

BURT RUTAN

AN EAA PERSPECTIVE

By Jack Cox

If thinking outside the box and turning that thinking into successful ventures and products is a mark of genius, then Burt Rutan (EAA 26033 Lifetime) has claim many times over to that distinction. No other individual in the history of aviation has designed as many aircraft . . . radically different aircraft . . . and had them built and flown.

- Burt first came to the attention of EAAers in 1972 when he flew his newly completed VariViggen to Oshkosh.
- He came to the attention of the entire world in 1986 when the Voyager completed the first non-stop, non-refueled circumnavigation of planet Earth in an airplane.
- And to no one's surprise who knew of his accomplishments over the previous 32 years, Burt's SpaceShipOne became the first privately designed and constructed manned vehicle to soar into space, winning the ten million dollar Ansari Prize on October 4, 2004.

Interspersed between those landmark designs were scores of different, often fantastically innovative new aircraft designs - and even an all-composite automobile, a huge wing to replace conventional sails on the 1998 winner of the America's Cup sailboat competition, huge composite windmill blades and much, much more.

Then . . . last fall the announcement was made that Burt would retire this month, April of 2011, from Scaled Composites, the company he founded in 1982. Burt will be 68 on June 17 of this year, so he has every right and reason to rest on his laurels, but the announcement still came as a shock to those of us who have followed his career from its beginning. Though we know all good things eventually come to an end, it's just human nature to go blithely on our way as if they won't.

Aviation without some radical new aircraft design by Burt Rutan blowing our minds every year or so? Unthinkable!

Though purely coincidental, I had the great good fortune to be employed by EAA in January of 1970 and was editor-in-chief of **Sport Aviation** when Burt came on the scene with his VariViggen in 1972. This gave me the opportunity to closely observe and document his achievements during the years between 1972 and 1985 when his first company, Rutan Aircraft Factory (RAF), sold building instructions for homebuilt aircraft, and, to a lesser degree, the subsequent years during which he was president and chief engineer of Scaled Composites.

THE VARIVIGGEN

The VariViggen, the design of which Burt had started working on in the early 1960s while an aeronautical engineering student at Cal Poly, was an effort to design a relatively fast airplane for its power, but one that was easy to fly and essentially stall and spin proof. Most of the aerodynamics involved were worked out using a large scale model mounted on an articulating, instrumented arm attached to the top of his Dodge Dart station wagon - Burt's famous "car top wind tunnel." The design was completed while Burt was a civilian employee of the U.S. Air Force at Edwards Air Force Base, where he was awarded an Air Medal for his successful efforts to improve the bad spin characteristics of the F-4 Phantom.

Construction of the wood and metal VariViggen began in Burt's garage at Lancaster, CA in 1968 and it was nearly completed early in 1972 when it was loaded into a moving van and hauled to Newton, Kansas where Burt had taken a job with Bede Aircraft as director of development and flight testing. The prototype VariViggen, N27VV, was flown for the first time in April of 1972 - by Burt, who was the test pilot on all his early homebuilt designs.

When flown to Oshkosh three months later, Burt would receive the Stan Dzik Design Contribution award for the VariViggen, the first of many awards he would subsequently win at the annual EAA Convention. EAAers puzzled over the airplane's unfamiliar delta wing/canard configuration but frequent flight demonstrations allayed any fears that this was some sort of far out, dangerous airplane, and an article by Burt entitled "VariViggen . . . Designer/Builder Report" that appeared in the August 1973 issue of **Sport Aviation** answered the questions most had on the technical aspects of the design, its performance and handling characteristics. That issue also featured the first of many Rutan designed aircraft that eventually appeared on the covers of **Sport Aviation**.

The VariViggen would prove to be popular enough that Burt was able to begin selling building instructions for it, and soon numbers of them were under construction around the world. That made it necessary to start a quarterly newsletter to answer builders' questions . . . and to implore them to keep communications to a minimum so new development could take place.

The VariViggen's success prompted Burt's departure from Bede Aircraft after two years in Kansas. After checking out a number of airports in southern California for affordable facilities, he leased one of the "temporary" air base buildings left over from World War II at the Mojave Airport . . . the now legendary Building 13 . . . and began operating there as the Rutan Aircraft Factory (RAF). Americans love rags to riches stories and RAF certainly began as a prime example. Building 13 was a thrown-up, minimal structure when new and had not improved over time when Burt and his wife, Carolyn, hung out their shingle there in 1974. Their facility was, in fact, so primitive that after my wife, Golda, and I visited the Rutans there for the first time, we wondered how we could send them a care package of some sort without offending them! Today, I wonder what we would have thought if somehow we could have been made aware that some three decades into the future, SpaceShipOne would be rolled out of a hangar just a short distance away from Building 13! Although we always believed Burt was destined for great things,

in our many subsequent visits to Mojave, we always made it a point to drive by Building 13 to renew the perspective of just how far he had come in the aviation world.

With the growing popularity of the VariViggen, Burt began taking it to fly-ins and air shows around the nation, conducting seminars on its construction and, especially, the aerodynamics of the canard configuration. All that, however, was just a prologue to what was about to emerge from ol' Building 13.

THE VARIEZE

For the May 1975 issue of **Sport Aviation**, I wrote a short article entitled "VariViggen Vignette," which introduced EAAers to Burt's new moldless composite construction process. Builders, it said, would be able to fabricate an entire airframe, including wing spars, using simple hand tools like a pair of scissors, carving knife and a paint brush. The initial utilization of the process would be to construct new, higher aspect ratio outer wing panels to replace the prototype VariViggen's metal panels.

The stunner, however, was a photo Burt had provided of the car top wind tunnel model of his newest design, which, he said, his sister, Nell, had named the "VariEze." Today, we are so accustomed to the configurations of the VariEze and Long-EZ that running across that photo in an old back issue results in little more than a passing glance, but in 1975 it was a mind blower! An overhead, planform shot of the model, it highlighted the design's high aspect ratio straight canard, high aspect ratio swept wings with even higher swept inboard strakes and then newly invented Whitcomb winglets at the tips - the first use of the devices on an aircraft. No one had ever seen such a shape for an aircraft - the first Star Wars movie was still two years away from introduction - and the realization that this was to be an affordable homebuilt powered by a VW engine was nothing short of revolutionary in 1975.

In early May Golda and I had visited Burt at Mojave and were able to see, climb in and photograph the partially completed prototype VariEze, N7EZ. There we learned more about the airplane, including its "kneeling," retractable nose gear and a really unique control system. Burt had gone a step beyond Richard Whitcomb by adding rudders to the winglets, actuated by two-phase rudder pedal throws. Press on a pedal to move a rudder in the conventional manner, then press it further for differential braking. Even more unusual was the fact that the movable surfaces on the canard were elevons. They moved up and down simultaneously as elevators and differentially as ailerons, thus requiring a linkage from the stick that was less than two feet long. There were no control surfaces on the wings.

We managed to get a number of the photos in the June '75 issue of **Sport Aviation**, examples of which are reproduced here mainly to illustrate how quickly the prototype VariEze was built. On May 21, 1975, only about three weeks after the photos were taken, Burt flew the airplane for the first time! The total construction time had been just under four months.

The following month, July, we ran an article by Burt in which he announced the audacious intention to have his brother, Air Force Major Dick Rutan, fly N7EZ non-stop from Mojave to Oshkosh '75 and, once there, to attempt a world's closed course distance record in the VariEze's FAI C-1A weight class. He also announced that a second VariEze would be built that winter, incorporating lessons learned with the prototype, and it would be used as the basis for building instructions that would be sold to homebuilders. Needless to say, every EAAer attending Oshkosh '75 was stoked to the max in anticipation of the VariEze's arrival there.

And what an arrival it was! The EAA Convention ran from Tuesday, July 29 through Monday, August 4 in 1975. On Wednesday, the 30th, Dick was set for an early departure from Mojave, but the VW engine's oil cooler blew on start up. Undeterred, the cooler was removed, the oil line was replumbed and Dick took off for Oshkosh, some 1,800 miles to the east. For most of the day all went well, with Dick checking in with pre-determined air traffic facilities, which Burt, who was already at Oshkosh, phoned to keep abreast of Dick's progress. He, in turn, passed the word on to the fly-in's PA announcers, who kept the EAA crowd up to date.

Then, late in the afternoon, Dick noticed that the engine's oil temperature and pressure were on the rise - fortuitously just as he was passing over the Worthington, MN airport and a Holiday Inn motel located on the adjacent Interstate Highway. Having previously punched out of two F-100s, Dick knew an emergency when he encountered one, so he landed - after eight hours, 50 minutes and 1,500 miles aloft - to determine the nature of the problem. Oddly, nothing could be found except that most of the oil had somehow disappeared - and after it was replenished, the engine ran perfectly. Dick and Burt suspected that in the rush to get the oil system replumbed that morning, no one had topped it off, so the decision was made to fly on to Oshkosh the following morning.

That morning, July 31, is one I'll never forget. As Dick winged his way toward Oshkosh, the PA announcers kept the crowd informed of his progress and ETA, so the showline was crowded by the time he was nearing Oshkosh. We had a partial, low overcast that morning, with a small blue hole right over the airport. Everyone was looking up and, suddenly, there it was - just for an instant, the radical profile of the aircraft that would lead to the Rutan designs that would dominate the EAA world for the next decade and a half.

An audible gasp arose from the crowd at the sight of the VariEze and in a moment all those who weren't already on the showline began racing forward like a tidal wave. After a high speed pass down the runway, Dick landed and because of the surging mass of EAAers, had to shut down the engine and push the Eze to its roped off parking spot.

I've been to every day of every EAA Convention, except two, since 1964 and I've never seen a more dramatic entrance than that of the VariEze that July morning.

Still more drama was about to unfold, however. After thoroughly inspecting the VW engine and making several local test flights, Burt and Dick decided to make an attempt on the Closed Course Distance record on Saturday, August 2, 1975. An early morning

takeoff was made, with Burt and myself flying chase in the VariViggen, and Dick headed north to the Menominee, MI turn point. Unfortunately, low ceilings were moving into the Oshkosh area that morning, so on the way back to Oshkosh to complete the first lap, Burt landed at the Green Bay airport to check the weather at the FSS there. Afterwards when we walked out of the building, we were astonished to see Dick striding toward us, yelling, "Hey, where were you guys when I needed you?"

Dick had completed the first lap, had flown back north on the second lap and had the engine blow just north of Green Bay. Somehow he managed to get back to the airport and dead stuck the still fuel heavy Eze, coming to a stop in the middle of the runway.

The rest of the day was quite an adventure. Still undeterred, Burt and Dick decided to try to locate another VW engine at Oshkosh and try for the record again. Luckily, John Monnett was not only willing to loan one of his Sonerai VWs, but was willing, along with his friend, Mike Core, to spend all night installing the engine in the VariEze, which had been disassembled and trailered back to the Convention grounds at Oshkosh.

Early on Monday, August 4, 1975, Dick launched again, with Burt and John Monnett as chase in the VariViggen. This time all went well and at 7:03.45 p.m. CDT that evening, after 13 hours, eight minutes and 45 seconds aloft and having flown 1,638 miles, Dick landed - with a world's record to his credit and that of his brother, Burt, for his design of the VariEze. To cap off the week, Burt received the Best New Design award for the VariEze.

Having been involved nearly all year in the VariEze introduction, I was able to write a very detailed account of the record flight and all that led up to it. You can access it by going to www.eaa.org and looking up the article "VariEze . . . For The Record" on page 20 of the October 1975 issue of **Sport Aviation**.

The events of Oshkosh '75 proved to be the real beginning of the Rutan Revolution. That winter, as promised, Burt developed a new version of the VariEze, with a Continental O-200 for power, with ailerons on the wings instead of elevons on the canard, a belly board speed brake and a number of other improvements. The prototype, N4EZ, was completed in just a few months and was flown for the first time on March 14, 1976. After thorough flight testing, Burt wrote and illustrated a set of building instructions, modeled after the step-by-step format of Simplicity dress patterns, and began offering them for sale in July of 1976. Predictably, the orders flooded in.

At Oshkosh '76, Burt copped another prestigious award, The Professor August Raspert Award for Outstanding Contribution to the Advancement of the Design of Light Aircraft. Shortly afterwards, he launched out on a nationwide series of builder's seminars and followed those with seminars in England and France.

THE LONG-EZ AND MORE

The instantaneous success of the VariEze was like throwing gasoline on the fire of Burt's creativity. It provided him with the financial resources to begin designing and

building seemingly every new aircraft that came to his mind. One of them, however, could almost have been considered a retrograde step. Despite Burt's urgent pleas to builders not to make changes in their Ezes, many did so and topping the list was the use of larger engines. Burt's response was the Long-EZ, which was designed around the Lycoming O-235. The prototype, N79RA, was flown for the first time on July 13, 1979 and initially was a test bed for all sorts of new ideas, including a "rhino rudder" mounted just ahead of the canopy. Scores of changes and a new, longer wing were incorporated before the definitive Long-EZ emerged and was made available to builders, but the effort proved to be more than worthwhile. Today, Burt considers the Long-EZ to be the best of all his designs for homebuilders.

Amazingly, the late 1970s saw all sorts of new designs coming out of RAF. In 1977 Burt designed the Quickie in collaboration with Tom Jewett and Gene Sheehan. It would fly for the first time on November 15, 1977 and would win the Outstanding New Design award at Oshkosh in 1978. At the same time he was designing a centerline thrust twin, the Defiant, which made its debut at Oshkosh '79, along with the new Long-EZ.

In the early 1980s came the Amsoil biplane class racer, the really unusual Grizzly bush plane and the Solitaire powered sailplane that won a Soaring Society of America design contest.

By this time, however, Burt was already operating on a second, parallel path. In 1976 he had been contracted to design a proof-of-concept jet powered skew wing aircraft, the AD-1 for NASA, and, later, a scaled down New Generation Trainer for Fairchild and a joined wing ag plane called the Predator for a private individual. Burt quickly realized that these contracted jobs held great promise, business-wise, so in 1982 he formed a new company, Scaled Composites, to do that sort of work. An 85% scale Starship for Beech Aircraft was an immediate result. Scaled Composites would, in fact, become so successful that in the July 1985 issue of his Canard Pusher newsletter, Burt announced that he was getting out of the homebuilt business. At that point, more than 12,000 sets of building instructions for the VariEze and Long-EZ had been sold, but bigger things lay in the future, culminating with SpaceShipOne.

It was not a matter of Burt abandoning EAAers, however. He continued to attend the EAA Convention each year, presenting talks before standing room only audiences and taking part in many other activities. A number of his Scaled Composites developed aircraft have been flown to Oshkosh for display - the Catbird, Boomerang and others - that while not intended as homebuilts, have been of great technical interest to his fellow EAAers.

VOYAGER

No, I haven't forgotten the Voyager. I've saved it for last because even though Burt designed it in the early 1980s, it was several years in construction and testing, during which time Burt made his exit from the homebuilt building instruction business. Voyager, thus, was the last homebuilt project in which he had active participation.

The story of the Voyager's inception is legend today. One day while Burt was having lunch at the Mojave Inn with brother Dick and Jeana Yeager, the conversation turned to a new challenge for the trio. Dick and Jeana had been setting record after record in VariEzes and Long-EZs and had reached the point of "what's next?" A never before accomplished round-the-world, non-stop, non-refueled flight was an obvious choice and Burt promptly sketched out a configuration on a napkin that would shortly evolve into the Voyager, an incredibly efficient aircraft with a wing span of 110.8 ft. and an empty weight of just 939 pounds!

A shoestring operation at the start, the Voyager was built almost entirely by Dick, Jeana and Bruce Evans, initially at RAF and, later, in Voyager's own hangar at Mojave. Financing the project was in many respects a more formidable task than building the airframe. Initially Dick and Jeana hoped to sign on corporate sponsors, but none were forthcoming. Finally, with the future of the project in dire jeopardy, Jeana came up with the idea of a grassroots fund raising program, centered mainly around EAA members. The concept was to ask for small donations of cash, in hopes that the money could help keep the Voyager project going. Almost every month, Dick or Jeana would call me at EAA Headquarters with progress reports on the airplane's construction, which I would write up in Hotline - and always end with a plea for continued donations. To the credit of the EAAers of the mid-1980s, they did help keep the Voyager program afloat until corporate sponsors came aboard at the eleventh hour. A poignant, yet typical anecdote involved a note with one of the small donations that read, "Don't laugh . . . I didn't have lunch today."

Dick flew Voyager for the first time on June 22, 1984, and he and Jeana flew it to Oshkosh the following month, making another of Dick's signature grand entrances. Arriving high over Wittman Field, he orbited for some four hours before landing - symbolically demonstrating the airplane's tremendous endurance capability. Two more years of development and testing passed before Dick and Jeana launched on the world flight in mid-December 1986. Nine days later, they arrived back at Edwards Air Force Base to the cheers of the entire world. The following Monday, December 29, Dick, Jeana and Burt were presented Presidential Citizen's Awards by President Ronald Reagan. For the complete story of the flight, go again to the EAA web site and look up my article "The Flight of Voyager, A Victory of the Human Spirit" in the February 1987 issue of **Sport Aviation**.

From 1985 through the subsequent quarter of a century, the amazing output of new designs by Burt has continued, and enough awards to fill this page have come his way - including two Collier Trophies and four honorary Ph.Ds. EAA is planning a special day, Thursday, July 28, to honor Burt at AirVenture this summer. His wife, Tonya, friends and co-workers like Mike and Sally Melvill, John Roncz, Doug Shane and so many others who have figured prominently in Burt's career will be there . . . and, hopefully, so will you to honor one of our own.

