

Virginia Aviation History Project Report

Norm Crabill



We had three replies to the Mystery Plane last time around. The first to respond was Bill Schultz, VAHS member and President of the Williamsburg Chapter, and the winner of the prize. This time's Mystery Plane is more mysterious, and has one unusual feature surrounding it. Check it out!

Sharon Dillon returns with her story on the Rogallos and their invention of the Paraglider, and Linda Burdette makes her debut with her story of early flying at the Richmond Fairgrounds. It must have been interesting to have been there then. I'll ask Neil.



Rogallo Had A Dream

by Sharon Dillon

Francis and Gertrude Rogallo had a dream. They followed that dream much to the delight of aviation buffs around the world. Francis said, "My intention was to give everyone the opportunity to experience flight first hand."¹ And he succeeded.

From his boyhood in Sanger, California Rogallo dreamed of flight. In 1912 he was born to a Polish father and a French mother who ran a hotel. As a child he had plenty of time to observe the birds and dream of flying free like them. He followed his curiosity and received an aeronautical engineering degree from Stanford University in 1935. The following year he was one of only four engineers chosen to work at the National Advisory Committee on Aeronautics at the Langley Research Center in Hampton, Virginia.

Rogallo thought aircraft wings should be able to fold like a bird's wings. He was interested in the concept of roadable aircraft and thought such a vehicle would be much more feasible if the wings could fold enough that the vehicle could be driven on roads and stored in a garage rather than being towed and stored in

a hangar. He did not pursue this aspect of aviation for very long, though he had one model that he drove in parades.

By the end of World War II Rogallo began experimenting with an idea for a flexible wing. However, NACA was not interested and did not allow him to use the 7 x 10-foot wind tunnel where he was section head. They said that he could experiment at home. This actually worked to Rogallo's advantage. Because any work done at NACA belonged to the agency. Work done at home belonged to him.

During that time Francis would create various designs and Gertrude would assemble the kites with supplies she had at home. In the meantime Francis rigged up a 36-inch fan in the hallway to produce his own wind tunnel. They tried kites of different sizes and shapes and with different numbers of strings.

The first completely flexible wing was made from Gertrude's kitchen curtains. Because the material was chintz it was less air permeable than other fabrics. Gertrude added interfacing to make the edges stiff. They and their children (Bobby, Carol, Bunny and Fran) tested these kites at Merrimac Shores, Buckroe Beach and Plum Tree Island. Regrettably, they never kept a log-book of their experiments. Instead Francis kept his notes on scraps of paper. Early designs had shapes that resembled boat sails. Later models were more similar to parachutes. The flexible wing was a hybrid design.



The Rogallo Foundation

The Flex Wing was really an In-House Program for the Rogallo Family. Frank and Gertrude with three of their children with an early Flex Kite.

In 1948 they finally designed and successfully tested a semi-rigid model made of translucent plastic. This design, without any struts or spars, became known as a Flexi-kite. This model was so successful that they applied for a patent. Three years later the patent was issued in Gertrude's name. The patent approval came as a shock to the patent attorney who didn't think the kite would fly. They also invented a gliding parachute about this time.

For a while the Rogallos made and sold Flexi-kites at Virginia Beach. Eventually, Arnold Clark Company, the maker of Silly Putty, persuaded them to sell their rights to the design. Francis designed a special tube for storing the kites. Models were sold at LL Bean and FAO Schwartz. However, the Clark Company could not find a satisfactory manufacturer so the Flexi-kites went off the market. Not all is lost, however. Their granddaughter Carol is a teacher who makes models for gifts and for her students to fly in science class. While they were pleased with this success the Rogallos felt that "toys should copy real thing and not the other way around."²

While the Flexi-kite did not become a best-seller the technology changed aviation. As early as 1952 Rogallo suggested that flexible wings might someday be useful for space commuters. In 1954 he presented this concept to the Air Force Research and Development Command. Shortly thereafter he unsuccessfully submitted proposals to NACA to include parawing research in the budget and to the Institute of Aeronautical Sciences (IAS). Both rejected the idea.

After the Russians (then called the United Soviet Socialist Republic) launched Sputnik I in 1957 NACA gave Rogallo approval to do some wind-tunnel and model testing in the 7 x 10-foot wind tunnel. In late 1958 after NACA became NASA, he presented his results to the Langley Committee on Aerodynamics and others became interested. In 1959 he tested cloth parawings in the 4-foot supersonic pressure tunnel at Mach 2. Other models were tested at altitudes of 150,000 to 200,000 feet at nearly Mach 3 at Wallops Island.

Early space capsules used parachutes to slow entry speed and then landed in the ocean and were retrieved by Navy divers and moved to the ship for transport. In the early 1960s Rogallo proposed that NASA could use a controllable paraglider to recover the Apollo capsules on land. This inflated fabric flexible wing (parawing) design was tested and finally rejected for both the Gemini and Apollo programs. The idea was to pack the “parawing like a parachute until the spacecraft fell to about 60,000 feet, at which time an elaborate unstowing and unfurling process began. By 20,000 feet if all went well, the descending spacecraft would turn into the world’s heaviest hang glider, suspended under a dart-shaped parawing. The astronauts themselves would then bring the soaring craft down to a landing either on water or on soil.”²²

By late summer of 1959 Warner Von Braun became interested and invited Rogallo to give a presentation at NASA Huntsville. From that time until early 1961 Rogallo was busy presenting his concept to various technical groups including the Society of Automotive Engineers, Ryan Aeronautical Company, North American Aviation and Institute of Aeronautical Sciences.

As 1960 drew to a close Ryan Co. began building a powered man-carrying ultra-light aircraft known as the Ryan Flex-Wing. Rogallo was there to witness the first flight. Then in early 1961 NASA Marshall awarded contracts to Ryan and North American to study the possibility of using parawings to recover Saturn boosters. Later that year Ryan won a contract to perform test-flights on the Flex-Wing. This was later tested at the Langley full-scale wind tunnel. After that research on this simple technology increased rapidly.

By 1963 it looked like parawings would be the retrieval method of the future. In a special ceremony Rogallo gave NASA license to use his designs royalty-free. He said, “We feel confident that the civil and military agencies of the government will carry on this work, and we hope private industry will promote use of the concept for business and pleasure as effectively as they have for astronautics and military



aeronautics.”²² In a separate ceremony NASA presented a check for \$35,000 to the Rogallos for developing the flexible-wing concept.

Research moved forward at NASA Langley and among many NASA employees who continued studying the designs on their own time and with their own equipment at the Outer Banks of North Carolina. This study included the concept of a flexible lifting surface to ride frame gliders with conical and cylindrical canopies. NASA was planning to use the technology on the Mercury Mark II, later called Gemini flights. They believed this would provide a controlled glide and a horizontal landing. They were even thinking ahead to space station studies. In mid-1963 NASA made 12 manned flight tests at Edwards Air Force Base with a Parasev (Paraglider Research Vehicle).

Because of the rush to get to the moon the paraglider concept was pushed aside. According to a quote from Richard Hallion, “Eventually, because of poor test results and rising costs and time delays, the idea was dropped from Gemini in mid-1964. FRC engineers and pilots believed that any vehicle so equipped might present a pilot with a greater flying challenge than contemporary advanced airplanes.”²²

By 1964 NASA decided to use water landings for the Apollo spacecraft and the paraglider project was cancelled but research at the Langley Pawing Project Office continued until 1967.

The Rogallos remained committed to the concept and continued research at Nags Head, North Carolina. They began experimenting with aluminum coated Mylar in 1963. That didn’t last long because some people flying the aluminum coated Mylar kites attached tails of the same substance. Occasionally, the kite tails became entangled with power lines causing severe shock to the kite flyer and power outages. They then switched to a coated Mylar. The Rogallos were among the first to use the newly developed Mylar. When they read of Mylar they wrote to the DuPont Company for a supply of it to use in their experiments.

By 1967 the Rogallos had developed a powered delta wing vehicle that was then manufactured by Ryan Company. This was the start of ultralight aircraft that millions enjoy. Then the some Australian researchers began to use this technology to develop the hang glider. Francis celebrated his 80th birthday in 1992 by going hang gliding at the Kitty Hawk dunes where the Wright brothers first flew their fixed wing aircraft.

Their technology has lead to ultralights, hang gliders, paragliders, delta kites, stunt kites and revolutionized parachutes. The more controllable rectangular shaped parachutes come from their research.

Over the years the Rogallos have received many honors. Among them are:

- Induction into the Space Technology Hall of Fame in 1995
- Induction into the First Flight Shrine at the Wright Brothers Memorial at Kill Devil Hills, North Carolina
- Smithsonian Air and Space Award in 1992
- A film called Der Traum des Francis Rogallo (The Dream of Francis Rogallo) was made in Germany by Charlie Jost
- The Rogallo Foundation was formed in 1992 to support aeronautic research and education and dedicated to honoring F.M. Rogallo, inventor of the flexible wing and the “father of hang gliding”
- The Rogallo Foundation Hall of Fame for sports pioneers was established in 1997

Both Francis and Gertrude are still living at their Kitty Hawk home.

References

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Crabill, Norman and Wonsey, Marguerite, December 16, 1998 a videotaped interview with Francis and Gertrude Rogallo at their Kitty Hawk, North Carolina home

Sharon Dillon is a freelance writer who lives in Williamsburg. She has nine years experience writing for newspapers and regional magazines. Her love of aviation was boosted dramatically during the seven years she worked for the Wisconsin Bureau of Aeronautics as an aviation education outreach coordinator. Her story on VAHS member Buz Rich was featured in the Jan/Feb/March 2005 issue of the *Eagles*.



Richmond Fairgrounds

by Linda Burdette

In the very early days of aviation, flying was viewed by the majority of the population as an oddity – something undertaken by the most adventurous or fool-hardy of folk. It is no surprise that people decided that airplanes and aviators were most appropriately viewed at State fairs and fairgrounds. Such was the case with Richmond. The first flights in the Richmond area occurred at the grounds of the State Fair of Virginia, what is now North Boulevard and Hermitage Road/Sherwood Avenue. The State Fairgrounds encompassed a large area and had one large public exhibition hall, originally called the Administration Building and later the Richmond Arena. For aviation related events, the fairgrounds, racetrack, and grounds surrounding the arena were used as runways and the building was used for a hangar and maintenance. See map on the next page.

In 1909, the city fathers in Richmond apparently saw the potential in aviation and the Mayor approved aerial demonstrations from the State Fairgrounds. The State Fair officials began a campaign to have demonstrations by all of the aircraft manufacturers of the time. During the next three years, they managed to persuade three manufacturers to perform to the delight of the local population. Since they always managed to schedule these "demonstrations" during the State Fair, the question remains whether their goal was entertainment or the promotion of aviation, but in the end they accomplished two goals - free entertainment for the crowds and promoting aviation in the hearts and minds of future aviators.