without doing something different. The weekend before this date my tach read 93 hours, so I spent the weekend building hours. On the morning of 9/9/99, I drove to the airport (in my van, whose license plate reads N999MN) and was in the air at sunrise. As the Beryl and I passed through 9,999 feet the tachometer rolled over 99.9 hours. Six minutes later we were at 10,000 feet when the tach recorded 100 hours of pure flying pleasure. In that time I have made over 300 landings.

Other than the usual care, the airframe has been maintenance free, which speaks highly of the design. I believe many people build experimental aircraft and are disappointed with the final product after a few hours of flying. Initially, I liked my Beryl, but after flying Cessna 172s I felt uncomfortable. That would have been the case with any homebuilt, especially a taildragger, but it didn't take long for my "liking" the Beryl to become pure love.