



## Elbert Leander "Burt" Rutan

American aerospace engineer noted for his originality in designing light, strong, unusual-looking, energy-efficient aircraft. He is often described as the "second true innovator" in the field of aerospace materials technology; his most important predecessor was German engineer Hugo Junkers, who pioneered the design of all-metal aircraft in 1915. He is most famous for his design of the record-breaking Voyager, which was the first plane to fly around the world without stopping or refueling, and the sub-orbital spaceplane SpaceShipOne, which won the Ansari X-Prize in 2004 for becoming the first privately funded spacecraft to enter the realm of space twice within a two week period

Born in Estacada, Oregon, 30 miles southeast of Portland, and raised in Dinuba, California, Rutan displayed an early interest in aircraft design. By the time he was eight years old he was designing and building model aircraft. His first solo flight piloting an airplane was in an Aeronca Champ in 1959, when he was sixteen. In 1965 he graduated third in his class from California Polytechnic University with a BS degree in aeronautical engineering.

From 1965 to 1972 Rutan worked for the U.S. Air Force at Edwards Air Force Base as a flight test project engineer, working on nine separate projects including fighter spin tests and the LTV XC-142 VSTOL transport. He left to become director of the Bede Test Center for Bede Aircraft, in Newton, Kansas, a position he held until 1974. At that time Jim Bede still had a powered version of a Schweizer SGS 2-32 sailplane which he had built with the intent of achieving a nonstop flight around the world. That effort had effectively ceased in 1969, before Rutan was hired (Bede had not announced that the project was stopped, but he had moved onto other projects, effectively abandoning it), but the aircraft was still part of the BTC.

Rutan returned to California in June 1974, to create his own business, the Rutan Aircraft Factory. In this business he designed and developed prototypes for several aircraft, mostly homebuilt. His first design was the Rutan VariViggen, a two-seat pusher single-engine craft of canard configuration. The canard would become a common feature of Rutan's designs.

In April 1982, Burt Rutan founded Scaled Composites, LLC, which has become one of the world's pre-eminent aircraft design and prototyping facilities. Scaled Composites is headquartered in Mojave, California, at the Mojave Air & Space Port.

Rutan is married to Tonya Rutan.



## The Rutan VariViggen

His first design, the VariViggen, which he began building in his garage in 1968, first flew in April 1972. It had the rear wing, forward canard, and pusher configuration design elements which became his trademarks. In lieu of wind tunnel testing, Rutan developed the aerodynamic parameters for the VariViggen using a model rigged atop his station wagon, and measuring the forces while driving on empty roads

The VariViggen was the Rutan model 27. A new set of outer wings, with winglets, was later developed by Rutan for the VariViggen, producing the VariViggen SP, Rutan model 32. The VariViggen was named in honor of the Saab 37 Viggen, a canard-configured fighter jet developed in Sweden. One VariViggen, built in France, was powered by two Microturbo TRS-18 jet engines in lieu of the usual piston engine

## VariEze and Long-EZ



Rutan VariEze homebuilt experimental aircraft

The VariViggen design led to the successful Rutan VariEze homebuilt experimental aircraft designs, in which he pioneered the use of moldless glass-reinforced plastic construction in homebuilts. In 1975 his brother Dick Rutan set a world distance record in the under-500 kg (1100 lb) class in the VariEze, and these aircraft went on to set other world records in this class.<sup>[1]</sup> They were also the first aircraft to fly with NASA-developed winglets.<sup>[2]</sup> The original VW-powered VariEze used by Dick Rutan to set the forementioned records was the Rutan model 31. The later, standard homebuilt VariEze was the Rutan model 33. Most VariEzes have been powered by Continental O-200 engines.



Vari Eze (1976)

Rutan later revised the VariEze design, providing more volume for fuel and cargo, resulting in the Rutan model 61 Long-EZ, designed to be powered by a Lycoming O-235, although some have used Lycoming O-320s or Lycoming O-360s.

### **Ames AD-1**

In the 1980s NASA issued a contract to Ames Industrial Company of Bohemia, New York to develop a small, low-cost aircraft to investigate Robert T. Jones's (a NASA researcher at NASA's Ames Research Center) oblique wing concept. Ames turned to Rutan, who designed a small, fiberglass airframe, powered by two Microturbo TRS-18 jet engines. This was the Rutan model 35, the Ames AD-1. After being tested at the NASA Dryden Research Center it was retired to the Hiller Aviation Museum in San Carlos, California.

### **Defiant**

Rutan next developed a twin-engined canard-configured aircraft, the Rutan model 40 Defiant. The aircraft was configured with the two piston engines mounted in the fuselage, one pulling and one pushing. After several years of use as Rutan's personal airplane a homebuilt version was developed, the Rutan model 74 Defiant. The prototype is now at the Hiller Aviation Museum

### **Quickie**

Rutan was approached by Gene Sheehan and Tom Jewett to develop a single-seat personal sport aircraft. A tandem wing configuration resulted from their collaboration. The aircraft was powered by a 22.5 hp Onan industrial engine. The prototype was the Rutan model 49. Quickie Aircraft then marketed a slightly improved version as the Quickie. This was the Rutan model 54 Quickie

Two derivatives of the Quickie were subsequently developed, both expanded to include two seats. Quickie Aircraft had Gary LaGare develop the Q2, while Viking Aircraft developed the Viking Dragonfly.<sup>[*citation needed*]</sup>

### **Amsoil Biplane Racer**

Dan Mortensen approached Burt Rutan about designing an aircraft for use in the Biplane Class at the Reno Air Races. Rutan chose a layout similar to the Quickie. The Lycoming O-290 powered aircraft was the Rutan model 68 AMSOIL Racer. The aircraft was first raced in 1981. In 1983 it crashed during a heat race. Pilot Mortensen sustained minor injuries but the airplane was destroyed. The aircraft was rebuilt for static display and was displayed in a bar at the Grand Sierra Resort in Reno, Nevada until 2008.

### **Grizzly**

Rutan designed the model 72 Grizzly to investigate the possibility of a STOL canard aircraft. It was retired after testing

### **Fairchild NGT Demonstrator**

Ames Industrial was contracted to build a twin-engine demonstrator of Fairchild Republic's design for the US Air Force's *Next Generation Trainer* competition. Ames contracted to Rutan to design and build the airframe. The aircraft, powered by two Microturbo TRS-18 jet engines, was the Rutan model

73. The aircraft was retired after test flights helped Fairchild win the NGT contract with the T-46 (although the T-46 . was later rejected by the USAF).

## **Voyager**



Rutan Voyager on display in the National Air and Space Museum

Rutan was approached by his brother Dick about designing an airplane that could fly nonstop, unrefueled around the world, something that had never been done before. Around-the-world flights had been accomplished by military crews using in-flight refueling. About this time, Quickie Aircraft was working on an aircraft for the same mission and Jim Bede had designed the BD-2 LOVE with that goal in mind, but had effectively given it up.

Rutan developed a twin-engined (piston engines, one pusher and one tractor) canard-configured design, the Rutan model 76 Voyager. The pusher engine would run continuously; the tractor engine would be used for take-off and the initial climb to altitude, then would be stopped. The aircraft was first flown with two Lycoming O-235 engines. After development work, it was reengined with a Continental O-200 (modified to include liquid cooling) as the pusher engine and a Continental O-240 as the tractor engine. Initially, MT propellers were used, but after several propeller failures, a switch was made to Hartzell propellers.

As a proving flight, Dick and his partner Jeana Yeager made a record setting endurance flight off the coast of California. In December 1986, they took off from Edwards Air Force Base in California and flew around the world (westward) in nine days, fulfilling the aircraft's design goals. The Voyager was retired and now has the honor of hanging in the *Milestones of Flight* exhibit in the National Air and Space Museum (NASM) main exhibit hall, with the Wright *Flyer*, Spirit of St. Louis and Bell X-1

## **Solitaire**

The Soaring Society of America opened a competition for a homebuilt, self-launching sailplane. Rutan designed the model 77 Solitaire for this competition, which it won. The sailplane was canard-configured, with a retractable engine ahead of the cockpit

## **Catbird**

Desiring a new personal airplane, Rutan designed a five-place, single-engined pressurized airplane, the Model 81 Catbird. The airplane was configured as a three-surface aircraft (canard, main wing, and tail). After serving as Rutan's personal airplane, it was retired. The Catbird is notable for winning the CAFE Challenge aircraft efficiency prize in 1993.

## **Lotus Microlight**

Rutan was approached by Colin Chapman, the founder of Lotus Racing, to design a single-seat ultralight aircraft. Again, a canard configuration was developed, the Rutan model 91. Colin Chapman's untimely death brought this project to an end, after the aircraft had flown

## **Beech Starship POC**

Beech Aircraft Company contracted Rutan to participate in the design of a twin turboprop business aircraft. Initial design studies (model 89) were for a three-surface aircraft. At Beech President Lyndon Blue's direction, the aircraft was instead configured like a scaled-up LongEZ, powered by two Pratt & Whitney PT6A engines, mounted on the wings in pusher configuration. The result was the Rutan model 115. An 85% scale prototype was built and flown. From this, Beech developed the Beechcraft Starship.

## **Predator**

Rutan was contracted by David Record to design an agricultural aircraft. Initially, a joined-wing design was chosen, the Rutan model 59. This was revised to a three-surface configuration, the Rutan model 120. A prototype was built and flight tested. After delivery to the customer, the airframe was destroyed in a crash, but the pilot was not injured

## **ATTT**

Rutan formed an expanded company, Scaled Composites, in 1982. DARPA contracted Scaled to design and build a special-mission utility twin aircraft. After studying several configurations, a three-surface design was chosen, the Rutan model 133 Advanced Tactical Trainer and Transport (ATTT). Powered by two Pratt & Whitney PT6A turboprops, this aircraft was built and flown. After initial testing, the conventional tail was replaced with a "Bronco tail". The aircraft is now retired and stored at Edwards Air Force Base

## **Triumph**

Scaled Composites was purchased by Raytheon, the parent company of Beech Aircraft. Rutan was tasked with designing a cabin twin aircraft that could alternatively be powered by piston, turboprop or turbofan engines. The resulting three-surface configuration aircraft was the model 143 Triumph. Construction started on two airframes, but only one was completed, powered by two Williams FJ44 turbofan engines. After being flight tested, the aircraft was retired and is now on display in the Plant 42 Heritage Air Park in Palmdale, California.<sup>1</sup>

## **CM-44**

California Microwave contracted Scaled to develop a slightly scaled up Long EZ for use as an optionally piloted UAV. The resulting aircraft was the model 144 CM-44. The aircraft, powered by a Lycoming O-360 was flight-tested and delivered to the customer

## **ARES**

After discussions with DARPA, Scaled began design of a single-seat turbofan ground attack aircraft. The canard-configured aircraft was the model 151 ARES. the aircraft was powered by a single Pratt & Whitney JT15D turbofan, offset to port, with a 30 mm cannon, offset to starboard. The aircraft was flown, tested and then stored for a number of years; in 2008 it was reactivated as a flight test vehicle

## **Pond Racer**

Concerned about the dwindling numbers of WWII aircraft, with many being consumed by use as Unlimited Class racers at the Reno Air Races, Bob Pond contracted Scaled to design an Unlimited

Class racer. The result was the Pond Racer. After design studies, a twin-engined, conventional configured layout was chosen. The aircraft was powered by two 1000 hp Electromotive-Nissan VG-30 3-liter GTP piston engines running on methanol. The aircraft was built and tested before delivery to the customer. It appeared at the Reno Air Races in 1991, 1992 and 1993. The aircraft was destroyed in a forced landing crash on September 14 1993, killing pilot Rick Brickert

## Boomerang

A departure from the canard design was the Scaled Composites Boomerang perhaps one of the unconventional designer's most unconventional aircraft. The aircraft, the model 202 Boomerang, is an asymmetric twin-engine tractor configuration aircraft with one engine on the fuselage and another mounted on a pod. A November 1996 *Popular Mechanics* feature article said it "looks more like a trimotor that lost its right boom and engine".

## Proteus

The Model 281 Proteus is a tandem-wing high-endurance aircraft designed by Burt Rutan to investigate the use of aircraft as high altitude telecommunications relays. Its first flights were in 1998. It holds several altitude records, set in 2000

## Spacecraft



SpaceShipOne now hangs in the National Air and Space Museum in Washington D.C. with the Spirit of Saint Louis and Bell X-1 "Glamorous Glennis"

Rutan made headlines again in 2004 with SpaceShipOne, which became the first privately built, flown, and funded craft to reach space in June of that year, winning the Ansari X Prize a few months later on October 4. SpaceShipOne completed two flights within two weeks, flying with the equivalent weight of 3 persons and doing so while reusing at least 80% of the vehicle hardware. The project team was honored with the 2004 Collier Trophy, awarded by the National Aeronautic Association for "greatest achievement in aeronautics or astronautics in America." The craft embodies Rutan's unique style, and is another of the "icons of flight" displayed in the NASM *Milestones of Flight* exhibit.

This achievement was quickly commercialized — Virgin Galactic, an offshoot of Sir Richard Branson's Virgin Group, announced that it would begin space tourism flights in 2008 using craft based on the designs of SpaceShipOne. Dubbed SpaceShipTwo, these new craft, also designed by Burt Rutan, are intended to allow six "experience optimized" passengers to glimpse the planet from 70–80 miles up in suborbital space. Production of the first of five planned SpaceShipTwo craft has started, with the first test flights currently scheduled for 2007-8. An explosion at the Scaled Composite factory at the Mojave Spaceport on July 26, 2007 killed three engineers and seriously injured three others. They were testing components for SpaceShipTwo, but as of August 2007 Scaled Composites remained dedicated to perfecting the design of SpaceShipTwo.

Richard Branson, on July 28, 2008, unveiled Scaled Composites White Knight Two "Eve," at the Mojave Spaceport. Flight tests were set to begin in September 2008.<sup>[7][8]</sup> The launch customer of

White Knight Two is Virgin Galactic, which will have the first 2 units, and exclusive rights to the craft for the first few years. Branson prophesied the maiden space voyage will take place in 18 months: "It represents... the chance for our ever-growing group of future astronauts and other scientists to see our world in a completely new light." Virgin Galactic contracted aerospace designer Burt Rutan to build the mothership and spacecraft.

Burt Rutan is also working with t/Space in the development of an air launched, two-stage-to-orbit, manned spacecraft. It is intended to have a taxi capacity to carry passengers to the International Space Station. As of June, 2005 air drop tests of quarter scale mockups had verified the practicality of air release and rotation to vertical.

## GlobalFlyer



On March 3, 2005, the Virgin Atlantic GlobalFlyer, an aircraft similar to the Voyager design, but built by Rutan's new company Scaled Composites, with stiffer materials and a single jet engine, completed the first solo non-stop, non-refueled flight around the world with adventurer Steve Fossett as pilot. Reducing weight was critical to the design, and Rutan is quoted as facetiously telling his staff that when they finish building a part, they must throw it up in the air for a weight test, and "If it comes down, it's too heavy".<sup>[11]</sup> Between February 7, 2006 – February 11, 2006, Fossett and the GlobalFlyer set a record for the longest flight in history: 41,467.53 km (26,389 miles), the third absolute world record set with this aircraft<sup>[12]</sup> before being flown to the NASM Steven F. Udvar-Hazy Center. Global Flyer is the sixth vehicle designed by Burt Rutan in the NASM collection.