Sport Aviation®

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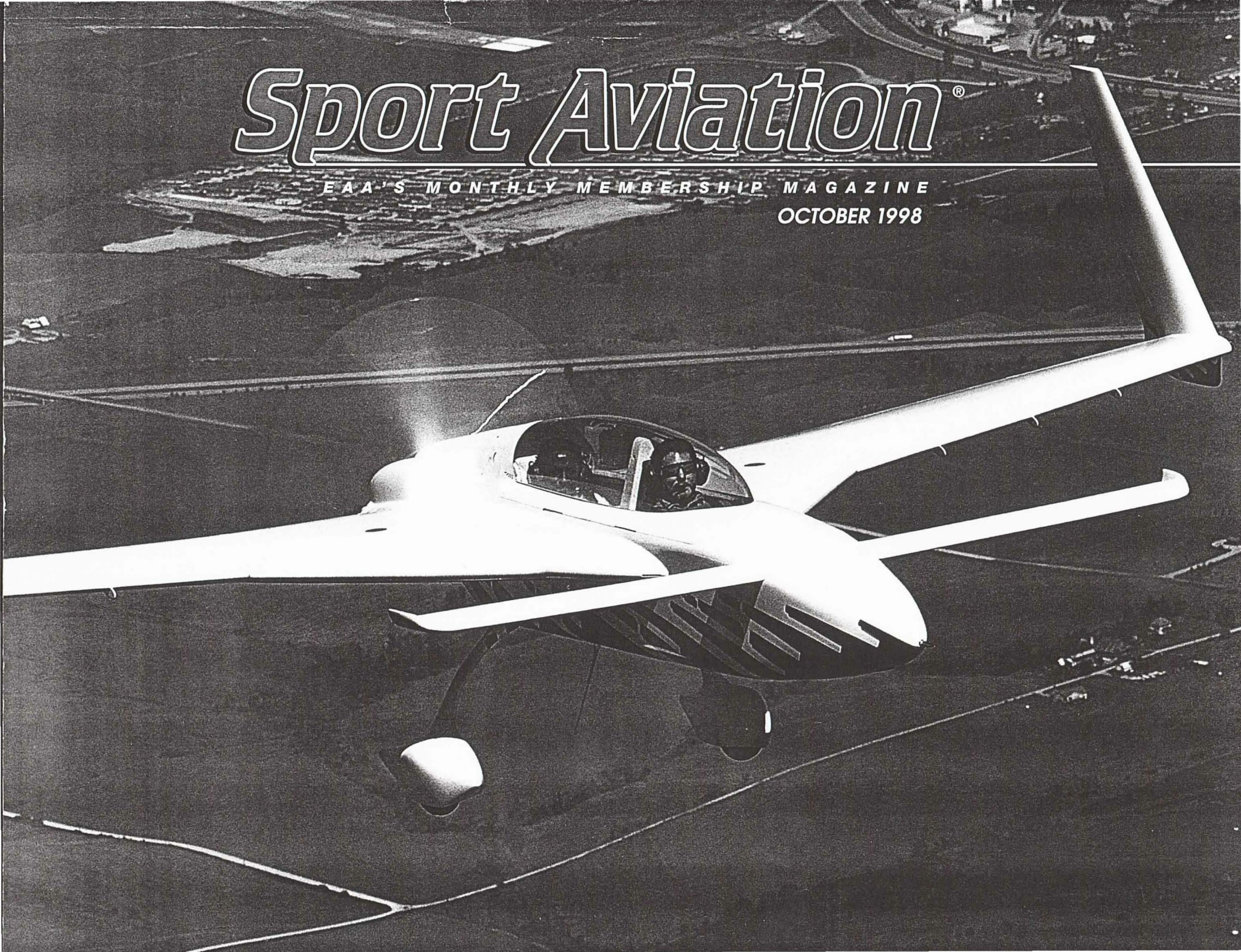
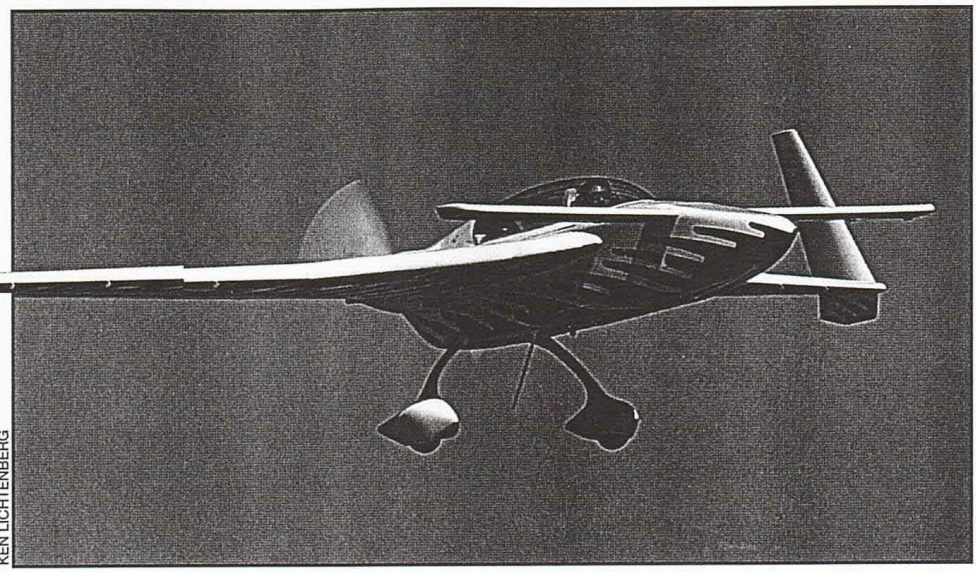
OCTOBER 1998



Acknowledgment

A part of the Hartman/Hayes display of Ten Forward at EAA AirVenture '98 acknowledged the following vendors (parts, materials, etc.) and individuals who contributed to the project in some way:



KEN LICHTENBERG

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Jan, Andrea and Caitlin Hartman
Theresa Hammond
Casey Munsell
Yoshito Okamura
Kevin Gorden
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Don Eldredge

even had a back seat ride when EAA AirVenture '98 rolled around.)

"With a tailwind, I could fly across my assigned test area in about 10 or 12 minutes, so I was just going 'round and 'round for what seemed like forever. With a newly overhauled engine, I'm not exceeding 2,500 rpm for now , which gives me 150 mph. The rate of climb is good with the prop we're using, so I am happy with the performance and I know it will improve once the engine is ready to be run a little harder. I'm not sure I want to run it up over 3,000 rpm like a lot of EZ owners do, but I'll be happy with whatever it turns out to be. The real payoff for me is the economy of operation. We use auto gas, which we're buying at or below $1.00 per gallon locally, and the Lycoming is burning six gallons per hour at 150 mph. I really love that. Both Bernie and I are looking forward to using the long legs the airplane has. With its speed and range, it will, in effect, shrink the size of the U.S. to the size of Iowa if you have to drive. Bernie wants to use it to fly back to Baltimore to visit his family, and Denver and Minneapolis are on the planning list for Janice and me. My daughter, Andrea, who really gets upset with me when I go flying and don't take her along, wants to fly to the Bahamas. 15 years was a very long time to build an airplane, and now we want to enjoy it."

First, however, there was the matter of the Grand Champion award at AirVenture '98.

"Before I left for Oshkosh, I told the girls that the competition would be terrific and that there was every chance that someone else had done a better job. My little one, Caitlin, said, 'But, dad, you **have** to win Grand Champion!' I said, 'Why?' and she said, 'Because every weekend for the past year you've been telling us you were going to the airport so you can win Grand Champion.' Talk about **pressure**!"

When Randy arrived at Oshkosh, there was no doubt about his mission. He arrived with highly professional signage, fancy posts and color coordinated ribbon to rope off the airplane and stood all day, every day patiently answering the questions of the judges and everyone else who stopped by to admire Ten Forward . . . which was about everyone who attended AirVenture '98. It was immediately obvious to even the casual observer that the EZ was a strong trophy contender, so the word quickly spread that it was a "must see."

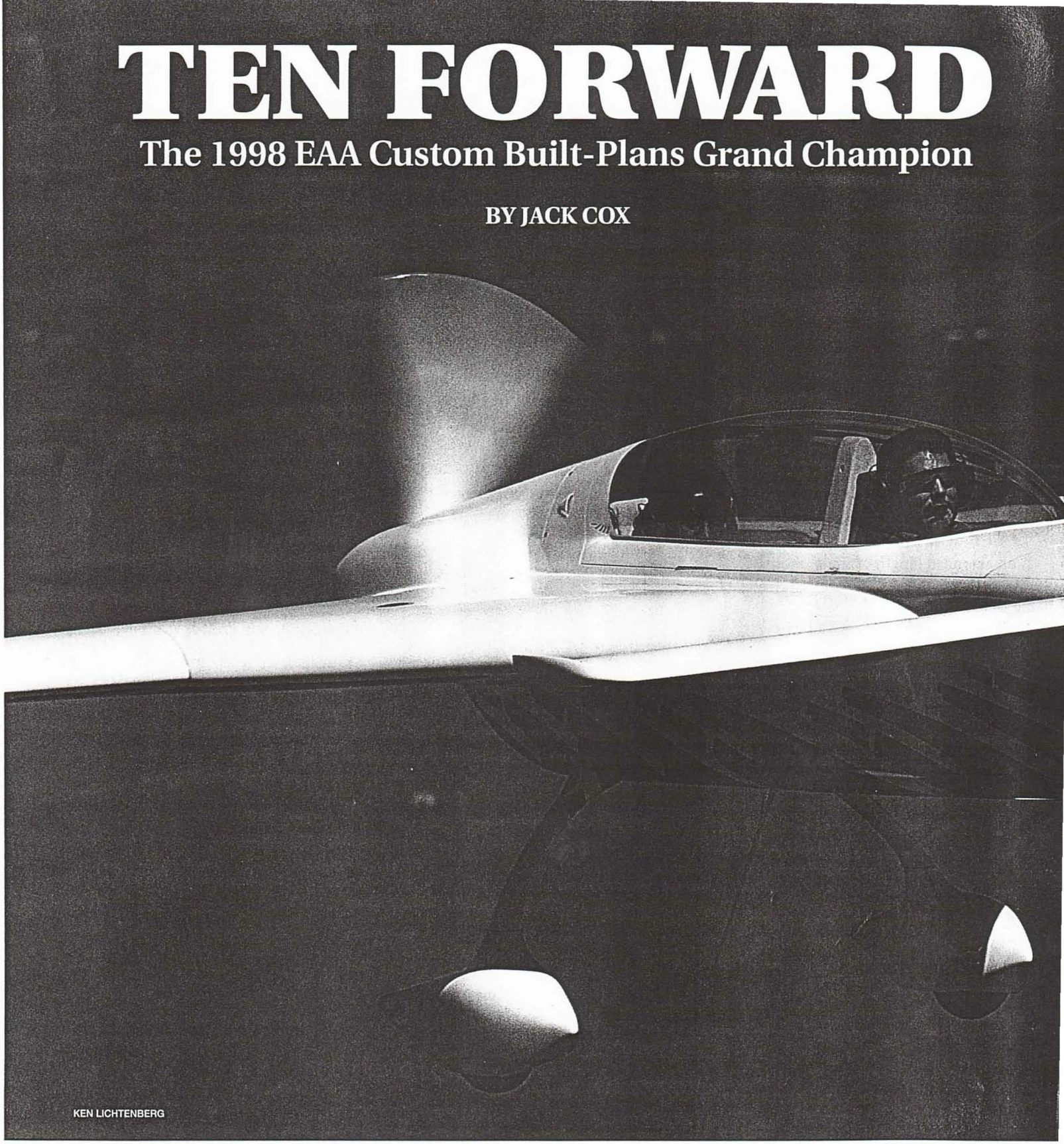
On Monday night, Randy sat through the awards program, with the tension growing ever more unbearable as his name continued to **not** be called. The world seemed to stand still when the Reserve Grand Champion-Plans winner was announced, but when again it was someone else, he knew he had won! The weight of the world . . . and some pretty tall explaining to Caitlin . . . was lifted from his shoulders when, at last, his name was called to come forward and be presented the EAA Custom Built-Plans Grand Champion Award for 1998.

His only regret was that Bernie could not be there to share the moment. ◆

TEN FORWARD

The 1998 EAA Custom Built-Plans Grand Champion

BY JACK COX



KEN LICHTENBERG

Randy Hartman (EAA 290382), a program manager for Rockwell Collins in Cedar Rapids, Iowa, has a sign he places on his office door when he leaves for the day and intends to go flying in his Long-EZ. It reads, "Randy's in Ten Forward." If you're a Star Trek fan, you'll immediately grasp the significance of that message; if not, an explanation is in order. "Ten Forward" is what might be termed the "rec room" of the Starship Enterprise, the place where crew members go to get away from the pressures of life out in the far reaches of the cosmos. For Randy and his partner, Bernie Hayes, both devoted Trekkers, "Ten Forward" is a perfect name for their Long-EZ. It's as futuristic in appearance as the star fighters in sci-fi flicks, but, more to the point, it whisks them quickly away into a different realm that provides a welcome respite from the work-a-day world.

This year at EAA AirVenture '98, Randy was **really** transported into an-

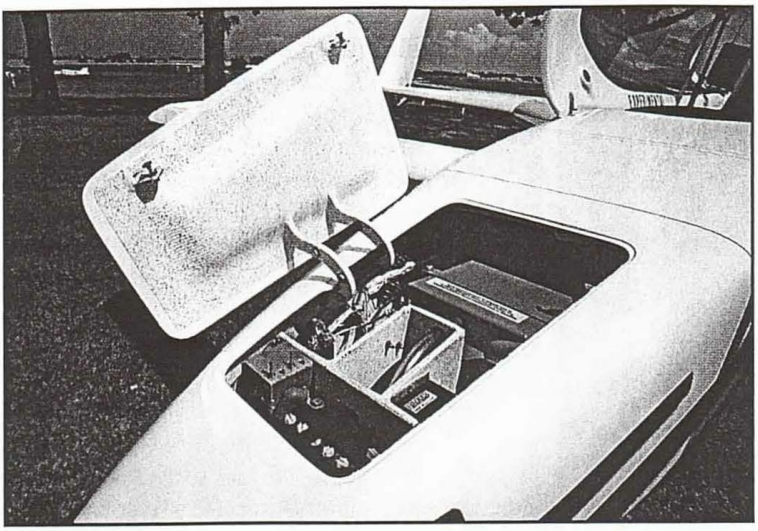
other realm when he was called to the stage at the Theater in the Woods to receive the Grand Champion Custom Built - Plans award for Ten Forward. Unfortunately, Bernie, who is a flight test engineer for Rockwell Collins, was on a company assignment in Israel and had to wait until the following morning to learn by phone that their 15 year quest for a Gold Lindy was successful.

Randy was born in 1956 in Wyandotte, MI and grew up in nearby Grosse Ile, which had a Naval Air Station on the south end of the island at the time. Airplanes flew over his house all the time and, he believes, had a lot to do with his childhood dreams of soaring like Peter Pan over his neighborhood, without benefit of mechanical wings. Randy was a champion wrestler in junior high, high school and college, where he finished eighth in the nation one year.

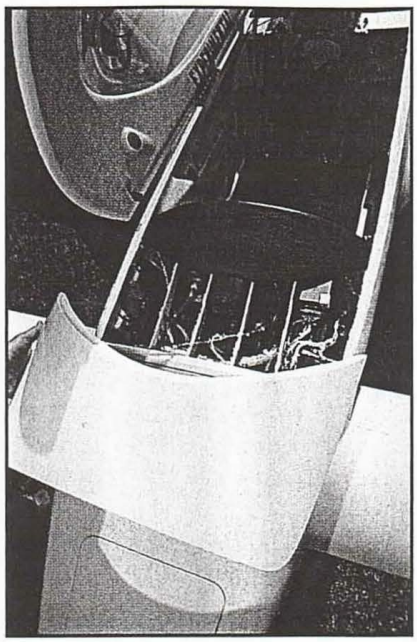
Bernard "Bernie" Hayes (EAA 210205) was born in Baltimore, MD in 1955 and grew up there. "I have always found enjoyment in attempting to arrive at an analytical understanding of just how anything works. My parents helped feed this interest with chemistry sets and microscopes, and I built dozens of model airplanes over the years." Like others of his generation, he says his early interest in aviation was unquestionably triggered by watching TV programs like *Sky*

KEN LICHTENBERG

Randy Hartman, left, and Bernie Hayes

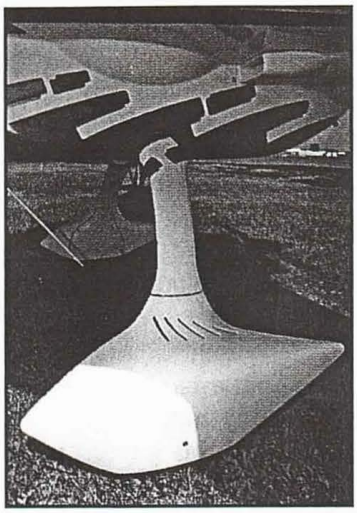


Flush door, actuated from the cockpit, provides access to batteries.

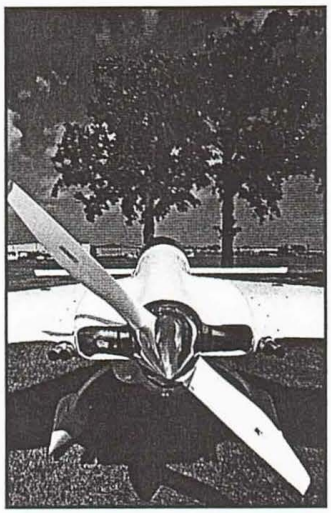


LEE ANN ABRAMS PHOTOS

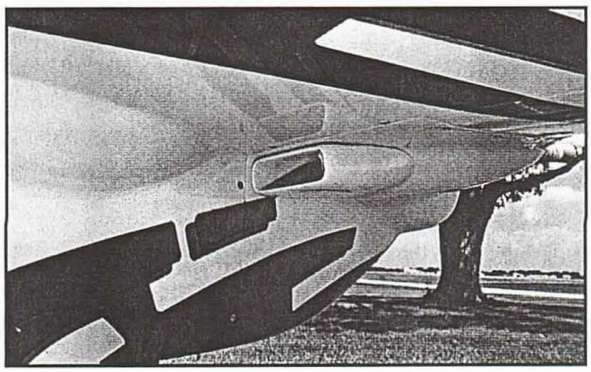
Flush panel (no screws) provides access to back of instrument panel.



Main gear is permanently faired. Note the brake vents in the top of the wheelpant. They angle backward as if blown by the wind. Adding style to function was one of the goals of the project.



A Prince 63" x 68" wood prop is used with the O-235 L2C Lycoming.



Removable "armpit" scoops cured an initial high cylinder head temperature problem.

King, *Whirlybirds* and *Rocky Jones*.

As fate would have it, the paths of Bernie and Randy would cross in the mid-1970s when they met while attending Le Tourneau University in Longview, Texas. Bernie was majoring in electrical engineering and Randy in mechanical engineering, but both were also pursuing aviation courses to obtain their Private pilot and A&P licenses. By chance, they were assigned as partners in one of their A&P propulsion labs and quickly became friends . . . for life, as it has turned out. Bernie is an African American, so their lab teacher jokingly referred to them as Salt and Pepper. The sobriquet has stuck with them over the years, and when the time came to obtain an N number for their Long-EZ, they chose N812SP for "812 Salt and Pepper."

According to Bernie, "Even the '812' in the N number is significant. I sent the FAA registry an annual 'donation' for probably 10 years to reserve this registry assignment. The ancient Hebrews and Greeks used their alphabet as numerals (just as the Romans did, i.e., Roman Numerals) so, each Greek word has a numerical value. '812' represents the Greek word 'phileo', which means 'brotherly love.'"

Bernie was a year and a half ahead of Randy at Le Tourneau and thus the first to enter the work force after graduation. He was employed by Rockwell Collins at Cedar Rapids, Iowa, and became a flight test engineer for installations of the company's autopilots in air carrier, corporate and other sophisticated aircraft. He found the company, the community and the work very much to his liking, so he began encouraging Randy to seek employment there, also. Initially, Randy dismissed the idea that a mechanical engineer would be needed by an electronics firm like Rockwell Collins . . . he was thinking more along the lines of Beech or Cessna in Wichita . . . but after a visit to Cedar Rapids and learning there were indeed opportunities available in his field, he decided to submit an application.

"Bernie was right. I was hired and soon found I had a job from heaven. I could wear blue jeans, tennis shoes and a golf shirt to work because I spent a lot of my time crawling around in the bellies of new OEM airplanes, designing servo installations for our autopilots and other equipment. I also did structural analyses, so they just gave me a desk and put me to work designing parts for airplanes. Since I also had an A&P, they didn't have to start with, 'This is a rivet, and this is an AN bolt' — they just put me to work and it was great. I've been at Rockwell ever since."

Randy worked in manufacturing for several years, transferred to product management for about four years, and after earning his MBA in 1992, moved into the program management position he holds today. Bernie, in his position as a certification flight test engineer can go wherever Rockwell Collins autopilots are installed and is occasionally out of the country for weeks at a time.

"Most of my work over the years with Rockwell has been predominantly domestic, Wichita being my second home," Bernie says. "1998 was unusual for me in that two of the projects I was assigned to that were originally scheduled for late 1997 and early 1998 slid into the spring and summer of 1998, right on top of our first flight of the Long-EZ and Oshkosh. The folks in the Czech Republic at LET a.s. and in Israel at IAI

are industrious and hardworking and the success of their certification programs means hope, jobs and economic stability in regions of the world where those commodities are in short supply. 'Loving your neighbor as yourself' doesn't mean a thing if you don't act on it - besides that, it's very much in keeping with the spirit of N812SP. "

That is why Bernie was unable to accompany Randy to Oshkosh this summer and share the glory of winning a Grand Champion trophy.

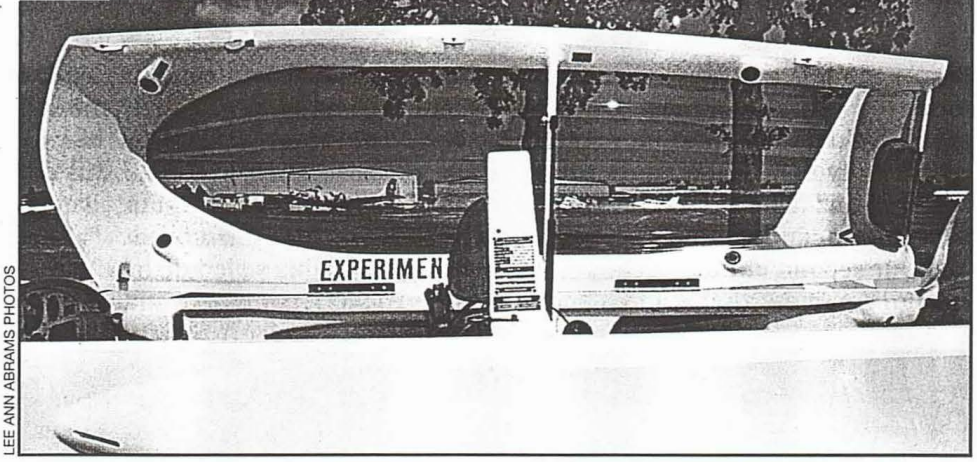
Soon after both were at work in Cedar Rapids in the late 1970s, Randy and Bernie essentially fell into one of the sweetest flying deals ever. Rockwell's facility manager at the airport had bought a Cherokee 180 for his daughter, but its utilization was proving to be so low that one day he asked Randy and Bernie if they would fly the airplane just to keep it from rusting from disuse. All they had to do was buy their own fuel!

"Of course, we had to oblige him," Randy chuckles today, "and we were able to fly the airplane for several years at minimal cost. We flew it to Oshkosh and all over eastern Iowa and neighboring areas. I was married during this period of time and, fortunately, my wife, Janice, also enjoyed flying. In fact, one of her requirements for a husband was that he had to be a pilot! It was too good to last, however; eventually, the manager had a job change and we lost the use of the Cherokee."

By that time the Long-EZ project was already under way. Like almost everyone else in aviation in the late 1970s, Bernie and Randy had been completely blown away by Burt Rutan's VariEze and its follow-on, the Long-EZ. Having grown up entirely in the space age, they had a reaction markedly different than those of previous generations, however. They were not shocked in the way those were who had the Mustang emblazoned in their minds as the ideal shape for an airplane. To their age group, the Ezes were a logical progression in the two decades of space hardware they had been exposed to, but, more importantly, their *Star Wars* appearance was like all the science fiction Bernie and Randy had grown up with suddenly becoming reality.

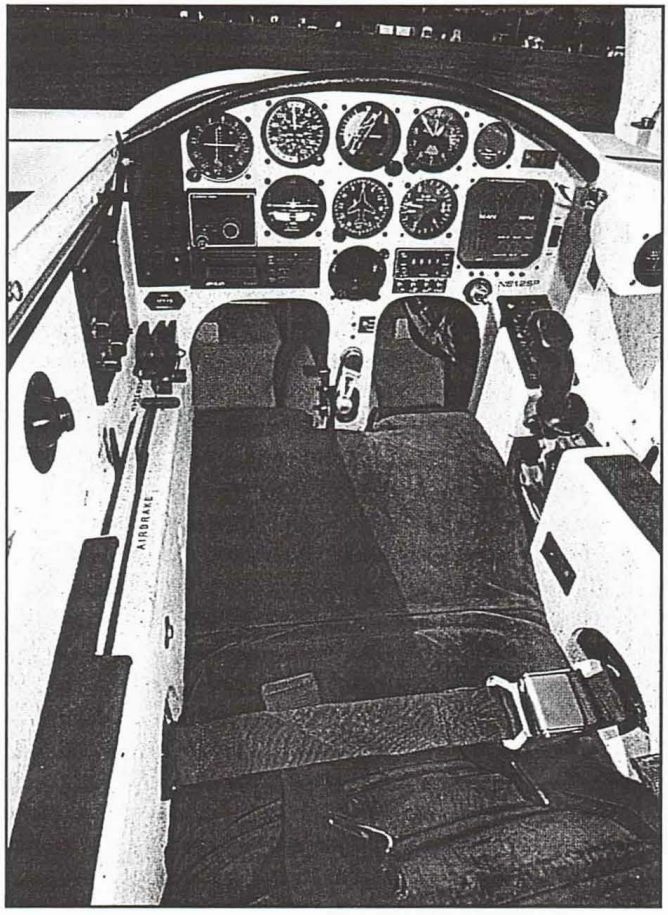
An **affordable** reality.

In due time the Long-EZ building instructions were ordered and intensively studied and discussed from their viewpoints as engineers and A&Ps; then a year later raw materials and parts were ordered from Wicks, Ken Brock and Aircraft Spruce. When the boxes of foam, fiberglass and epoxy were delivered and deposited on the front lawn of Randy's home, he and Bernie shook hands and **agreed then and there to build a grand champion**. All their subsequent efforts were directed toward that lofty goal.



LEE ANN ABRAMS PHOTOS

Pointable lights are provided for both seats.



Even before starting their own project, Randy and Bernie had been closely examining the Long-EZs at Oshkosh each year and talking to their builders. One thing they learned was that due to all sorts of extra goodies being built into the airplanes, many were turning out tail heavy, forcing their owners to fly with ballast in the nose. Some were extending the noses of their EZs to make room for batteries and other equipment to avoid having to carry dead weight as ballast. Anticipating a similar problem in Ten Forward, because it would be well-equipped and would have a lot of mods, they decided from the start to extend the nose. Randy was working on a job at the time that gave him access to a very large drawing table, so he put the RAF full size drawing down, covered it with a sheet of vellum and proceeded to loft a new, longer nose.

Randy and Janice were married about the time the project started and inevitably there were lifestyle changes that ultimately affected the Long-EZ project.

"Once we lost the use of the Cherokee, I was essentially out of flying for about 11 years. I kept up my medicals and BFRs in hopes I would get back to it, but it was just too expensive to rent, especially after the kids started coming along. Janice and I expected that the plane would be finished in three years, then we would start our family. Well, our first child, Andrea, came along two years into the project and we have pictures of her in her little bassinet, sitting on the work bench and pointing out the flaws I was making. She's been involved in the project from the start and knows it inside out. (In fact, during the interview for this

article, Andrea was present and occasionally reminded her father of technical details that ordinarily one would only expect the builder to be aware of and understand. Obviously a very sharp young lady.)

"Our second child, Caitlin, came along 17 months after Andrea and as they grew older my time switched over more and more to family activities, to the extent that for about the middle six years of the 15 year project, I was doing very little work on it. Fortunately, my partner, "Mr. Consistency", kept right on with his schedule of 30 to 40 hours of work per month and kept the project going. Even after the kids were in school and I had more spare time, it was hard for me to get back into building . . . until one day when Bernie casually asked if I would be interested in selling my half since I wasn't working on it very much. As he expected, that was a real kick in the pants for me, and I promptly got back on the project really hard."

KEN LICHTENBERG PHOTOS

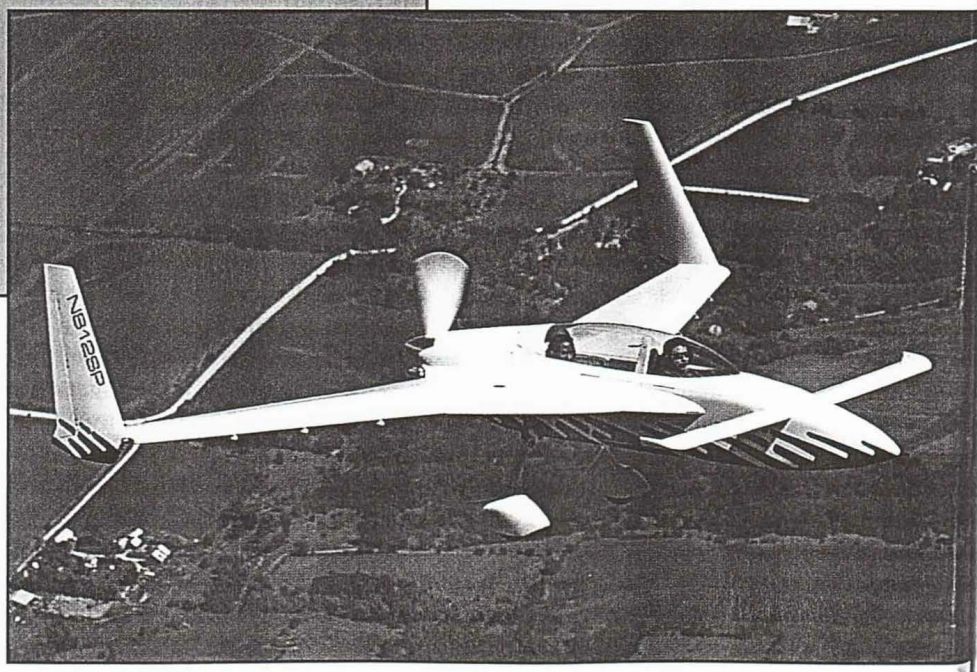
Other than the extended nose, the basic structure of Ten Forward was as per Burt Rutan's building instructions and thus familiar to EAAers everywhere. It was in the modifications and adaptations to systems, the add-ons and finishing details that would ultimately set the Long-EZ so much apart from its contemporaries.

• To power all the gadgets they expected to employ, electric rather than vacuum gyros among them, Bernie, the electrical engineer, designed a 28 volt electrical system for the airplane. That involved a 28 volt starter, alternator and a "pretty big 28 volt battery." A number of items, such as the radios, needed 12 volts, however, so a converter was installed to step down the voltage for them. That meant two batteries, which were placed in the nose.

• To get as much weight forward as possible, the brake master cylinders were moved from the basic design position on the firewall to the nose. In addition, the pitot tube, which extends forward from the nose, was made quickly removable so a similarly sized tube with a stainless tie-down ring could be fitted in its place.

• Neither Bernie nor Randy wanted

LEE ANN ABRAMS



a hole in the side of the fuselage for a key-lock for the canopy, so they designed, built and installed their own electronic remote opening system, like those on new cars. It involved a linear servo with a lead screw device attached to the canopy latching mechanism . . . activated by an Alpine security alarm system remote key. Just push the buttons on the electronic "key" to latch and unlatch the canopy. A separate button was installed in the cockpit to latch and unlatch the canopy from inside.

• The standard NACA flush inlet in the front of the canopy was omitted in favor of slits in the leading edges of the wings, with the fresh air routed into the cockpit and controlled with eyeball vents.

• Viewing windows were installed in the bottoms of the strake baggage areas to allow the rear seat passenger views downward.

• Lights were built into the canopy frame for both the front and rear seats and wired through the hinges. The front seat lights are pointable for playing them on the instrument panel or on a map, and dimmers are available for the pilot and passenger. Lights were also installed in the strake baggage compartments, the battery compartment and in the box spar. To avoid running down the batteries, the lights have a timer control that can be adjusted to automatically turn them off any time between 30 seconds and three minutes.

• An IFR panel was installed, but it took some doing. Using the Vision Micro Systems VM1000 instead of individual engine gages left room for the required flight instrumentation.

• The aircraft uses electrically actuated fuel selector valves. There NO fuel lines in the cabin. Greatly reduced (by approximately 10 ft.) fuel line runs to the electric and engine driven fuel pumps significantly lower the potential for a vapor lock condition.

• Randy and Bernie made their own switch panels, mounted on the sides of the fuselage and instrument panel. "Circuit breakers in front of the side stick are inherently visible, easily accessed and do not take up space from the strake baggage area," Bernie notes.

• All the panels are back lit, which was accomplished by using overlays of a plastic laminate with a black surface layer. Small light bulbs were mounted on the back sides of the laminate so light could be emitted through the edges of the cutouts for instruments and through the engraving that identifies the various switches, knobs, etc. A glareshield was built in over the instrument panel, and it, too, has a light built in. These lights can be dimmed or brightened at will, also.

• Perimeter, flush-mounted lights were installed under the canard, the winglets and where the wings bolt onto the strakes. When the aircraft is approached at night, the remote electronic "key" is punched and the bottom of the plane and the ground under it is bathed in light. The lights themselves are 14 volt units, but are operated in Ten Forward on just four volts. The bulbs are rated at 10,000 hours at 14 volts, so Bernie and Randy figure they'll have a lifetime of operation at just four volts. The perimeter lights also operate on a timer to avoid the possibility of running down the batteries.

• All the exterior aluminum, from the pitot tube back to the spinner was polished, and all the exposed metal inside the cockpits (levers, latches, etc.) was black anodized.

• A removable panel was built into the top of the fuselage between the instrument panel and the canard to provide easy access to the back sides of the instruments and avionics. Extensive beefing up was done around the opening and at station F22 to compensate for cutting into the composite fuselage shell. Before cutting into the shell, Randy did a structural analysis of the proposed change and was satisfied with the projected integrity provided by the planned beef-up of the structure.

• Bernie and Randy made their own custom wheel pants for the main gear wheels, as well as permanent gear leg fairings. The gear leg fairings began as blobs of poured-in-place foam that, after curing, were carved and sanded to the desired shape, then glassed. A thin gap was left between the fairings and the fuselage at the top and the wheel pants at the bottom to allow the gear to flex without interference at either end. In order to exhaust the heat generated by the Cleveland disc brakes, some means of venting them had to be devised. This would have been little more than an afterthought to most builders, but involved months of deliberation in this project . . . in which every detail had to be special. In the end, a computer-designed line of slits was cut into the tops of the wheel pants, with each slit angled ever more backward, as if being blown by the wind. This image of motion was repeated when similar slits were cut into the canopy skirt to exhaust air from the cockpit.

• Other custom touches included upturned canard tips, rear seat foot rests, rear seat armrest extensions, custom designed rudder/brake pedals, and a custom nosewheel crank handle with a safety ratchet.

From the beginning of the 15 year project, both Randy and Bernie knew they wanted something very special in a paint job for the Long-EZ . . . but having more of an engineering than an artistic bent, they couldn't decide on a specific design. Each year at Oshkosh they tramped up and down the rows of Ezes looking at the paint jobs, but only succeeded in confusing their choice even further. The help they knew they needed came quite by accident, right in the Rockwell Collins plant. As Randy recalls . . .

"I was getting some help from a CAD specialist when I noticed color renditions of RC models all over the desk next to his. The artist turned out to be a fellow Rockwell employee named Eric Baldwin, who would become a good friend and make a lot of contributions to the final configuration of our airplane. This was about five years ago — about the time I got seriously back into the project. I looked at his art work and asked Eric if he would like to design a paint scheme for our Long-EZ. He said he would, but thought I was talking about an RC model. When he came to see the airplane and found it was the real thing, he **really** got excited and has been involved in the project ever since. Over the next few years, I bet he drew nearly 50 different paint schemes. At one point I had them all around the perimeter of my office at work, trying to see which one I would keep coming back to as my favorite. We ended up with two or three we really liked and we took the best points of those plus a few features from some other designs and combined them, and, finally, Eric drew up one we all agreed was it.

"A lot of work remained before the paint scheme would be applied, however. Every square inch of surface was sandblasted or hand-sanded prior to filling. Bernie and friend and fellow

Long-EZ builder, Bill Finley, took on this operation (as well as the definition and fabrication of the electrical harness). I spent two and a half years filling and sanding, filling and sanding to get all the surfaces perfectly flat. I can't even stand to think about the number of times the airframe has been sanded. I read all the articles on how to use the really long sanding blocks, but finally went to a local guy in a body shop and said, 'How do you get something 13 feet long perfectly flat?' He gave me about a two hour sanding lesson, showing me the techniques he used and the 3M sanding blocks he employed in his work. He used 3M sanding blocks that are about 24 inches long and three inches wide. They have a kind of rubberized bottom and sticky sandpaper you place on them. You work at an angle, starting at one end of a wing or whatever, and work your way to the other end. There are air powered versions of this block that vibrate to accomplish the sanding motion, but I did not use them. I sanded the whole airplane by hand — never used an electric sander on it anywhere. What a mess it was! I'd come in day after day after day covered with dust from head to toe. Throughout the process I probably filled my 20 gallon shop vac four or five times. I finally resorted to vacuuming my beard and hair to get rid of the dust and was constantly changing the filter in my air mask. After going through the usual steps of fill and primer, most of which ended up on the floor and in my shop vac, we finally got around to finishing the airframe in white Imron™."

Eric Baldwin's contributions to the project were not restricted to the design of the paint scheme. It was his suggestion that resulted in the interchangeable pitot/tiedown probe for the nose, and it was his idea to replace all the screws in the access doors for the batteries, the back of the instrument panel and the oil filler cap with internal latching and release mechanisms.

"Yes, they were his ideas," Randy laughs, " then I had to make all those parts. He designed them on his CAD equipment, then I built and installed them. They really turned out well. Having everything flush on the exterior surface of the airplane is a real plus. Eric also designed our Ten Forward logo. He works as a CAD designer, but he's really an artist at heart. He has his own business on the side that serves as an outlet for his artistic side. It's called Visionquest and we had him put the name on the back side of the belly flap that we lower when we display the airplane. It also has our Ten Forward logo and our names on it as the builders. "

After the completion of the composite airframe, the systems installation phase began. When the Long-EZ was introduced in the late 1970s, Burt Rutan recommended use of the 115 hp Lycoming O-235 L2C engine that was standard on the ubiquitous Cessna 152. Randy and Bernie located one in Michigan that had suffered sudden stoppage, bought it sight unseen and, exercising their A&P tickets, tore it completely down and overhauled it. New mags were purchased, the carb was overhauled and a custom stainless steel exhaust system was built by a local race shop. A six inch prop shaft extension was used to project their Lonnie Prince 63" x 68" wood fixed pitch propeller back to where it could run in less disturbed air coming off the fuselage and strakes.

Randy says that because he and Bernie work for Rockwell Collins, everyone assumes all their avionics are by Collins.

"What they don't know is that the Collins line of radios for small general aviation aircraft (Microline) was sold off years ago. We have three Collins units in the airplane, our VIR-351 NAV, GLS-350 glideslope receiver and IND-351 indicator, which we bought on the used market. Otherwise, we have a II Morrow loran, which will be replaced by a GPS when we've recovered financially from building the airplane, a Narco Escort NAV/COM radio with a built-in VOR, Terra transponder and the usual instrumentation required for IFR flying."

The application of the paint trim scheme was one of the biggest jobs of the entire project . . . not counting the filling and sanding, of course. As recalled by Randy . . .

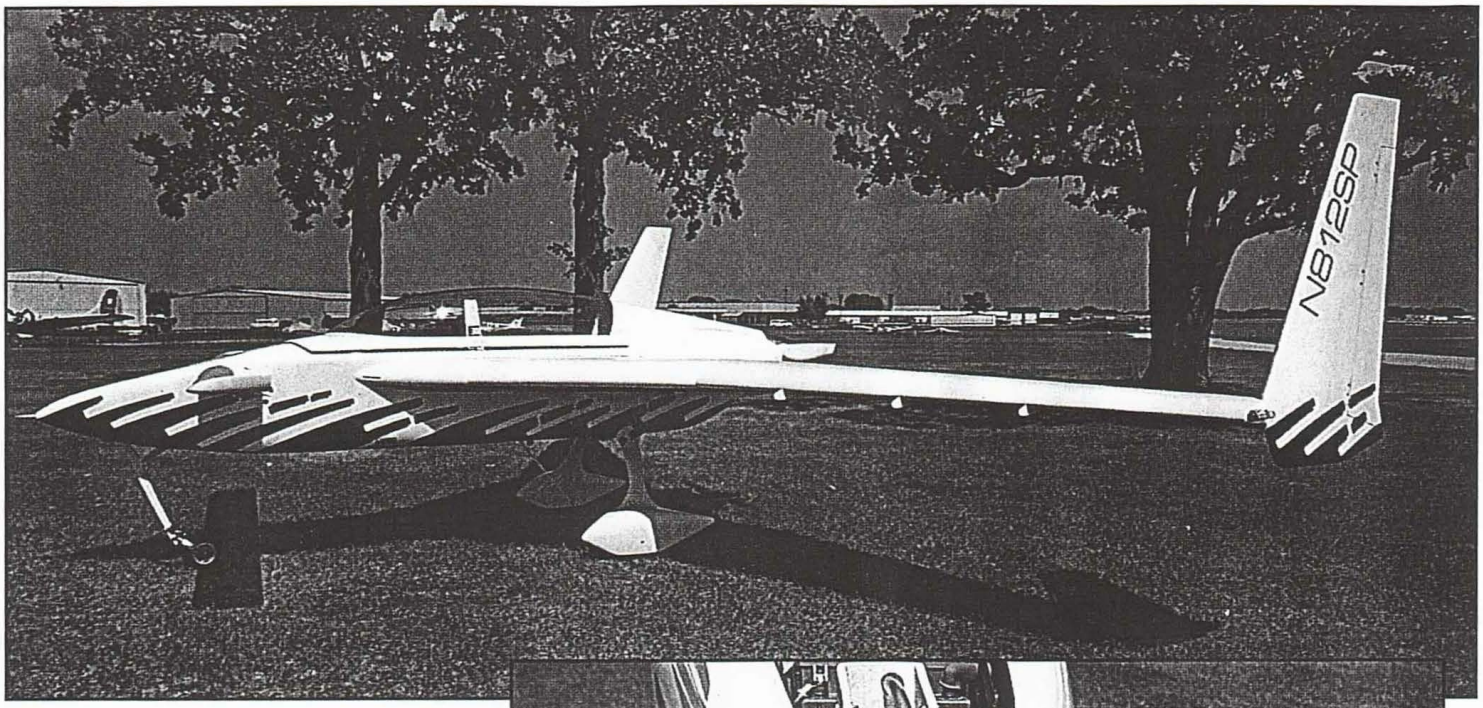
"When the time came to apply the paint scheme, we took Eric's drawing to the airport and used it as a guide to mark off the design in grease pencil. After all that work on the finish, it was really hard to begin marking it up with a grease pencil and then sanding that beautiful white paint to make the color scheme stick. Once we completed the marking, we began taping off the design in preparation for air brushing the color on. We counted and I think there were about 140 'fingers' and secondary color panels and shadows we ultimately had to tape off. The colors were applied by Chad Renken, a real artist with the air brush who normally does motorcycles, motorcycle and auto racing helmets and show cars. There were six colors in all, starting out on the bottom with purple and progressing upward and around the sides of the fuselage with dark blue, Caribbean blue, teal, and two progressively lighter shades of teal. There was also a shadow for each of these colors to produce a 3-D effect. Chad blended each of the succeeding colors with his air brush and just did a great job."

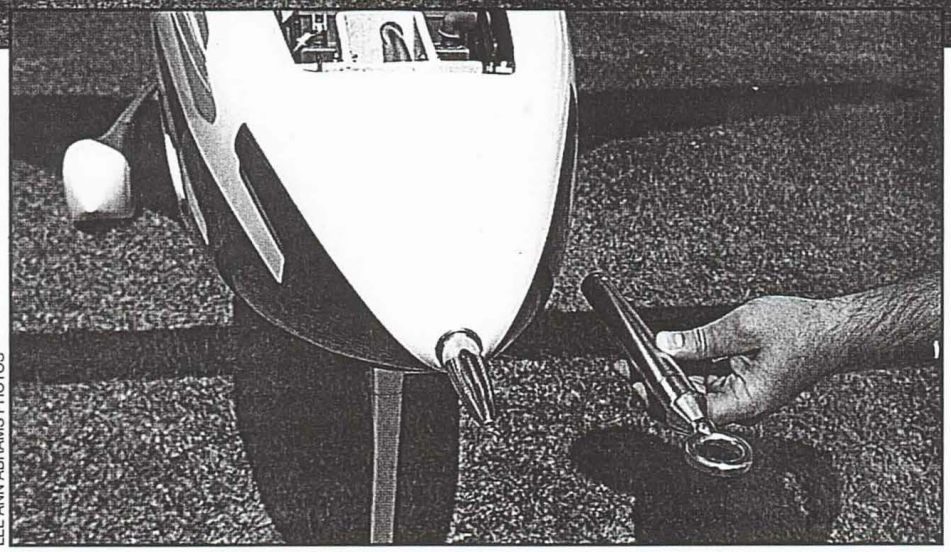
Bernie recalls that, "We propped up the nose of the aircraft and put the mains on risers to attempt to make painting the underside and wings a bit simpler. This helped, but it still meant that Chad would do much of the painting on his back for hours at a stretch, occasionally having to deal with dribbles down his arm (I think Michelangelo would understand). A realization of the logistics of this operation gives one all the more appreciation for the beauty of the outcome and the effort required."

"It took us 20 days of hard work to put the paint scheme on," Randy says, " and we ended up with piles of used masking tape. We did it in winter and since we didn't have a heated hangar, we had to rent one. All-in-all the paint job was incredibly expensive, but it was worth it. I really like it . We finished off with a clear coat, and even though DuPont says you can't do it, we found that you **can** sand Imron with 1200 grit and bring it back to a shine."

There were some setbacks along the way. One involved the canopy. It was purchased at the beginning of the project, was sprayed with a protective agent and stored for nearly a dozen years. Eventually, the protectant deteriorated, was peeled off and replaced with a new spray coat.

"I don't know what we did," Randy says, "but a year later when we tried to peel off the second coat, it wouldn't budge. We couldn't even pick it off. We tried everything, we consulted with chemists, we used kerosene, but nothing worked. As a last resort, we used 600 grit sandpaper and sanded it





LEE ANN ABRAMS PHOTOS

Pitot and tiedown ring tubes are interchangeable.

off. Of course you couldn't see through the canopy when we finished, so we contacted Micro Mesh, got some of their products and spent a whole day progressing up through 2400 grit paper trying make the canopy transparent again, but it was still kind of milky when we finished. Then we took it to the Micro Mesh plant, which is about an hour's drive from Cedar Rapids and had it polished out. They wouldn't let us see how they did it, but when they brought it out, it was perfect again. Since then we have followed their advice and kept it clean with a really special solution: soap and water. That's all you use. Wash it down every time you fly and use a little of their finish polish and it stays looking like new."

Somewhere late in the game, Eric Baldwin saw a picture of a Lamborghini that had what he considered to be an absolutely stunning blue suede interior. "You have to have that for your seats," he told Bernie and Randy. "It will be perfect with the trim colors." Randy began tracing down a source for blue suede and perhaps not surprisingly (at least for the Elvis generation), eventually ended up on the phone with a supplier for a shoe manufacturer. He ordered a roll and it was used to cover the seat cushions and arm rests. As Eric had predicted, it did indeed look great . . . but very quickly the color began to fade. Initially, it was thought the suede was merely soiled, but after an expensive trip to a dry cleaner, they realized the sun was indeed doing a number on the dye in the leather. The seats still look very good, but the original bright laser blue is now a more subdued hue.

With all the custom additions, it was expected that Ten Forward would be heavy, and, indeed, it tipped the scales at just over 1,000 pounds when the weight and balance was calculated. The nose extension and the mounting of the batteries in the nose paid off as hoped, however, and the CG was found to be right in the center of the envelope. The airplane was inspected and signed off for flight on May 6, 1998 and the first flight came on May 9, with Randy doing the honors. It was a short flight, however . . . the cylinder heat temps were found to be climbing faster than the airplane, so Randy got the EZ back on the runway as quickly as he could. As shortly ascertained, a ram air box for the carburetor that had been built into the NACA flush inlet for the engine was blocking off too much of the air that should have been going to the cylinders. Knowing that Mike Melvill, Dick Rutan and others had installed "armpit" scoops under the wing roots of their Long-EZs with great success, Randy and Bernie decided to give them a try on their airplane. Not wanting to have to repaint the complex trim on their cowling . . . Oshkosh was just three months away . . . they built removable scoops that fed air through S-shaped ducts directly to the cylinders — and saw a 170 degree CHT reduction on the next flight! With that problem solved, Randy began grinding away on his 40 hour test time so the airplane would be ready for the flight to Oshkosh in late July. (Bernie was on the aforementioned jobs in the Czech Republic and Israel during this period and had not