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**ON THE COVER:** When it came time for Bill Smith, EAA 496718, to paint his striking Pitts biplane, his friends urged him to think small.  
Photo by Connor Madison

**ON THIS PAGE:** For Allen Floyd, EAA 693897, building this Long-EZ was more than just a project — it was his destiny.  
Photo by Julia Apfelbaum



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To view and submit aviation events, visit [www.EAA.org/calendar](http://www.EAA.org/calendar).



# EXCIT





# THE BUR:

## ONE MAN'S DREAM

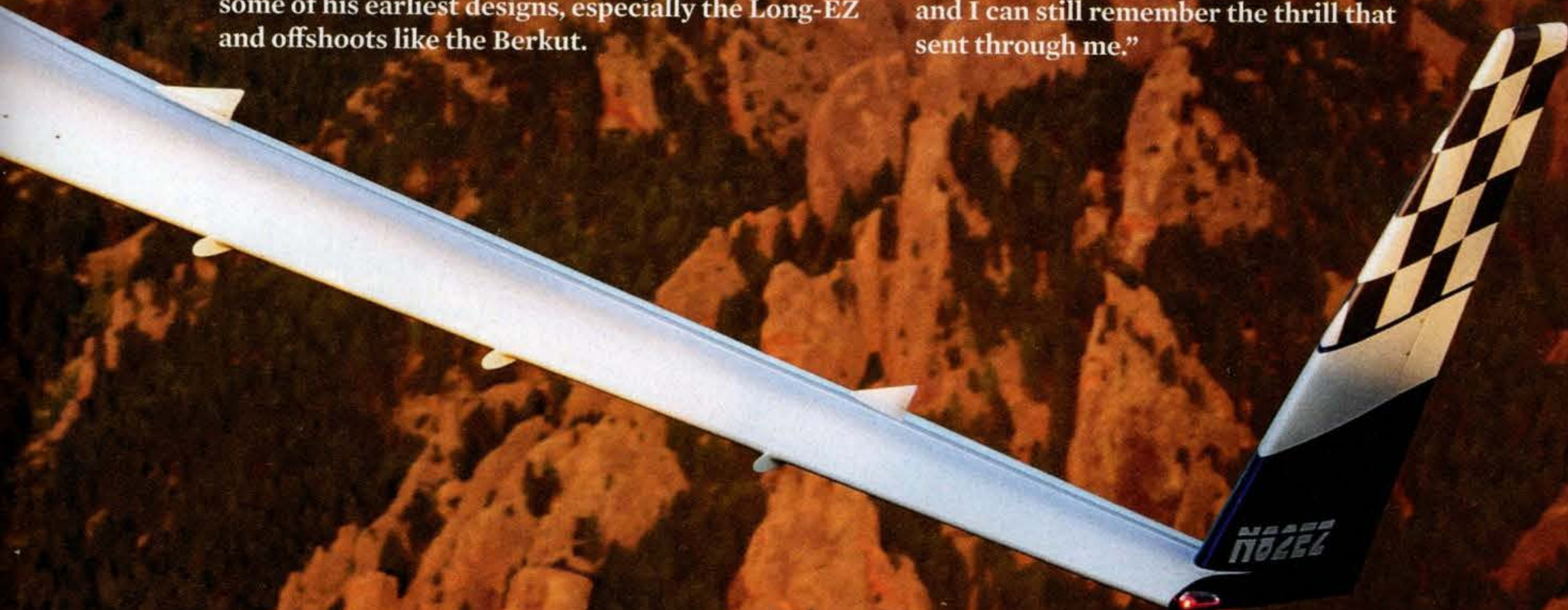
### A NEXT-GENERATION LONG-EZ

BY BUDD DAVISSON

THIRTY YEARS DOWN THE road it is going to be interesting to see how history remembers Burt Rutan. Given that it has been an amazing 44 years since he shocked first the homebuilt world and then the world in general with his VariEze, and since we're still seeing the effects of his first designs, it's a safe bet that he'll remain an icon as long as flying machines fly. Over the years, we've watched him do his best to take us to the moon with design after design. In fact, we seem to be seeing a resurgence of some of his earliest designs, especially the Long-EZ and offshoots like the Berkut.

Allen Floyd, EAA 693897, of Erie, Colorado, freely admits that the Long-EZ set its hooks into him almost as soon as he could tell one airplane from another.

"I swear that me building and flying the EZ was destiny," he said. "I first experienced aviation watching a crop duster working a field right next to my grandfather's farm in Kansas in a Pawnee. I was about 4 years old and was waving at the pilot. On his fourth pass, he waved back, and I can still remember the thrill that sent through me."





**W**hen Allen was in high school, he went to work the line for a local FBO and was blown away by three aircraft in the FBO's care he soon identified as Long-EZs.

"I can't explain exactly why, but even though I was drawn to other sport aircraft like Pitts and such, my heart kept returning to what most people considered to be outrageous-looking airplanes — but I didn't feel that way at all," Allen said. "I thought they were sexy beyond belief, and I somehow knew I was going to own or build one — or both. To that end, as soon as I graduated from high school in 1983, I bought the Long-EZ plans."

Shortly after college, Allen began climbing the airline ladder starting with a local airline.

"I was flying with the regionals and taking de Havilland DHC-7s into some STOL type strips at the ski resorts around our area," he said. "As I moved into bigger airlines, I went through the inevitable furlough routine. But, along the way, I became a Boeing 737 captain at the young age of 28. Eventually, I wound up with my airline where I am now and have been for over 22 years."

Allen had a vision for building his Long-EZ, but that didn't go exactly as planned.



*The nose was extended and a sleeker canopy designed and fabricated to give a more streamlined profile.*

**"I HAVE TO RECOGNIZE THAT, BASICALLY, I WAS BUILDING THIS AIRPLANE ON THE SHOULDERS OF GUYS WHO HAVE BEEN DOING THIS FOR 40 YEARS. THEY ARE THE ONES WHO HAVE MADE SO MANY IMPROVEMENTS TO THE AIRPLANE, AND TO A VERY LARGE EXTENT, I JUST FOLLOWED THE TRAIL THEY HAD BLAZED AND EXTENDED IT."**

— ALLEN FLOYD







#### UP-CLOSE WITH N82EZ

**Top, Left:** The pressure recovery spinner goes clear to the engine for smoother flow.

**Top, Right:** Flush doors cover the nose gear and the LED landing light retracts.

**Bottom, Left:** The "bumpersnoot" is a carbon fiber bumper that protects the nose in case of a gear failure.

**Bottom, Right:** Burt Rutan gladly signed the avionics hatch, indicating his approval of Allen's design work.

"When I bought my plans, I had the vision in my mind that I was going to be building my EZ in a cozy little garage workshop somewhere, but I had no idea how long it was going to take for my life to settle down enough for 'somewhere' to be defined," he said. "I changed airlines so many times and was based in so many different places that there was no such thing as permanency in my life."

Progress slowed down when Allen discovered the Sport Air Racing League.

"In fact, that totally changed my direction," Allen said. "Little by little, I became a serious speed demon, which cost me about two years in terms of progress because I went back and redid so many things in the interest of squeezing every little bit of speed I could out of the airplane. Everything had to be lighter and cleaner."

Allen also did something that, while not unheard of, had a lot to do with how he built his EZ. He bought an award-winning Long-EZ built by Bob Wilson of Longmont, Colorado, to have something to fly. Of course, it also gave him a yardstick to use in measuring what he was doing to his airplane.

"Before we get much farther into what modifications I built into the airplane, I have to recognize that, basically, I was building this airplane on the shoulders of guys who have been doing this for 40 years," he said. "They are the ones who have made so many

improvements to the airplane, and to a very large extent, I just followed the trail they had blazed and extended it. They are the guys who actually started us toward developing the NG, next generation, Long-EZ."

No one has ever looked at a Long-EZ, or any of Rutan's designs for that matter, and said, "Boy, is that airframe ever dirty!" They don't say that because the aerodynamics of most of his designs let the airplanes cruise at high speeds with minimal power. However, no airplane on the planet is perfect. Plus, a lot of years have passed since Burt laid down the original lines for the Long-EZ. In that interval, Allen and others have seen a few areas that can be improved enough to squeeze a few more miles per hour out of it. After all, races are won by inches, not miles.

"First, the more I looked at the general outline of the front part of the airframe, the more I wanted it more streamlined with a little less frontal area," Allen said. "So, I extended the nose, which also helped with the CG with the heavier engine, and lowered the canopy line giving it a little slinkier look. And, of course, slinky is fast. Todd's Canopies formed the bubble for me."

Allen spent about a year and a half designing and building the super-light-weight carbon fiber cowling, which is central to many of his aerodynamic cleanup efforts. The cowling and the baffling are designed to lower the overall cooling drag, but none of that would work if the air going into the NACA intake for the cowl wasn't totally clean and flowing correctly.

"Some of the nose shape contributes to the cowling airflow, but so does everything else on the fuselage," Allen said. "This includes the main landing gear fairings and especially the retracting nose gear doors. Usually, a Long-EZ nose gear has no door, so there is a lot of flow disturbance in that area."

The door makes sure the flow in that area produces no drag and is streamlined all the way to the engine cowling inlet.



"I went so far as to design retention systems for the nose door components and avionics hatch that eliminate external screws," Allen said. "I wanted everything to be so slick you could run your thumbnail down the fuselage anywhere on the airplane and not have it catch on a single thing. That contributes to speed and helps cool the engine. It seems to have worked because, as opposed to some EZs, I've had zero cooling problems. This, even though I have more horsepower being produced under that cowl than most."

Allen also put flow fences next to the ailerons.

"This not only increased the ailerons' effectiveness but changes the center of lift slightly so I can shift the CG a little farther aft, which contributes to speed by unloading the canard," he said.

In any kind of racing, the name of the game is horsepower. That's something Allen knows well and took care of by stuffing a Lycoming

IO-360-A1A engine behind him. It is equipped both for efficiency and power. The 10-to-1 NFS pistons and Airflow Performance injection push the power past the normal 200 hp the IO-360 puts out while the in-cockpit telemetry and timing curve management that are part of the dual electronic ignition add to the power and increase the efficiency. The same thing could be said of the custom exhaust that blends square outlets into the cowl design to produce less drag and more power.

"The crankcase vent flows into the exhaust system so it creates a vacuum in the crankcase," Allen said. "This is one reason you don't see any oil dripping out of my engine. It's always clean."

The prop was custom designed by Craig Catto of Catto Propellers.

"It is optimized for this horsepower and airframe, so it has a couple of really cool features Craig developed," Allen said. "If you can believe this, he built a GoPro camera into the hub so he could watch airflow on the blades. This resulted in him putting little flow fences on the leading edge of the blades about halfway out. This kind of high-tech stuff is combined with the carbon fiber pressure-recovery spinner to really minimize the drag that's often associated with pusher props."

His airplane may be made for "go" as well as "show," but he didn't cut any corners in providing for the crew. When he's going cross-country, he's really moving and being pushed along by a state-of-the-art Lycoming. He has the panel set up with equally state-of-the-art instrumentation. This includes a GRT electronic flight instrument system (EFIS) that lets him monitor everything; even his fuel level reads out digitally. Dual AHRS/magnetometers and triple GPSs keep track of where he is, and ADS-B In and Out lets everyone know he's coming. The two-axis autopilot is also controlled through the EFIS. As if that's not enough, the IFR panel is controlled via hands-on controls mounted on both the stick and the throttle. This thing is space age!

The leather seats are not only as ergonomic as he can get them but also feature heated lumbar supports, and he has XM weather and radio to keep everyone on board entertained. Plus, the interior consoles and panels are all designed to be quickly removed as they are the primary access to all fuselage systems, to make maintenance easy.

The cockpit has widened consoles for more hip room, but EZs are known for their form-fitting cockpits, which largely precludes carrying much in the way of baggage. Allen solved this by putting hard points in the wings where he mounts removable streamlined pods that can carry 35 pounds a side. However, they are not plumbed for fuel. With internal fuel, he reports a 1,500-mile range.

"You pack these pods EZ style, meaning everything is in a number of soft nylon sacks [and] bags that you stuff into the pods, and they conform to the shape available," he said.

As much as he designed for comfort and speed, Allen also went out of his way to build safety into the airplane. That includes a custom-fabricated rollover structure made of 4130 rather than composites. The nose gear extension system has a manual backup, the critical pivot points inside the bottom of the nose are protected by an 11-ply Kevlar skid pad, and there's a cockpit-accessible fire extinguisher within easy reach. All of the seat foam is energy absorbing, and the four-point Hooker Harness keeps people in place. The electrical system has a backup battery system and is mostly solid state. It uses a Vertical Power module that features customizable switches wired in such a way that there is no actual voltage flowing through them; they are just grounds.



N82EZ COCKPIT

*The cockpit is comfortable, and removable panels give access to airframe systems.*





N82EZ ENGINE



## SPECIFICATIONS

**AIRCRAFT:** Long-EZ  
**DESIGNER:** Burt Rutan  
**BUILDER/PILOT:** Allen Floyd

### DIMENSIONS

**WINGSPAN/AREA:** 26 feet, 1 inch/81.99 square feet  
**CANARD SPAN/AREA:** 11 feet, 9 inches/12.8 square feet  
**TOTAL WING AREA:** 94.8 square feet  
**LENGTH:** 18 feet, 3 inches

### WEIGHTS

**EMPTY WEIGHT:** 1,021 pounds  
**GROSS WEIGHT:** 1,600 pounds  
**FUEL CAPACITY:** 52 gallons

### ENGINE/PROPELLER

**ENGINE:** Lycoming IO-360-A1A

- Airflow Performance fuel injection
- NFS pistons with 10-to-1 compression
- Dual electronic ignition with in-cockpit telemetry and timing curve management
- Crankcase vent pressure recovery system
- Custom carbon fiber cylinder baffles specially designed and fabricated for optimum performance
- Custom exhaust with low drag profile exit tips
- Other performance enhancements

**PROPELLER:** Custom design by Craig Catto of Catto Propellers

- This three-bladed composite prop, in combination with the carbon fiber pressure-recovery flow guide and spinner, allows the ability to easily cruise at more than 200 knots true airspeed.



"I even went so far as to use Belleville washers on the prop bolts that keep a constant tension on the prop bolts regardless of temperature and humidity," Allen said.

On every project of any kind, there is always a juncture where something happens that is critical in the progress of that project. In this case, it happened in 2012 when Allen moved the reasonably completed airframe 100 miles south to Peyton, Colorado, where he could assemble the airplane in a friend's workshop.

"Burrall Sanders was critical to the completion of *Excalibur*," Allen said. "Besides the fact that he had space for me, his business, Freeflight Composites on Meadow Lake Airport (KFLY), is lending a hand to the second generation of composite canard builders of all kinds. So, besides space, he also had expertise and imagination that came in handy as I closed in on the final details of the airplane. He had a guest apartment, and I would go racing down there a couple of days at a time, put in crazy 18-hour days, and race back home."

Allen said his wife, Laura, who is also a pilot, supported him and the project.

"If it weren't for her and Burrall, I'm not sure *Excalibur* would have been completed," he said. "She's truly a homebuilder's dream wife."

Of course, the obvious and most often asked question he faces is, "What is its top speed?" He'll answer a lot of questions about his airplane but not that one. He's a racer, remember? He'll admit to it cruising at 215 knots at 2700 rpm, but not what it'll do at 3000 or 3200 rpm with his racing prop. However, there is no doubt that it's very fast.

At the end of the week, when the awards were handed out, Allen found himself holding the Grand Champion Plansbuilt Gold Lindy, as well as the EAA AirVenture Outstanding Design Contribution/Stan Dzik Memorial Award. Was that the high point of his week? No, it wasn't. That was being called a "full a\*\*" by one of his heroes.

"I was prepping the airplane for the judges when I looked up and saw Burt Rutan coming in my direction," Allen said. "He was sort of incognito but easy to recognize. I'll have to admit to instantly developing a case of nerves. I didn't know how he'd react to all the changes I had made. He, however, was very easy to talk to and said some nice things about my changes. As he was examining the engine, he said, 'Do your friends call you a full a\*\*?' I didn't know how to answer. He continued, 'I say that because it's obvious you don't know how to do anything half-a\*\*ed!' And that was the high point of my week! It couldn't possibly get any better than that!"

The judges obviously agreed with Burt, and so did the spectators. *Excalibur* is more than just an outstanding piece of craftsmanship. It is the purposeful co-mingling of art, passion, and imagination. It is homebuilding at its best. **EAA**

**Budd Davisson**, EAA 22483, is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on [www.AirBum.com](http://www.AirBum.com).

**"LITTLE BY LITTLE, I BECAME  
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LITTLE BIT OF SPEED I COULD  
OUT OF THE AIRPLANE."**

— ALLEN FLOYD



Even the rudder tips are finessed to improve the aerodynamics.



Safety was central to many of the modifications, including the 4130 turnover structure.

