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Burt Rutan: The Scaled
Composites Years



Hope One

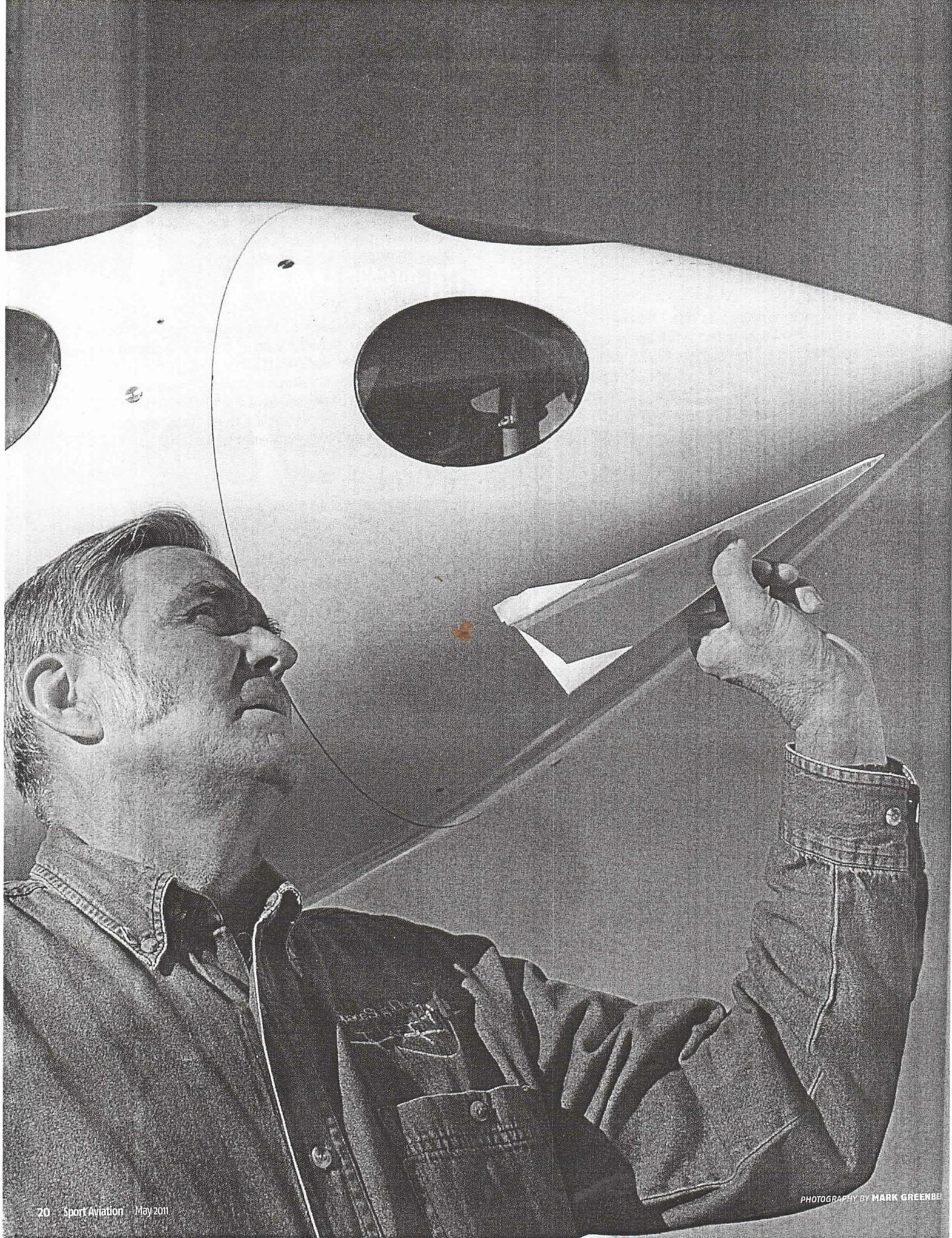
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Burt Rutan

THE SCALED COMPOSITES YEARS

BY STEVE SCHAPIRO

FOR MORE THAN 30 YEARS, no one has been closer to Burt Rutan, EAA Lifetime 26033, professionally or personally than Mike Melvill, EAA 53387. He built the first VariViggen. He was the first employee Burt hired for the Rutan Aircraft Factory (RAF). He was best man at Burt's wedding—twice. And he conducted the first flight of 10 of Burt's designs, including SpaceShipOne.

As Burt was preparing to retire last month from Scaled Composites, the company he founded in 1982, EAA thought Mike would be the perfect person to discuss Burt's legacy and what's next for one of aviation's most innovative designers.

"The other day I was down there working with him," Mike told *Sport Aviation*. "And he said, 'You know, Mike, for the first time in my life, I have no idea what I'm going to do. Tonya and I are going to go up to Idaho, we're going to get ourselves settled into the new place we've bought, and I haven't a clue what I'm going to do after that. I have no plans, and I'm glad of it.'"

There's an irony for someone who has spent a career meticulously planning and designing unconventional aircraft. "How Burt does a design is he conceives of something in his mind," Mike said. "And he doesn't just come to that conclusion in one minute. He's thought about it a lot before he puts it on paper. Then he designs a shape, and refines that shape, and comes up with reasons to do it that way."

But perhaps having no plans isn't so ironic. Most people spend their careers planning for what they might do in retirement. But that's not Burt. He was always focused on the next challenge, looking at a

problem and discovering a solution. "That's what he thrives on," Mike said. "He has the ability to determine what the problem is, get to the meat of it, and fix it. He's used that throughout his career."

For a man known for his unconventional thinking (he bought the engines for White Knight on eBay), he also is a creature of habit. His two most famous aircraft, the Voyager and SpaceShipOne, were both sketched out on napkins. He created a car-top wind tunnel to test his first airplane, the VariViggen. Thirty years later, he was using a similar technique to test a redesigned tail on SpaceShipOne.

Throughout all of his designs, whether it was meant for a recreational pilot building his own airplane or a major defense contractor attempting to win a multibillion dollar contract, Burt's design philosophy was always centered on providing highly efficient aircraft that broke new technological ground, and were extremely safe and fun.

During Burt's early years with RAF, detailed in Jack Cox's final article in the April issue of *Sport Aviation*, his homebuilt designs set the standard for innovative aircraft—the VariViggen, VariEze, Long-EZ, and Quickie.

AT SCALED COMPOSITES, BURT SHIFTED FROM DESIGNING AND SELLING PLANS TO HOMEBUILDERS TO DOING CONTRACT RESEARCH AND DEVELOPMENT WORK. "BURT WAS ABLE TO MAKE MONEY DOING ONE-OF-A-KIND RESEARCH PROJECTS, WHICH I DON'T THINK ANYBODY'S EVER DONE," MIKE SAID.

FORMING SCALED COMPOSITES

Ten years after the VariViggen debuted at Oshkosh in 1972, Burt was getting bored, Mike said. "He couldn't think of new things to do—new, innovative, clever, more efficient, better things. In the back of his mind, I really think he was looking for something new and different."

Enter Herb Iverson. He was with a French company that built a jet engine called the microturbo. Fairchild Republic wanted to design an aircraft around the engine to bid on the Air Force's next generation trainer (NGT) to replace the T-37 Tweety Bird. "Herb had this engine, but nothing to put it on," Mike said. "Burt said he could easily design an airplane around one or two of these engines, and it could do whatever the heck these guys wanted."

It took about 10 months from the day RAF started designing the NGT until the flight testing of the three-fifths scale model was completed. Fairchild Republic was the only bidder with a flying prototype, and it won the \$2.2 billion contract over competitors like Boeing, Lockheed, and Northrop, although the project was canceled before the aircraft went into production. "People went, 'Holy cow! Look what this guy builds in four, five months,'" Mike said. "He saw this as an opportunity to get into another business. The little NGT, that's what started Scaled."

The quick production process became a hallmark of the new company. "If you look at the early Scaled work—the Starship, Lotus airplane, the crop duster, and the DARPA airplane—all of them were done in a real short period of time," Burt said.

In fact, Scaled has produced and flown on average one entirely new aircraft design each year. "We've done almost 30 airplanes in the same number of years, and we keep doing that. We'll have a first flight very soon of something new," Burt said. "Bottom line, no one else has come close to introducing a new type every year, and we've done it consistently, if you include RAF, since the early '70s."

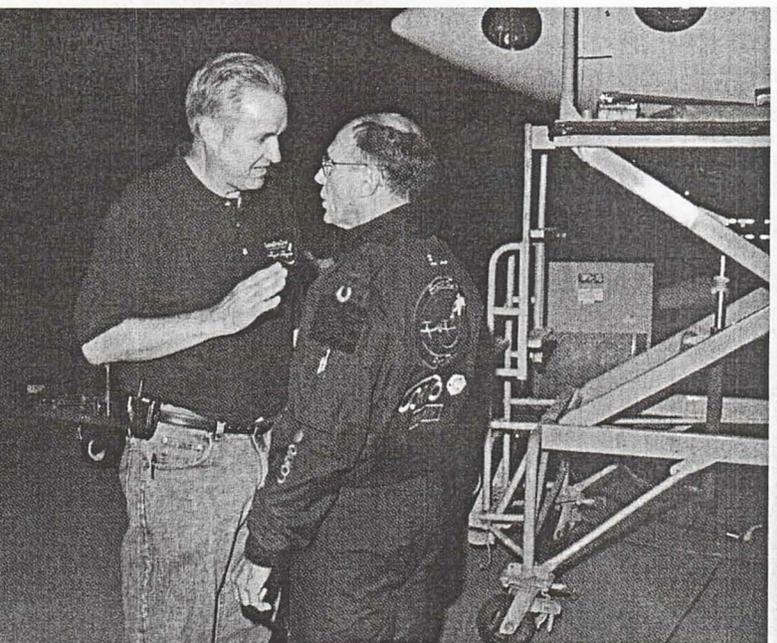
When Herb and Burt formed Scaled in 1982, Burt said in a *Sport Aviation* interview that he wanted to keep the company small—no more than 30 employees so he could personally be involved in every aspect of the business. He never dreamed 30 years later it would grow to 380 employees.

"We never did any planning. Scaled grew strictly from the fact that customers showed up at our door wanting us to do something," Burt said. "If it looked like fun, and it looked like we could do it and add technical value, and it was affordable, then we did it." In fact, Scaled was so successful it couldn't keep up with the demand and for several years stopped taking on new projects.

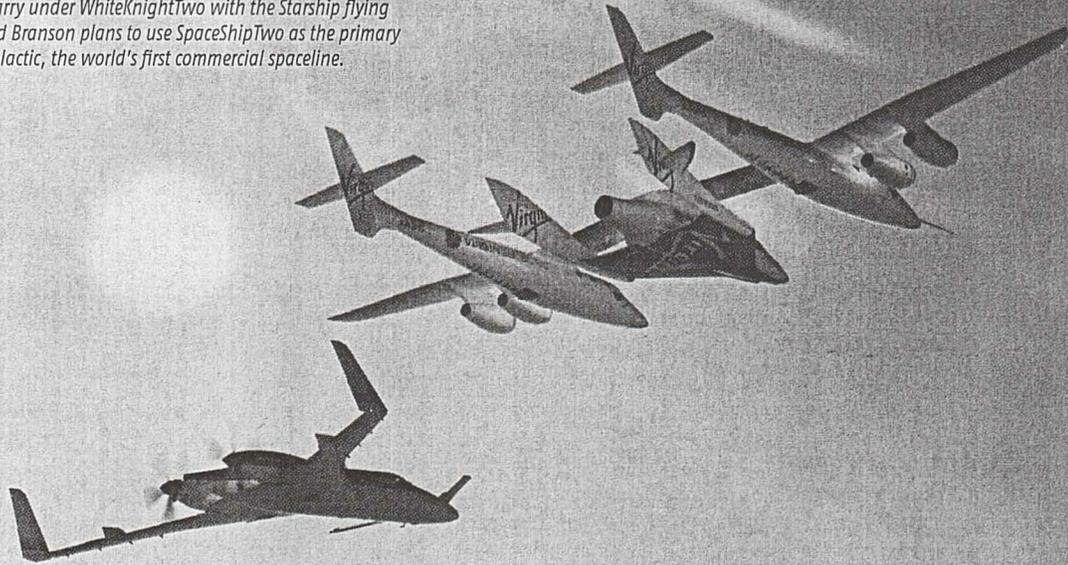
What Burt did is become successful doing research and development for customers who could afford to pay. Typically, the R&D

"All alone on the ramp, [Burt] would give me a rundown that was literally subtitles, short descriptions. 'This is what you need to look out for. Be careful of this. This will be fine.' Very detailed. And I have to tell you, he has never been wrong." – Mike Melvill

Burt and Mike talk in the pre-dawn hours on September 29, 2004, before the first of two flights of SpaceShipOne that resulted in winning the \$10 million Ansari X Prize.



SpaceShipTwo in captive carry under WhiteKnightTwo with the Starship flying as the chase plane. Richard Branson plans to use SpaceShipTwo as the primary vehicle to launch Virgin Galactic, the world's first commercial spaceline.



THE PIONEERS WHO INSPIRED BURT

For the centennial of the Wright brothers' first flight, Burt compiled a list of nine aircraft pioneers who inspired him and who he tried to emulate. "The thing that was interesting is this entire group of folks were little kids during the most interesting time of airplane development, which was 1908 through the First World War," Burt said.

In that 10-year span, the world went from having a dozen pilots to hundreds of aircraft designs being built by 39 countries. "I think that as kids they were really inspired by that, and that's why I point to that as significant."

Here are the nine pioneers who inspired Burt:

Wernher Von Braun—German scientist who was the father of the American space program

Kelly Johnson—First head of Lockheed Skunk Works

Charles Lindbergh—First pilot to cross the Atlantic solo

Jack Northrop—Founder of Northrop Corporation

Ed Heinemann—Engineer with Northrop, Douglas, and General Dynamics

Alexander Lippisch—German aerodynamics pioneer

Bill Lear—Avionics and autopilot designer; founder of Learjet

Howard Hughes—Aviation pioneer and designer

Sergei Korolev—Lead Soviet engineer during the early days of the space race

possible by the feather, an idea that literally came to Burt in his sleep. The aircraft breaks at about the 60 percent chord of the wing, and the aft end pivots up. This orients the aircraft into a nose-high position and allows SpaceShipOne to slow down and float back into the atmosphere, requiring little precision compared to the X-15 and space shuttle.

"Burt wanted to make a safe re-entry while you were sitting there reading the newspaper," Mike said. "That was his goal—a carefree re-entry; no matter what you did it would still re-enter safely and bring you back. And he achieved his goal."

He was greatly influenced by the X-15 program, which was underway while he was a civilian flight test engineer with the Air Force. He never forgot witnessing Mike Adams get killed when his X-15 broke apart because he wasn't able to keep it in the parameters of a few degrees of yaw and pitch when he re-entered the atmosphere.

"Burt wanted to make a safe re-entry while you were sitting there reading the newspaper. That was his goal—a carefree re-entry; no matter what you did it would still re-enter safely and bring you back. And he achieved his goal." —Mike Melvill

Another lesson learned from the X-15 program was the value of launching from the air, reducing the amount of fuel and power needed to achieve the suborbital speeds with dynamic loads that are a fraction of what they are on the space shuttle.

"I felt I could make an enormous difference in cost and safety for suborbital spaceflight. What we did with the structure of the program, the technical accomplishment, the success, by every criteria that to me is interesting, SpaceShipOne was a standout," Burt said. "It was done by a customer [Paul Allen, EAA 820282] who wanted to reach a goal because he wanted to enjoy the fun of it, as well as the legacy. To me that is the most important reason. 'Is it new? Can we have some sort of breakthrough to reach this goal even if we take real big risks to do it?' That's the most interesting thing."

What Mike found most striking is that Burt stepped "way out of his comfort zone" to design something unlike anything he had ever attempted. "He is a subsonic designer. Burt Rutan learned everything there is to know about and knows an awful lot about subsonic aerodynamics," Mike said. "But he's not a supersonic guy. Yet he did a super-

sonic airplane. The first one he ever did, and it was completely successful."

The event turned out to be the second largest news story worldwide in 2004—after Saddam Hussein being pulled out of his spider hole—based on the number of world

result of Burt losing his medical 13 years ago because of heart surgery. He considered donating it to a museum. "We got it out and washed it, and I flat out could not bring myself to bring it down because it is the only example of this type in the world," he said. "It just seemed criminal not to have it out there flying."

Burt plans to bring the Boomerang to Oshkosh this year, along with the Catbird, a pressurized, single-engine aircraft with coast-to-coast range and high fuel efficiency. It, too, hasn't flown in years and has been hanging from the ceiling of a Scaled hangar in Mojave.

"If you look at my career for general aviation, there are some real significant designs. If I let the Boomerang and the Catbird go into museums, the examples that are out there flying are the ones that have mediocre performance," Burt said. "You've got to keep these airplanes flying, so that's what's going to happen."

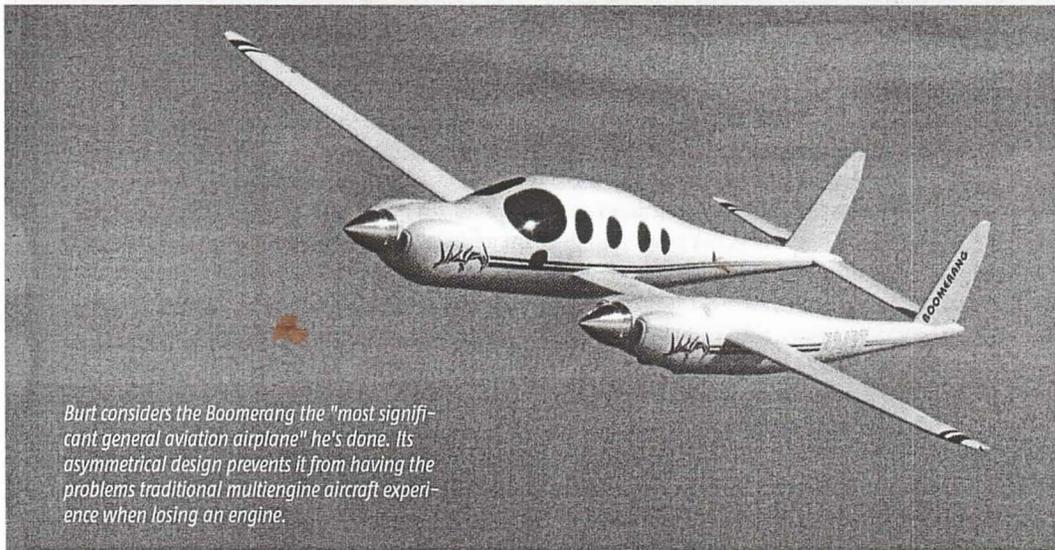
In fact, there is a group working on a turboprop version of the Boomerang that would have coast-to-coast range. But like many of Scaled's projects, Burt would not elaborate, deferring to the client to do the talking when the design goes public.

PROTEUS: A STEPPINGSTONE TO SPACE

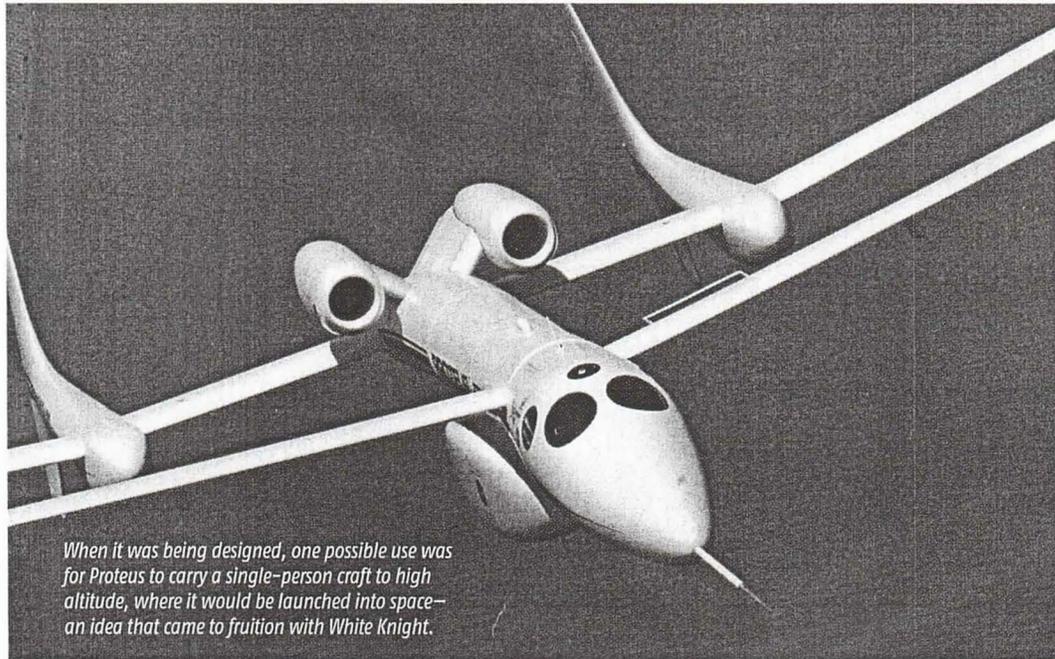
While two of his favorites haven't been in the air much in the past decade, keeping Proteus flying hasn't been a concern. Since Mike made its first flight in 1998, Proteus has flown a total of 3,000 or 4,000 hours. The large atmospheric research jet was one of the few designs that the company funded itself.

A small company came to Scaled because it wanted to develop broadband on demand with unmanned aerial vehicles (UAVs) circling cities. Scaled did a study and concluded it could work with manned aircraft. Scaled's parent company at the time thought it was worth the investment to develop the aircraft. To make it more justifiable and lessen the risk, Burt developed five other applications for Proteus. "One of them was a single-place manned spaceship for suborbital flight," Burt said. "Others were reconnaissance things, atmospheric research, that sort of thing."

While the initial idea to provide broadband never panned out, Proteus has been flown on projects for at least 20 different customers. It just completed a three-year research project for NASA, and it has flown atmospheric sampling missions with deployments to Australia and over the North Pole. It also was used for the initial glide tests of the X-37, and it was flown for approximately 1,000 hours to develop radar for the Global Hawk UAV.



Burt considers the Boomerang the "most significant general aviation airplane" he's done. Its asymmetrical design prevents it from having the problems traditional multiengine aircraft experience when losing an engine.



When it was being designed, one possible use was for Proteus to carry a single-person craft to high altitude, where it would be launched into space—an idea that came to fruition with White Knight.

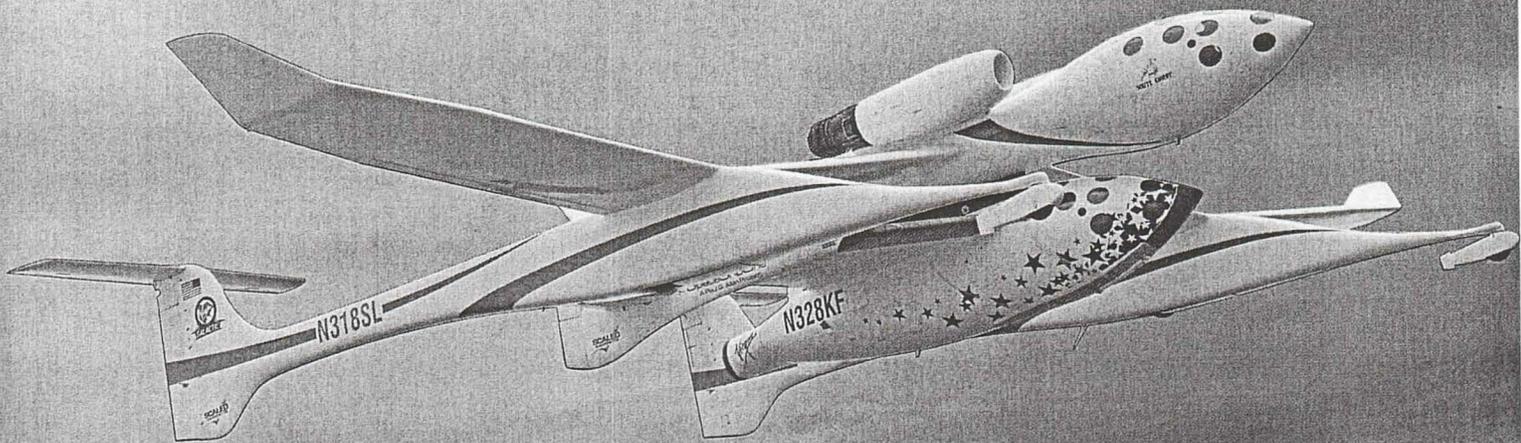
SpaceShipOne

Unquestionably, SpaceShipOne is Burt's crowning achievement to date. On June 21, 2004, Mike piloted SpaceShipOne to an altitude of 62 miles above the California desert, completing the first privately funded manned spaceflight in the history of the world. In October that year, SpaceShipOne flew to space for the second time in less than a week to claim the \$10 million Ansari X Prize.

"Nothing will top the SpaceShip," Mike said. "I mean, the goal was so ridiculous." When Burt first suggested to Mike that the technology existed to fly in space as a private company, Mike didn't think he was serious. "I just laughed in his face," Mike said. "I just thought, 'Poor old Burt, he's gone over the edge.'"

And that's exactly where they went—over the edge of space. The key to SpaceShipOne's success was the "carefree re-entry" made

SpaceShipOne in captive carry under White Knight. "We launched at 50,000 feet. The density of the air is so low, the indicated speed at Mach 1 is only 300 knots. The dynamic loads on the structure are a fraction of what they are on the shuttle." —Mike Melvill



departments of most companies are black holes, where money just disappears, only occasionally returning on the investment.

Despite the current size of the company, the specific programs still have small teams. "SpaceShipOne was a very big program, but the average number of people who worked on it, including shop and engineers, was 27, 28," Burt said.

Between the NGT and SpaceShipOne were many designs; some are widely known, like the Beech Starship and the Virgin Atlantic GlobalFlyer, in which Steve Fossett, EAA 562868, became the first pilot to fly solo around the world nonstop without refueling.

If you ask Burt and Mike which aircraft, besides SpaceShipOne, stand out from the Scaled years, names like ARES, a single-seat jet fighter concept, and Proteus, a high-altitude research aircraft, will come up. But the one they both point to as their favorite and perhaps the most significant design is the twin-engine Boomerang.

THE BOOMERANG

One look at the Boomerang, and you might ask yourself if it really flies. The first thing that's apparent is its asymmetrical design. It has two booms of differing length and width, both with engines in the nose. But the engine in the longer fuselage boom is a 210-hp Lycoming that Burt took from the Catbird, another of his favorite designs. The engine in the smaller left boom is only 300

hp. Why did Burt choose different engines? In 1996 he told Jack Cox it was because "that's what I had or could get cheap."

Besides the twin booms, the Boomerang has forward-swept wings, with the right wing longer than the left to lift the heavier fuselage section. The tail has two small vertical fins at the end of each boom, providing excellent low-speed handling. The horizontal tail goes between the two booms, yet it extends out beyond the rudder on the right side but not the left. "It's the subtle little things that he's done on that airplane that

Burt said. "It's the most special, most significant general aviation airplane I've ever done."

Mike, who was the test pilot for the Boomerang's first flight, said, "You can shut one engine down and feather it, and put your feet on the floor, take them off the rudder pedals, add full power or idle or anything in between, and you can still fly the airplane. There's no critical engine, which is weird."

The five-place aircraft has a range of 1,500 nm, cruises at 264 knots at 75 percent power, and stalls at 88 knots at maximum gross weight. "It is a remarkable airplane. It makes

"Anyone who flies multiengine general aviation will be shocked at the Boomerang's engine-out safety as well as performance. It's the most special, most significant general aviation airplane I've ever done."

—Burt Rutan

are really his and his alone. If you look at it, it's strange," Mike said.

Burt's goal was to design a high-performance twin without the safety issues normally associated with a multiengine aircraft. "Anyone who flies multiengine general aviation will be shocked at the Boomerang's engine-out safety, as well as performance,"

any general aviation, multiengine airplane look like a piece of garbage," Mike said. "I mean, that thing is very, very fast, it has enormous range, and it has unbelievable low-speed qualities. It takes no special skills to drive it. That is amazing. How the hell did he do that?"

The Boomerang has been in storage and hasn't flown for eight or nine years, mostly as a

So he can bring it to AirVenture 2011, Burt is taking his single-engine, pressurized, coast-to-coast-range Catbird down from the rafters of a Scaled hangar, where it has hung inverted for years.



Burt after a test flight of the Next Generation Trainer (NGT) prototype. This project, completed by the Rutan Aircraft Factory, gave Burt the idea to create Scaled Composites.



newspapers that reported the story above the fold on the front page.

“That was real heady stuff for a little company to have that kind of overall public attention,” Burt said. “The fact that a little company could indeed do a manned space-flight, whereas before it was only something that governments did, not companies. So that was huge. I didn’t see ever having that type of opportunity again.”

WHAT’S NEXT?

In looking ahead to what’s next, Burt first looked back at nine aviation pioneers who inspired him. He noted they were all between the age of 4 and 14 during aviation’s first technological growth spurt between 1908 and 1918. People like Wernher Von Braun, Kelly Johnson, and Charles Lindbergh.

“When you’re a kid you get impressed by what progress you see while you are growing up,” Burt said. “If everything is static, a kid tends to think, ‘This will always be static.’ Airplanes just blossomed—[by 1918] 39 countries were producing hundreds of airplanes, whereas only about 12 people had gotten off the ground to fly an airplane in 1908.”

Von Braun’s appearance on a Disney television show in 1955, in which he talked about going to Mars, impressed the 12-year-old Burt. The birth of manned spaceflight a few years later ushered in the second period of remarkable aerospace advancement that lasted through the Apollo years. Burt noted the people funding commercial space activities—Richard

Branson, Paul Allen, Elon Musk, and others—were at an impressionable age at that time. He hopes the projects these entrepreneurs are funding will be the next period of advancement to inspire a generation that desperately needs something to spark its imagination.

“They get impressed by the next iPad that has a camera, not by the fact we are exploring the moon,” Burt said of today’s youth. “That’s why I think it’s really important to have a breakthrough that allows the public to explore beyond the atmosphere. If that can happen, now we have something that can make a large impression on kids, and later on when they are adults they are the ones that will get us to colonize the moons of Saturn or head off to the stars.”

Burt certainly has done his part to move the technological needle forward. “I think my work has been more along the lines of what opportunities might be out there for significant breakthroughs, and either us or our customers have had the courage to try to develop something that may not work,” he said. “Did it work? Sometimes not. But when it did, it had the only opportunity available to provide any future improvement.”

Although he isn’t sure what he will do in retirement, it’s likely he will do some speaking engagements. In addition to the forums he does at AirVenture every year, Burt gives up to 40 talks a year on inspiration, creativity, and managing creative people. He speaks before management retreats, large symposiums, government events, and students in

his local area, and he expects to reach out eventually to his new community in Idaho to do educational events.

But before lectures become a bigger part of his schedule, Burt has at least one more aircraft to complete. “I’m working on my one now. I’m working very hard to do one more,” he said. While he declined to talk about it until it flies, he said publicly that he’s having fun building something with his hands, drilling holes and working with carbon fiber.

As for what’s next for Scaled, SpaceShipOne is the dominant project, but Burt mentioned the company also is working on electric propulsion, although he wouldn’t elaborate. Don Shane, EAA 238605, and Kevin Mickey, EAA 854546, will continue to run the company, and they have for some time, maintaining the culture Burt established to work on fun, innovative projects.

“His legacy, the thing that he’ll be most remembered for, is he really believes if you can dream it, you can achieve it. That really is Burt’s philosophy,” Mike said. “In his mind there is nothing he can’t achieve. And look at what he has achieved by having that sort of philosophy.” *EAA*

 **Steve Schapiro**, EAA 1018168, is senior editor of publications. He owns and flies a Piper Cherokee Arrow that has been part of his family since his father picked it up at the factory in Vero Beach in 1968. For more photos and links to past articles on Rutan aircraft, visit www.SportAviation.org