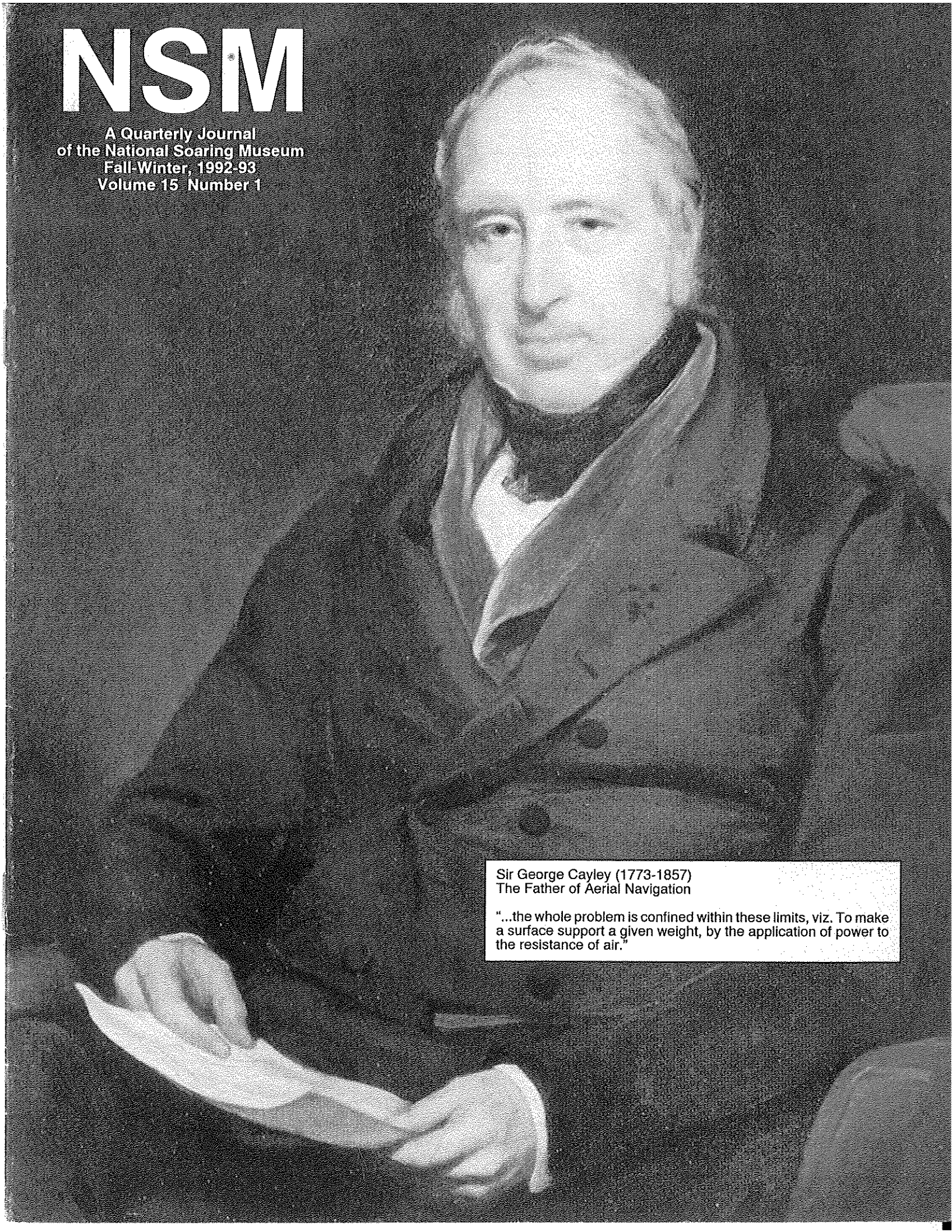
NSM

A Quarterly Journal
of the National Soaring Museum
Fall-Winter, 1992-93
Volume 15 Number 1



Sir George Cayley (1773-1857)
The Father of Aerial Navigation

"...the whole problem is confined within these limits, viz. To make a surface support a given weight, by the application of power to the resistance of air."

The NSM Unveils A Planned & Major Gifts Program

The National Soaring Museum is approaching its 25th anniversary, and when one looks back on what has been accomplished, it is impressive -- even breath-taking.

Originally conceived by a group of Harris Hill soaring enthusiasts and endorsed by the Soaring Society of America, the Museum has grown from a modest beginning at the Merrill House with a collection of only 4 sailplanes to a modern exhibit, restoration, and storage facility whose collection includes over 60 ships -- the largest collection of vintage and modern sailplanes in the world.

As a result of this distinguished and unique collection, the Museum has become a national cultural treasure whose archives, artifacts, and library preserve for all generations to come the history, science, and traditions of motorless flight.

And we're planning for the future now -- not only with a forward-looking schedule of new exhibits, commemorative celebrations, and educational programs, but also with a program to ensure the future financial well-being of the mission with which we've been entrusted.

The Planned and Major Gifts program, while supporting the Museum's future security, can also offer you current financial benefits within your own estate and financial plan.

Your Benefits

- Planned Giving can enhance your retirement benefits with additional lifetime income agreements for you and a second person if you like.
- Planned Giving can increase your current income.
- Planned Giving can increase your current assets by decreasing your income tax obligations.
- Planned Giving can offer special planning options that allow you to avoid capital gains tax in the management of appreciated assets.
- Planned Giving can increase the size of the estate you leave to your children.
- Planned Giving allows you and your family to become forever associated with the perpetuation of our national soaring heritage.

SIR GEORGE CAYLEY SOCIETY

Recognizing Those Who Support the National Soaring Museum With Planned or Major Gifts

The Planned Giving Options

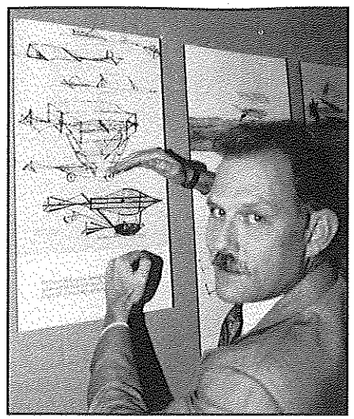
The two most widely used plans are gifts to establish Lifetime Income Agreements and gifts by Will or Revocable Trust.

Lifetime Income Agreements

This is an agreement in which you can make a sizeable cash or capital asset gift to the Museum and reserve lifetime income for you and/or another person. The Charitable Remainder Unitrust and the Charitable Remainder Annuity Trust are two common examples of this agreement. Brochures are available if you would like more information about either of these agreements.

Gifts by Will or Revocable Trust

A gift by Will (bequest) is perhaps the most common planned gift. You can make a provision for the future of the Museum while at the same time reserving for you and your family the full ownership and use of your assets. When your will is probated, the amount of the bequest provides you with an estate tax deduction.



NSM's Advancement Director, Michael Ziomko, considers the graphic of Cayley's man-carrying glider as one of the options for a Museum pin honoring membership in the Cayley Society.

The Museum's Advancement Office can assist you with suggested wording.

A gift by Revocable Trust works in a similar way except that you, some other individual, or some institution acts as the trustee of your assets until they are distributed. Many people choose this vehicle, because it allows them the privacy of bypassing probate. Brochures on either of these gift methods are available on request.

There are many other options which the Museum will discuss in detail in the resumed publication of Musings, now entirely devoted to timely articles on planned giving.

Your Recognition

In memory of the "father of aerial navigation", Sir George Cayley, the Trustees of the Museum have established a society to honor all those who make a planned gift, or who make an outright gift of $50,000 to the Endowment, whether as a single gift or as multiple gifts whose cumulative value equals $50,000.

You may establish an endowment fund, in your name or the name of someone you wish to remember or honor, to support specific aspects of the Museum's mission such as archives, education, or restoration. You may make a general gift to the Endowment, or you may choose to make the gift with absolutely no restrictions.

As the national treasure of soaring, the Museum is grateful for your support.

Please send me more information about the Cayley Society and the Museum's Planned and Major Gifts program.

I am especially interested in _____ Lifetime Income Agreements _____ Gifts by Will or Revocable Trust

Name: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Michael Ziomko, Advancement Director
National Soaring Museum
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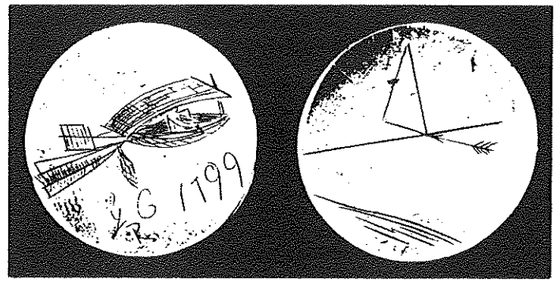
ON THE COVER

Sir George Cayley, the 6th baronet in the family line was born in Scarborough, Yorkshire in 1773. (1)

Charles Dollfus, a modern French authority, referred to him as, "The true inventor of the aeroplane and one of the most powerful geniuses in the history of aviation." (2)

He expressed his conviction that human flight required less force than might have been supposed and he categorically rejected the concept of using beating wings to produce lift. In 1809 he wrote in Nicholson's Journal of Philosophy, "...the whole problem is confined within these limits, viz. to make a surface support a given weight, by the application of power to the resistance of air."(3)

While many gifted visionaries, experimenters, exhibitionists and tinkerers preceded Cayley, most failed to even understand the problems they were attempting to solve. Through the centuries some hard-won aeronautical verities were recorded, but would-be aeronauts rarely bothered to find out what their predecessors had accomplished, and progress was dismally slow. (4)

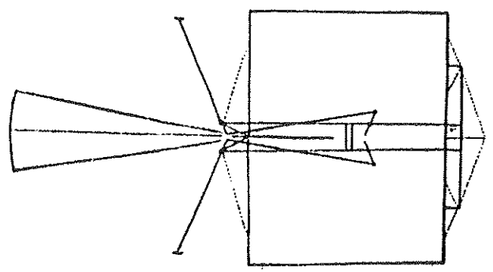


Engraved on a silver disc by Cayley, in 1799, this is regarded as the first design for an aeroplane with wing, fuselage, tail unit and a means of propulsion (paddles) divorced from the lifting system.

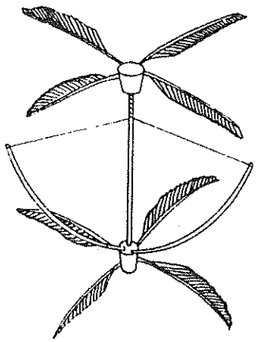
There is general agreement among aero-historians that Cayley was the first to investigate the possibilities of flight from a strictly engineering and scientific perspective. He knew that the secrets of flight lay in the nature of air itself. He understood that air offered varied and measurable resistance to objects moving through it. He knew that its density was not constant and great unseen currents and eddies existed. (4)

This seemingly limitless element supported bats, insects and birds; he set out to show that it could support humankind as well.

Before he died in 1857, at the age of 84, Cayley had discovered the basic principles on which the modern science of aeronautics was founded, built what is recognized as the first successful flying model glider, anticipated the airship and the present-day convertiplane, and built and tested the first man-carrying flying machine. (5)



Cayley's drawing of his 1799 fixed wing design, the first modern configuration aeroplane.



Cayley's 1796 helicopter design. The opposite-rotating rotors were made of feathers stuck into corks and activated with a bow string. A similar device was tested in 1784 by Launoy and Bienvenu.

The ten-year-old Cayley was enthralled when he learned of the Montgolfier Brothers' first hot-air balloons in 1783. He began in 1796 by making a small toy helicopter in which two rotors, consisting of feathers stuck in corks, were driven by a bow string. Unbeknown to Cayley, a similar device had been demonstrated at Paris in 1784, before the Academy of Sciences by Launoy and Bienvenu.

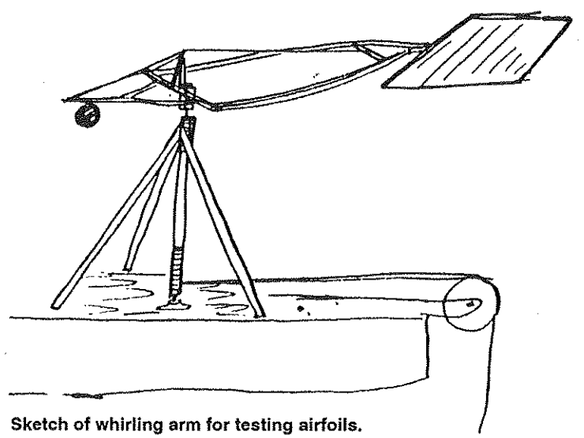
By 1799 he had advanced far enough to engrave a small silver disc showing the forces of lift, thrust and drag acting on a wing surface. On the reverse he engraved an initialled sketch, in perspective, of a fixed wing glider with a fuselage below containing a pilot. The device had a tail unit of horizontal and vertical control surfaces and a set of manually worked flappers for propulsion. As Charles H. Gibbs-Smith commented, "We have here, in the last year of the 18th century, the aeroplane of today in embryo; it marks the start of a new epoch and the true beginning of practical aviation." (6)

Cayley built a whirling arm apparatus in 1804 that enabled him to study the air pressure on a one-foot-square plane set at various angles of incidence.

With his recognition of the true significance of the kite, later that same year Cayley constructed history's first successful airplane. It was a five-foot-long model glider with a kite-like wing set at a 6 degree angle of incidence, mounted on a pole/fuselage. The cruciform tail unit was attached by a universal joint to act as a shifting rudder and elevator control. The model had a movable weight fore and aft to adjust the center of gravity. (2)

In 1809, he constructed and successfully flew a full-scale glider with a wing area of 200 feet. Cayley actually tested this ship carrying a young boy for a few yards at a time on his Brompton Hall estate.

His experiments led him to conclude that curved surfaces produced more lift than flat ones; the curvature creating lower pressure



Sketch of whirling arm for testing airfoils.

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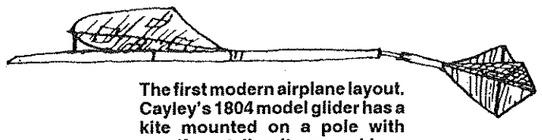
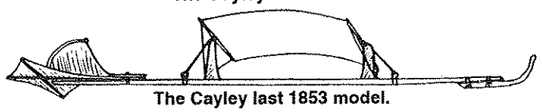


The first modern airplane layout. Cayley's 1804 model glider has a kite mounted on a pole with cruciform tail-unit secured by a universal joint.

The Cayley 1849 model.



The Cayley last 1853 model.

above the wing. He also suggested that superimposed wings (biplanes and triplanes) would increase total lift with minimum structure weight. He showed with great clarity the advantage of building wings with a dihedral (a flat vee from the front view) for lateral stability.

In 1843 Cayley designed a convertiplane arrangement based on the drawings of Robert Taylor. According to historian Gibbs-Smith, Cayley turned Taylor's convertiplane into history's first biplane and the first twin-airscrew design. (1)

He constructed many subsequent models and, in 1849 built a full-size triplane glider that was launched free in ballast, and later flown (and towed) with a boy aboard.

In 1853, according to a story told by his granddaughter, Cayley inveigled his very reluctant coachman into making a trial glider flight drifting across a shallow valley and bumping down in a cloud of dust. "Please, Sir George," the distraught driver/pilot shouted, "I wish to give notice: I was hired to drive not to fly." (4)

The scholarly Yorkshire baronet's inquisitiveness was not restricted to matters or flight alone. Gibbs-Smith shows that Cayley, "...researched and invented in many other fields, mechanical and social, such as land reclamation, unemployment relief, artificial limbs, theater architecture, railways, lifeboats, finned projectiles, optics and electricity."

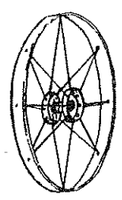
Some of his applied science inventions include the tension-spoked wheel, the expansion air engine (the hot-air engine) and the caterpillar tractor.

Cayley found time to write poetry, and served for a short time as Member of Parliament for Scarborough.

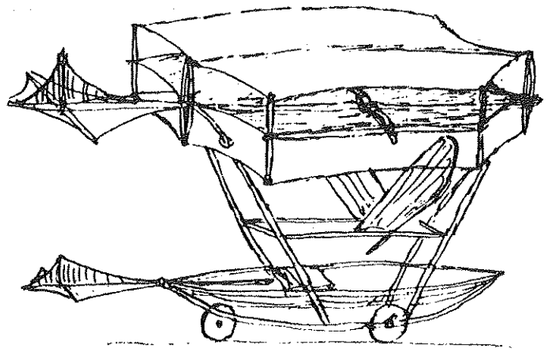
Sir George Cayley is the great-great-great-grandfather of the present Duchess of Kent (nee Katherine Worsley). (2)

The NSM's Sir George Cayley Society is well-named as the recognition of those donors whose gifts are planned for the future development and support of the Museum. It is only fitting that we remember the first true aeronaut as we plan for the preservation of the heritage of motorless flight.

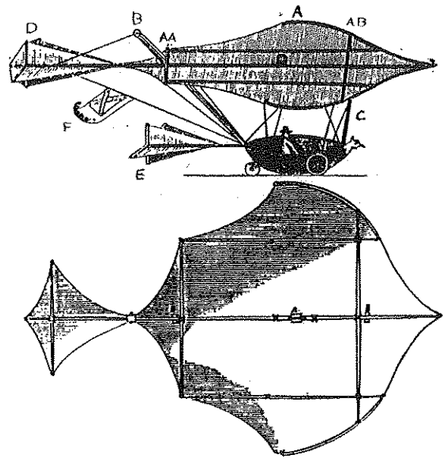
Those wishing more information on the fascinating and little-known historical figure may wish to read the well-illustrated: "Sir George Cayley Aeronautics 1796-1855" by Charles H. Gibbs-Smith M.A., F.M.A. Companion R.Ae.S., Science Museum, Her Majesty's Stationery Office, 1962, by The Curwen Press Plaistow, London, E.13.



Cayley 1849-53 advanced design for the tension spoked wheel.



Cayley's sketch of his 1849 boy-carrying glider showing the triplane wing structure, tail arrangement and wheeled car with moveable rudder/elevator and propulsion flappers.



Cayley's 1852 glider designed to be launched from a balloon with inherent longitudinal (pitch) and lateral (roll) stability and cruciform tail design for flight control.

A-wing
B- Elongated supporting strut and supporting cable for tail trim
C-Front supporting strut
D-Cruciform elevator and rudder trim
E- Pilot-operated elevator and rudder
F-Flag
AA-Trailing edge spar
AB- Leading edge spar

Cayley
Born at Scarborough Dec. 27, 1773
Became the 6th Baronet on the death of his father, 1792 and married Sarah Walker, daughter of his first tutor in 1795.

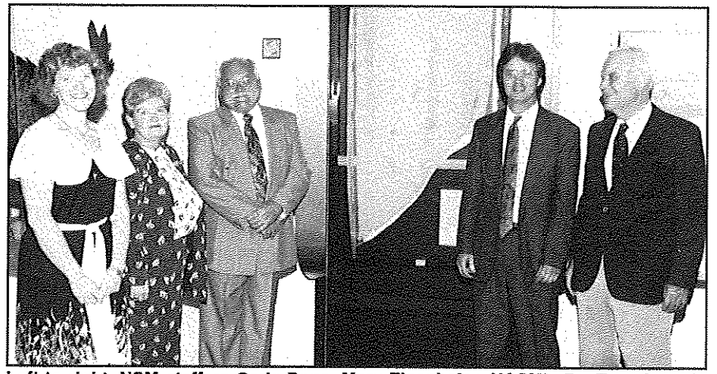
(1.) Sir George Cayley's Aeronautics, 1796-1855 - Charles H. Gibbs-Smith, 1962
(2.) Aviation - An Historical Survey From the Origins to the End of WWII, Charles H. Gibbs-Smith
(3.) Aviation, the Pioneer Years, researched and edited by Ben Mackwaith-Read - 1990
(4.) The American Heritage History of Flight
(5.) The Lore of Flight, advisor and supervising editor John W. R. Taylor
(6.) See (2) pg. 21
(7.) Incidence - the angle formed between the chord line of an airfoil and the longitudinal axis of the body supporting the surface.

1992 COMMUNITY SOARING DAY, SEPT. 19

★ WRIGHT FLYER FABRIC SHOWCASE
★ DEDICATION-RECEPTION-BANQUET
★ FALL KITECITEMENT
★ SAILPLANE RIDES - STATIC DISPLAYS
★ NSM OPEN HOUSE
★ E.O.G.A.S.E.SAILPLANE MODEL EXHIBIT OPENING
★ ADDRESS BY NASM'S DR. TOM CROUCH

There were fluttering kites and wheeling sailplanes over The Warren E. Eaton Motorless Flight Facility and Harris Hill Park Saturday, September 19, marking the First Annual Community Soaring Day. More than 1,000 people visited the Harris Hill Soaring Corporation and NSM outdoor towplane, vintage and modern sailplane displays.

Museum Trustee and Exhibit Committee Chairman, Paul A. Schweizer announced the opening of the 122-model "Evolution Of Gliders And Sailplane Exhibit." The showing features detailed scale models of historic motorless flyers with specs., dating from the end of the 19th century to the 1990's. Three years in the making by Chairman Schweizer and his committee, the exhibit started with a compilation of significant ships. Then a search of the archives was begun for plans, photos and design information on selected gliders and sailplanes. A call went out to modelers from all over the world to take part in the project. Those responding were asked to craft specific miniatures for this NSM showing. "EOGASE" will be officially dedicated during the May 1, 1993 U.S. Soaring Hall of Fame weekend.



Left to right, NSM staffers Carla Page, Mary Flasphaler, NASM's Dr. Tom Crouch, exhibit designer Robert Mulley and NSM trustee and Exhibit Committee Chairman Paul A. Schweizer, at the new Wright Fabric Showcase. (Circle on panel behind Mr. Schweizer shows location of fabric from the Flyer's lower right wing tip.)

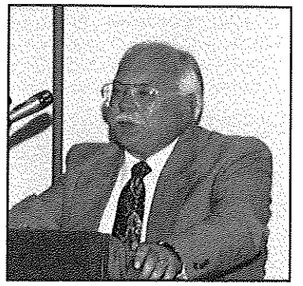
Community Soaring Day NSM tours were given during open house. At the banquet following the Wright Fabric Showcase dedication and reception, Dr. Tom Crouch, Chairman of the Department of Aeronautics of the Smithsonian Institution's National Air and Space Museum, and prize-winning author, spoke on the Wright Brothers and their accomplishments.

Dr, William Guerry Howard, Chairman of the NSM Community Soaring Committee and VP/Public Relations, HHSC, said, "It is difficult to relay, for those who were not able to attend, the sense of excitement, fun and pride we had at this event. The weather was perfect and there were more people on the hill at one time than I have ever seen, with the exception of soaring contests." **(See NSM NEWS Newsletter September/October 1992, Vol. 2 No. 5)**

The National Soaring Museum joins the Smithsonian Institution National Air and Space Museum and the U.S. Air Force Museum, as the only two other museums in the world to possess a significant piece of the fabric that covered the wing of the original Wright Flyer. This was the aircraft that Orville Wright piloted on history's first successful, powered, controlled flight, at Kitty Hawk, NC, December 17, 1903.

Schweizer explained how the fabric was given to the NSM.

The story starts in 1983 when the exhibit committee, planning ahead to 1986, decided to mark the 75th anniversary of Orville Wright's famous soaring flight by constructing a reproduction of the Wright #5 glider. Information was scant and no drawings of the



Dr. Tom Crouch, chairman of the Dept. of Aeronautics of the Smithsonian Institution, National Air & Space Museum.

ship existed, so Paul and Ginny Schweizer went out to Dayton's Air Force Museum and Wright State University for more definitive material.

The Schweizers then visited and interviewed Horace Wright, a nephew of the famous brothers and his wife, Susan, in nearby Xenia, OH. Horace Wright's father, Loren, was the second brother of the five Wright children, Orville, Wilbur, Reuchlin, and Katherine.

Ten-year-old Horace and his father were at Kitty Hawk on Oct. 24, 1911, when Orville made his record soaring flight in the Glider #5. **(NSM-Winter 1986-87, Vol 9, No. 3, "Orville, Wilbur and the Wright Expedition - Recollections of Mr. and Mrs. Horace Wright.")** This was the machine that the NSM sought to repro-

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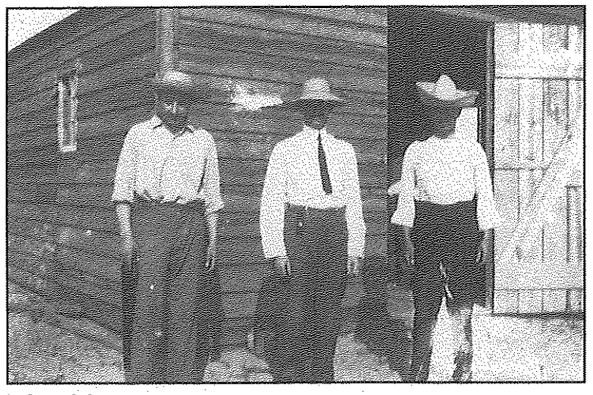
duce. Horace did not specifically recall the spectacular 9-minute and 45-second flight because Orville's log showed that it was just one of over 20 that day. However, Horace or "Buster" as the family nicknamed him, did have a very clear and colorful memory of the events of the October 10-27, 1911, Kitty Hawk expedition.

The Schweizers invited Mr. and Mrs. Wright, along with the National Air and Space Museum's founder and Curator Emeritus, Dr. Paul E. Garber (since deceased) and Dr. Tom D. crouch, now Chairman of the N.A.S.M.'s Department of Aeronautics to come to Harris Hill for the October 1986, NSM, 1911 Glider #5 exhibit and celebration.

Arrangements were made through the Corning Glass Aviation Department to have its jet fly the Wrights to Elmira and return. "This was one of the biggest thrills of their lives," Paul said, "...and as a result,

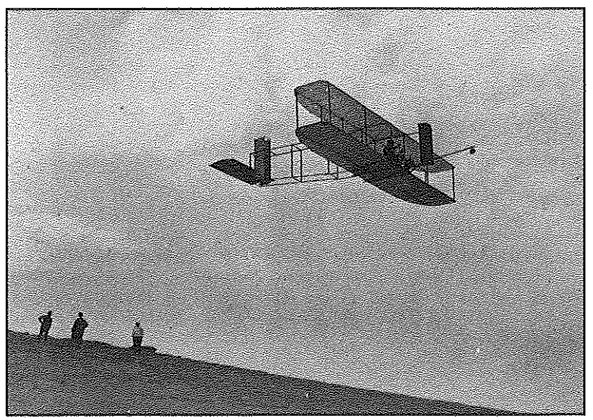


Left to right
Alexander Ogilvie, Orville's friend from England, Orville Wright and Lorin Wright, Horace's father standing in front of a 1911 Kitty Hawk Expedition Camp Building.

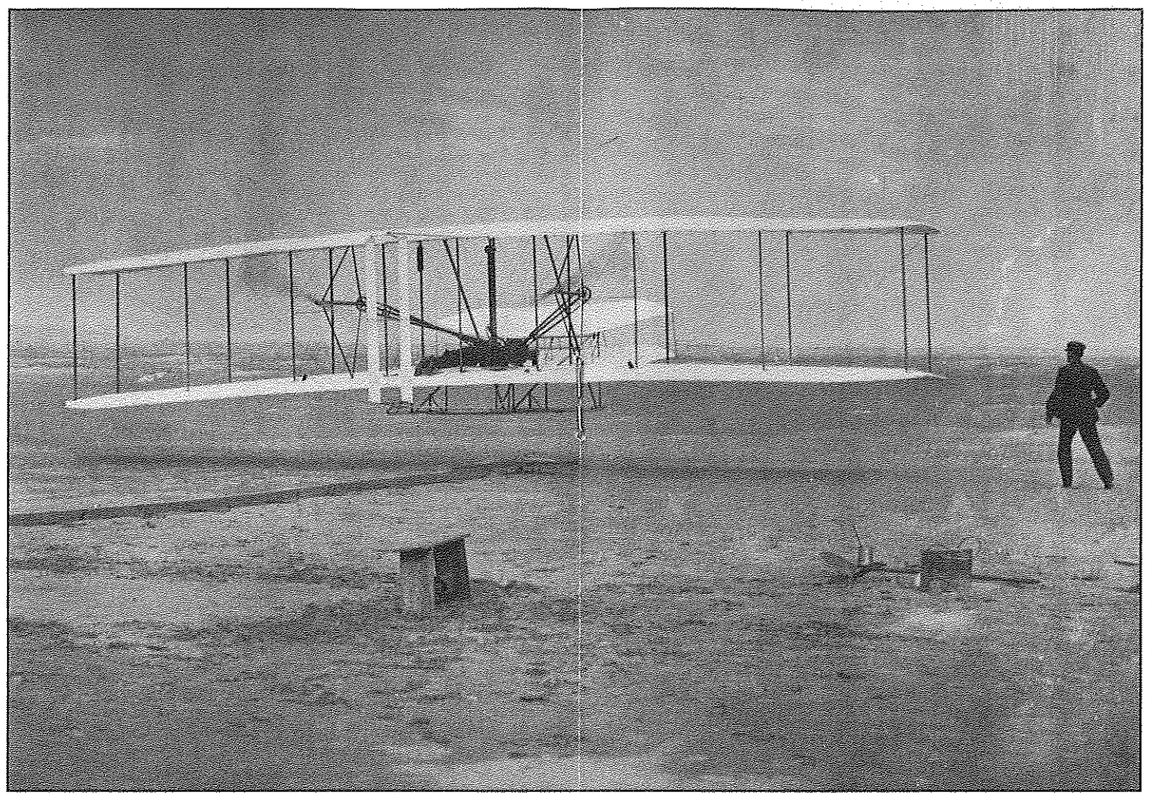
Horace, who had the remaining major piece of the 1903 Flyer fabric, decided to give it to the NSM. Unfortunately, before he could do this, he passed away."

His wife advised the NSM of her late husband's wishes and asked that a museum representative go there to pick up the fabric because it was much too valuable to ship through regular channels.

The Exhibit Chairman continued: "A presentation was made there in Xenia and on the way back we stopped at the 50th Anniversary of the Philadelphia Glider Council where the fabric was officially turned over to Charlie Smith, our director."



Orville Wright's record 9-minute 45-second soaring flight on October 24, 1911 at Kitty Hawk, NC. The world's only full-scale reproduction is on exhibit at the National Soaring Museum.



Probably the most famous aviation picture of the 20th century, Orville Wright's 12-second-120-foot flight: the world's first, 10:35 A.M. December 17, 1903 at Kitty Hawk, NC. Orville instructed John Daniels, of the Kill Beach Life Saving Station to snap the picture when the Flyer was at the end of the launching rail.
The fabric in the NSM's showcase is from the lower right wing tip.

Schweizer said that 90-year-old Susan Wright was unable to attend the Community Soaring Day but was pleased with the dedication.

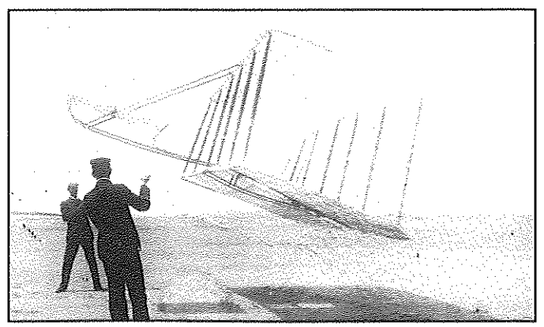
Dr. Crouch, considered the foremost Wright Brothers authority, was next on the program. He is current Chairman of the Department of Aeronautics at the Smithsonian's National Air and Space Museum. Previously, he was Chairman of the Smithsonian's Department of Social and Cultural History of the Museum of American History; prior to that he was Curator of Engineering and Industry Division and also Associate, then Curator of Astronautics and Aeronautics at the NASM for 11 years. He has written nine books, including the 1989 prize-winning, "The Bishop's Boys - A Life of Wilbur and Orville Wright."

Dr. Crouch is a lecturer at George Washington University, the University of Maryland and other advanced learning centers. He is responsible for many of the Air and Space Museum exhibits.

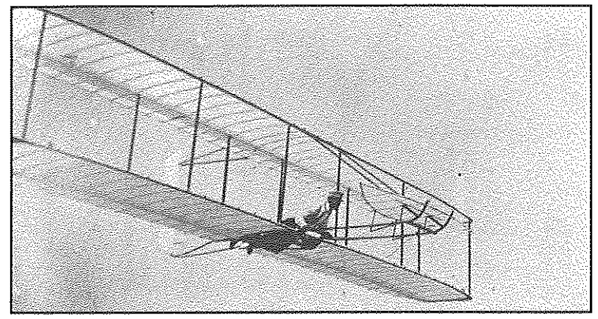
"Like a lot of writers I know," Crouch chuckled, "I really say what I want to say better on paper than standing at a podium. The Wrights were like that too. Orville absolutely refused to speak in public and Wilbur was the same way." Crouch recalled an incident in 1909 when Wilbur Wright, coaxed into speaking before the Ohio Society of New York, remarked: "Well, I almost said no to this invitation, but I said 'yes' because it was the Ohio Society...I can only think of one bird that can talk, the parrot, and parrots don't fly very well."

Crouch said that the fabric from the 1903 Flyer meant a great deal to Horace Wright. He said it was not just a piece of cloth that the Wrights wrapped over the wing ribs. Because of the wing's construction the fabric is actually an integral part of the structure of the airplane. The ribs fit inside fabric sleeves, so that the wing warps properly, thereby allowing the torsion on the wing. Without this fabric arrangement, the wing structure literally falls apart.

A slide show followed during which Dr. Crouch described the work of the pioneering aeronauts up to the time of the Wrights. He illustrated the Brothers' step by step progress from kites to the 1902 glider which was, arguably the world's first airplane. (This segment of the talk was repeated and expanded in Dr. Crouch's address given the following month at the NSM's 19th Annual Ralph S. Barnaby Lecture in Washington, DC. Entitled "Gliders, The Route to Powered Flight," the lecture is reviewed, starting on page 9 in this journal - Ed.)



The Wright's second glider, the 1901, being flown as a kite. It had a moveable forward elevator but no rudder. Turns were made by "warping" or twisting the wings.



Wilbur Wright flying the 1902 glider with controllable vertical rudder. The design of the glider incorporated data from the Wright's 1901-02 wind tunnel tests.

Returning to the Wright fabric story, Dr. Crouch stated, Wilbur had passed away in 1912, a victim of typhoid fever and in 1913, Orville was invited to show the 1903 airplane. At that time he was involved in the beginning of a feud with the Smithsonian Institution. The result was his wish to restore the original Flyer.

Orville took all the old pieces out of boxes, repairing, fitting and reassembling them to completion in 1915. When the 1903 Flyer was rebuilt, however, he did not put the original fabric back on. The fabric that had been on the plane, December 17th, the day when it became the world's first airplane, was ultimately split up among the family members, Horace included.

Crouch said, "We have a big swatch at the Smithsonian and the Air Force Museum has some swatches too. So essentially, that's how your fabric got here in the first place."

1993 CALENDAR OF EVENTS

DATE	EVENT	LOCATION
Feb. 26	Board of Trustees meeting at SSA Convention	Seattle, WA
May 20-22	EOGASE Model Designer/ Builder/Sponsor Symposium and Dedication Board of Trustees Annual Meeting U.S. Soaring Hall of Fame Induction Ceremony & Banquet	NSM
July 9-10	50th Anniversary - WWII Glider Pilots Symposium Annual Vintage Sailplane Assoc. Regatta & Membership Meeting	NSM/Harris Hill
Sept. 18	Annual Community Soaring Day/KiteCitement	NSM/Harris Hill
Sept. 21	Richard C. DuPont - National Soaring Landmark Dedication	Waynesboro, VA
Oct. 23	Ralph S. Barnaby Lecture	San Diego area
Dec. 3	Annual Community Soaring Luncheon	NSM

For further information contact:
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Harris Hill RD#3
Elmira, NY 14903

THE WRIGHT BROTHERS: SINGLE-MINDED GENIUSES

Composite photograph of the Wright family. From left to right: Wilbur, Katharine (sister), Susan (mother), Lorin (second brother), Milton (father), Reuchlin (eldest brother), Orville.

During a question and answer period following his talk, Dr Crouch called the Wrights technical geniuses. "If you really want to study the process of invention, how innovation and technology work, the way it's supposed to work, study the work of the Wright Brothers."

He continued, "If you want to understand how to do business, look at almost anybody but the Wright Brothers. These guys were raised by a father who had a backbone of iron. He was a bishop in his church and created two major schisms in that church over matters that everyone else thought were minor, at best."

The Brothers apparently had a very difficult time dealing with the outside world. Crouch said that their problems with Glenn H. Curtiss were, in large measure, a reflection of the difficulty they had doing business and trying to understand other people.

In answer to another question, the speaker said that the Wrights abandoned all their gliders at Kitty Hawk with the exception of the 1903 powered Flyer. "They went back to Dayton in 1903," he said. "They had only flown 800 feet. It was a sustained flight and was long enough to convince them that they had things under control. Bob Newhart used to do this comedy routine where he played the Wright brothers press agent and he would be back in Dayton talking to Wilbur down at Kitty Hawk. Wilbur was telling him about the flight and the press agent would say, "Well, how far did you fly Wil?...800 feet?...That's not going to cut our time to the coast by much..."

Back in Dayton Orville and Wilbur flew as secretly as they could in 1904 and 1905. They transformed the sort of marginal success of 1903 into the really practical airplane of 1905.

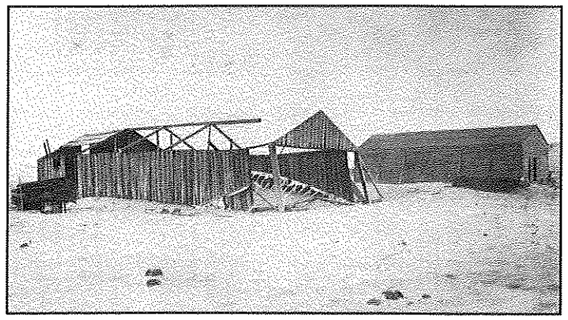
Another questioner wanted to know why the Wrights abandoned their machines at Kitty Hawk if they were aware of their historical value.

Crouch responded that the Wrights were engineers. Orville and Wilbur felt that the gliders left behind at Kitty Hawk were nothing more than tools for gathering data. He added, "I guess we have a vision of the Wrights being like Lilienthal, a romantic fellow who loved flying...The Wrights were really pretty hard-nosed and cold-blooded about this stuff...when all of the information was wrung out of machine, its useful life was at an end. I think we're lucky because they saved the world's first airplane...in view of their record, they might well have left it laying there on the beach, too."

A query arose as to the Wrights' education. Neither finished high school. Wilbur actually completed high school but the family moved before his graduation. Their formal education didn't have much to do with it, according to the speaker. He added that the mathematical level required for the invention of the airplane was of a fairly low level. "If you've been through Algebra II, you can basically deal with lift and drag problems that they faced," he said.

Dr. Crouch closed by saying, "What the Wrights needed couldn't be taught...it's that ability to image technology; to imagine a machine and know how that machine might behave through forces acting on it. That's the intuitive genius of the Wright Brothers; that and their clear ability to see problems and to define them."

Judging from the comments throughout the day-long program, the First Annual Community Soaring Day was an outstanding success. Visitors left Harris Hill with a much better understanding of the vitality of the soaring movement and with kudos to Dr. Tom Crouch for his description of America's motorless flight heritage.



This 1908 photo shows the weather's effect on the Wright Brothers sheds at Kitty Hawk. The remains of the 1902 glider are in and around the shed at left.

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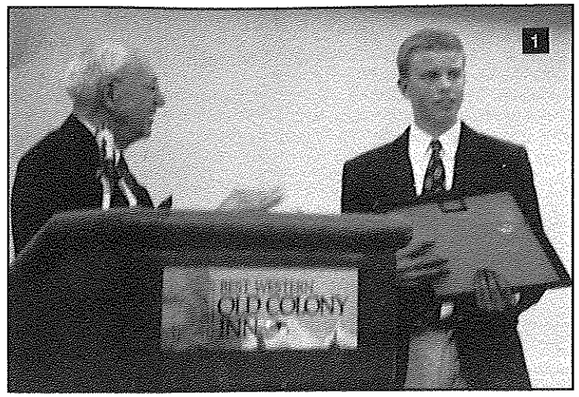

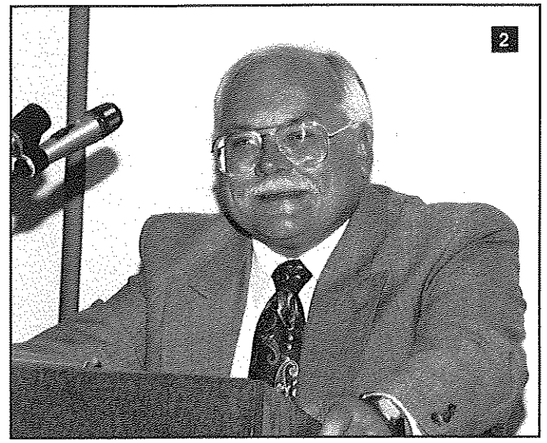

NSM's 19th ANNUAL RALPH STANTON BARNABY LECTURE PROGRAM:

Dr. Tom E. Crouch, "Gliders - The Road To Powered Flying, 1880-1903"

1st National Gross Sky Ghost Youth Achievement Scholarship

The National Soaring Museum in conjunction with the Mid Atlantic Soaring Association hosted the 1992 19th Annual Barnaby Lecture program October 24th at Alexandria, VA. Master of ceremonies and NSM Trustee Bernald Smith welcomed the banquet audience and reviewed the background of the annual Barnaby Lectures. **(See sidebar)**

Began in 1973, addresses are examinations of historic and noteworthy achievements in motorless flight by outstanding personalities in the field. They are named after the late Capt. Ralph S. Barnaby, USN, and each year the lecture is held at a different location. **(NSM Quarterly, Fall 1991, Vol 14, No. 1)**

The evening's program started with the 1st National Gross Sky Ghost Youth Achievement Scholarship presentation. Dr. Frank Gross, Akron, OH, built America's first two-place, dual-control glider in 1931, The Sky Ghost. **(NSM Quarterly, Summer 1985, Vol. 8, No. 1)** "This 4-place glider was one of the true forerunners of the WWII cargo gliders," Bernald Smith said introducing Dr. Gross. The pioneering sailplane designer and builder presented the $500 scholarship to Kurt John Asdal, Wurtsboro, NY. Asdal, an engineering student at the State University of New York, Geneseo, will use the award to further his soaring activities. Gross said, "This recognition is designed to give a hand to youth in soaring. They need to be encouraged and be active. Kurt Asdal is the first national winner in a new generation of sailplane pilots." **(Photo 1)**

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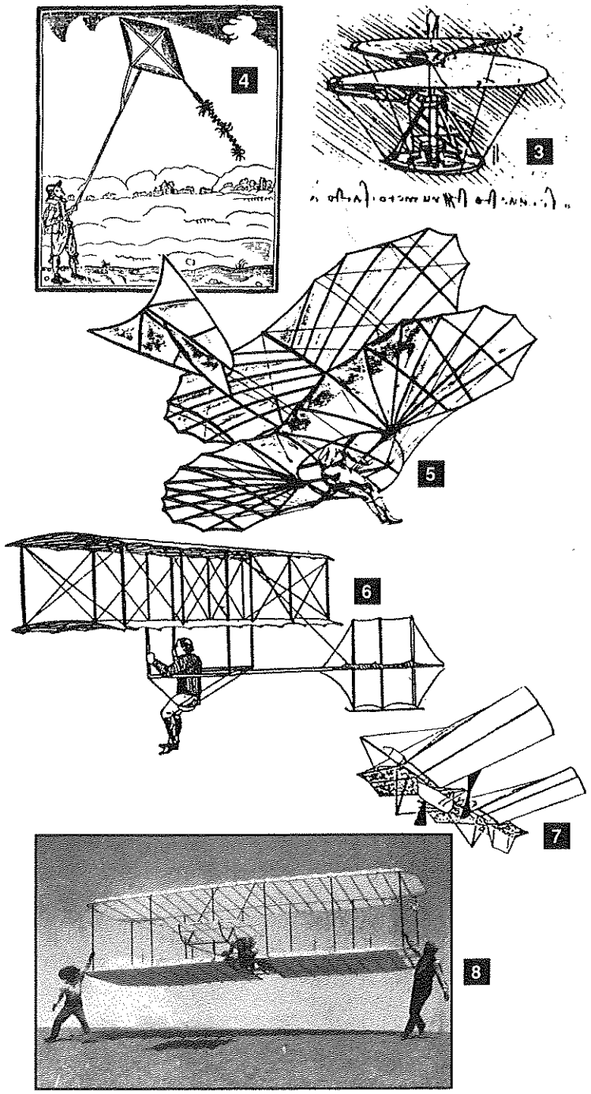

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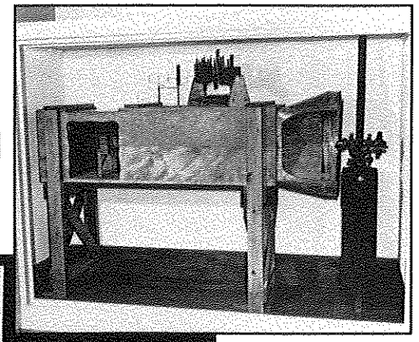

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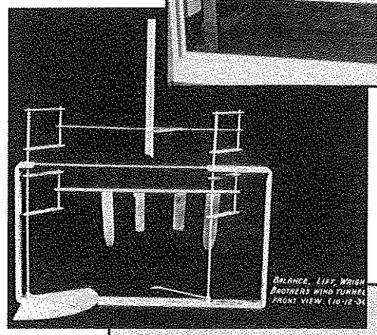

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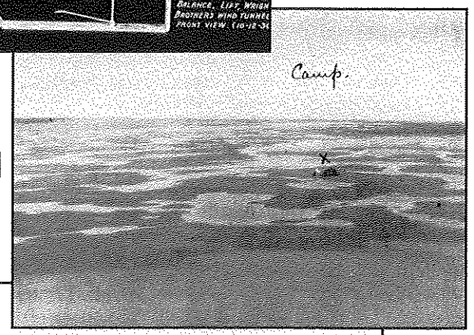

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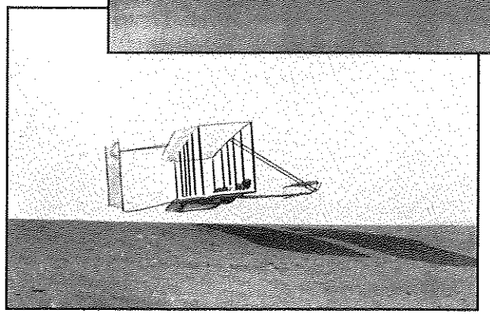

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Smith next introduced the 19th Annual Barnaby Lecturer, Dr. Tom Crouch, as "A person of high achievement, award-winning author, historian, teacher, and chief of the Aeronautics Department of the Smithsonian Institution's National Air and Space Museum. He has written and talked about everything from the Japanese internment in the western US during WWII to Charles Lindbergh." **(Photo 2)**

Dr. Crouch opened his remarks by saying what a privilege it was to have his name added to the list of previous Barnaby lecturers, "Capt. Barnaby and Paul Garber were great friends of mine for many years."

Crouch said that Len Deighton, the British mystery writer, commented in one of his non-fiction airplane books that, when talking about the invention of the airplane you can forget about Wilbur and Orville Wright...Give credit to a guy named Charlie Taylor, the machinist who made the engine for the Wright Flyer."

"The engine of that airplane was nothing," the speaker said, adding, "The heart and soul of what that airplane was all about had nothing to do with the propulsion system...It had to do with the aerodynamics of the airplane, particularly control, and that came out of gliding."

Wilbur and Orville really did invent the airplane in the truest sense of the word and to do that they had to take a quantum jump beyond what anyone had done before, Crouch said emphasizing, "it is absolutely, positively rooted in gliding."

He said that successful flight and the study of the human mind were born at about the same time, in the late 19th century bordering into the early 20th century. "The early psychologists and psychiatrists like Freud, Jung and Adler, people who were studying the human mind were fascinated by this flying machine stuff that was going on at the same time."

Crouch mentioned that Freud believed that the desire to fly was probably one of the few innate dreams that human beings have always had. It was the one gift that man could see in action all the time, birds in flight, and it was denied to humans. The ancients dreamed of gods that flew; that's why wings were put on the great heroes of flight like Daedalus and Icarus.

The lecturer showed a slide of the history's oldest powered flying machine, a 13th century toy helicopter with string attached. Kites from China made their European debut during the 13th and 14th centuries. **(Photo 4)** They are closely related to gliders as aerodynamic devices and from them a great deal was learned on how to build up a powered machine. There were lots of dreamers in the centuries before the Wrights, Da Vinci **(Photo 3)** being the best known for his helicopter, parachute, and flying machine designs.

"The awful truth about all these earlier centuries," Crouch emphasized, "is that almost nothing was learned...There's nothing for anybody who honestly wanted to build an airplane."

Sir George Cayley was the first to take a step in the right direction. Inventor of the first true glider, he is referred to as "The Father of Aeronautics." **(See Cayley's story in this issue.)**

The Cayley glider had a lot in common with today's airplanes. It has a separate system of control where the tail was set at an angle of incidence and had a special system for lift in its kite wing. Cayley talked about a separate propulsion system. Cayley was the first to treat lift, control and propulsion separately and attempt to integrate them in his designs.

"Cayley, in all likelihood, sent the first human being aloft," Crouch said.

He continued that if you were an engineer in the late 19th century and were interested in learning how to fly, you only had two choices. You could build models and fly them. But the real stream of learning and development was with the other choice, gliding.

LeBris, Mouillard, Montgomery and many others built a number of gliders after 1870, but made very few flights.

The great pioneer of the 19th century was Otto Lilienthal, the single most important figure between Cayley and the Wright Brothers, the speaker said. **(Photo 5)** He was a successful engineer when, in 1890, he turned to designing flying machines. He made 2,000 flights until the 1896 hang-glider crash in which he was killed.

Crouch said that the problem lay in control. The only control that Lilienthal exercised was the degree to which he could move the center of gravity of his aircraft by shifting his own body weight.

"There are a couple of implications here," the lecturer explained. "If you have a really big wingspan glider, then shifting your body weight (moving the center of gravity) will not be enough to exert control...And, with this size glider it is possible for the machine to enter into an attitude too acute to correct by shifting body weight. This is what happened to Lilienthal when his hang-type glider spun-in, resulting in his death in 1896...It is impossible to overestimate the influence that Lilienthal's accomplishments had on people all over the world."

1896 was a very important year for another reason: Samuel P. Langley, head of the Smithsonian Institution successfully flew a powered flying model over the Potomac River. **(Photo 7)**

Among those who followed Lilienthal's work closely in this country was Octave Chanute, a French-born, American railroad engineer. By the middle 1890's Chanute was in his 60's and too old to do any hang gliding himself, but he supported young engineers who were interested in flight. In 1896 he conducted a series of glider tests on the Lake Michigan sand dunes that resulted in the classic biplane glider, with a wing structure based on the Pratt Truss concept used

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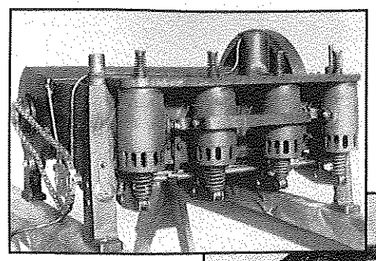

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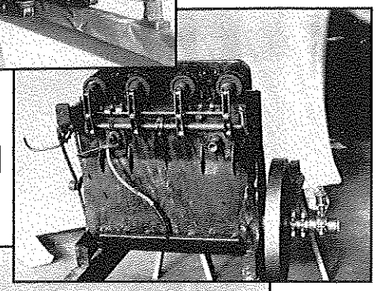

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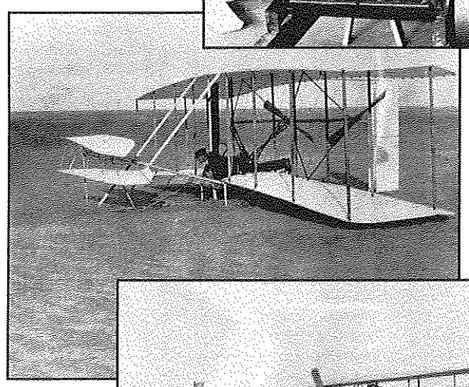

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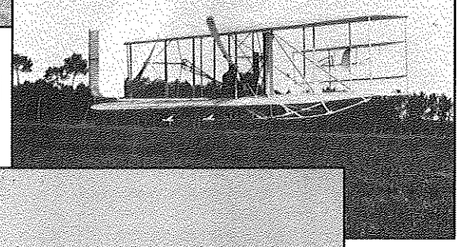

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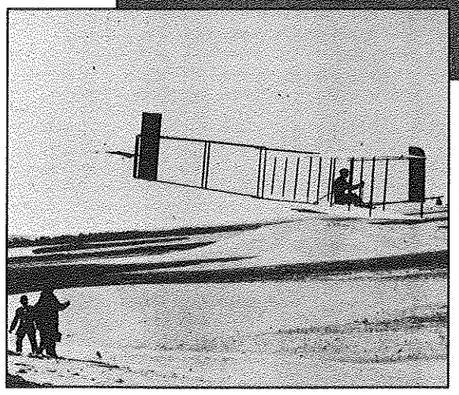

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in building railroad bridges. **(Photo 6)** This was an idea that the Wright Brothers were going to make use of.

At that time Orville and Wilbur were small Dayton businessmen running a bicycle shop and a printery. "Just making enough to keep body and soul together...and in the latter 1890's were looking for a challenge...flight," Crouch said.

The Brothers knew all about mechanics and they knew that lightweight engines were being developed by others. They decided that flying machine control would be their focus of interest.

Wilbur and Orville's first Kitty Hawk effort was the 1898-99 kite. Then came the 1901 glider which was not successful. Although it was engineered and worked out on paper, the 1901 was about 20% shy of its predicted lift. **(Photo 8)**

Serious questions arose concerning the validity of the data that they had gathered from the experiments of Lilienthal and others. "If they had known that these engineering errors existed when they began, the Wrights probably wouldn't have started... At that point they almost quit," Crouch said. Instead, the Brothers built a bicycle-mounted lift-testing contraption that confirmed their suspicions that their data was erroneous. Needing more information, they constructed a wind tunnel. Although the Brothers did not invent this device, they were the first to use it in solving specific engineering problems. **(Photo 9 and Photo 10)**

The cleaner designed 1902 was their next glider. **(Photo 11, The Kill Devil Hills, 1902, during a rainy period)** The aspect ratio and the wing separation were much different on this ship and several other modifications were incorporated, all as a result of the newly acquired wind tunnel data. "This one acted exactly as it was supposed to," Crouch said. "It was in fact, the world's first airplane." **(Photo 12)**

The Wrights' patent, granted in 1906, was for the aerodynamic control system represented in the 1902 glider; they never patented the 1903 powered Flyer.

The Wrights still had a couple of problems to solve before they made the transition to powered flight, however; the engine and the propeller. The latter proved to be tougher than expected, as marine propeller designs were not based on theory but on empirical data. The Brothers crafted propellers that had an amazing 66% efficiency, based on their recently computed Aerodynamic tables. The four-cylinder engine that Charlie Taylor helped them build, developed a little over 12 1/2 horsepower when heated up. It weighed about 160 pounds without magneto, water or oil. **(Photos 13 & 14)**

They were at the Outer Banks longer in 1903 than at anytime before, and finally had the ship assembled in December. On the morning of the 14th, Wilbur won the toss of a coin for the first flight. As he came chugging down the monorail guide and took off, he nosed up too far, stalled and damaged the forward elevator in the thump that followed. **(Photo 15)**

When repairs were made, it was Orville's turn. On the morning of the 17th, with Wilbur guiding the wingtip, the Flyer sputtered along the rail and into the air for a little over 10 seconds, covering 120 feet. Four flights were made that day, Wilbur's 59-second, 800-foot hop being the most successful. Unfortunately, as the Flyer was sitting on the rail after the last flight it was up-ended and smashed by a sudden gust.

It wasn't until the end of the 1904 flying season that the Wrights did as well as the fourth and last flight the previous year.

Toward the end of the 1905 season they were staying aloft for over one-half hour, making 25-mile flights and circling a local cow pasture repeatedly. By this time the media had taken notice and the brothers stopped and resolved not to fly again until their patents had come through and contracts for the sale of the plane were signed.

They were on the ground until the Spring of '08, when they received their first contract. Wilbur flew in France **(Photo 16)** and Orville at Ft. Myer, VA. This was the year that they flew in public for the first time and were finally accepted as the inventors of the airplane.

Thereafter, they flew all over the world, established the Wright-Dayton Company, established an exhibition team, built airplanes and taught people to fly. "Hap" Arnold, WWII commander of the Army Air Forces, learned to fly at their flying school in 1910.

After 1910-11 the Wrights began to move away from aeronautics. Wilbur died of Typhoid Fever in 1912, but Orville kept going. Gradually he became an honorary figure, a sort of "grand old man of aviation."

"I guess it's interesting to note that toward the end of his own flying career, Orville went back to gliding in 1911," Crouch said. "He had built an automatic pilot device and decided to go back down to Kitty Hawk to test it with the glider. When he got down there, he discovered that his automatic pilot device didn't work all that well, so he just continued to glide for the fun of it."

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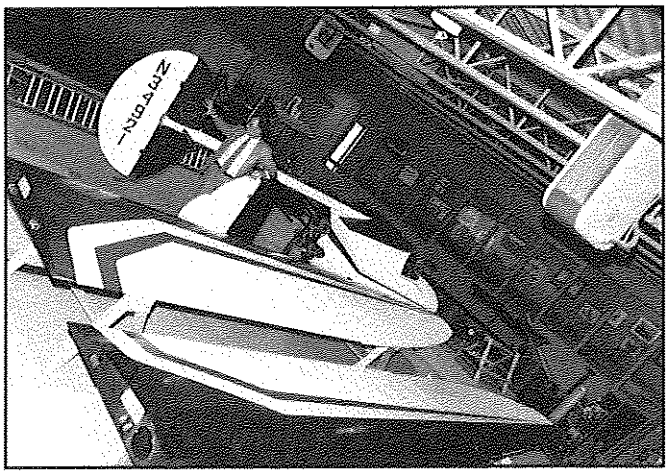
The speaker said that during the '11 Kitty Hawk expedition, it was the **(Photo 17)** first time in history that an airplane really soared, gained altitude and stayed airborne for any length of time.

Orville flew powered planes after that but not to any extent. "I really think that was one of the last times he really had a good time flying," the Barnaby lecturer opined.

Dr. Crouch closed by saying, "I hope you can see how all these things are linked together and recognize the role that the glider played in the invention of powered flight."

Following the lecture, NSM president George Edwards presented Dr. Crouch with a Resolution of Appreciation from the Board of Trustees for his "...unselfish labor and contribution of time and effort in connection with the Wright Flyer Fabric Exhibit at the National Soaring Museum and in appreciation for the delivery of the 19th Ralph S. Barnaby Lecture."



NSM's Michael Ziomko With recently Acquired Nelson/Bowlus Dragonfly

The Nelson/Bowlus Dragonfly was the first powered glider to be produced in the U.S. and was donated to the NSM by John Steen, Ada, MI.

A development of the Bowlus Baby Albatross in 1945, the first version was called the "Bumblebee."

The Dragonfly features 2-place, dual control, side-by-side seating with a fully retracted tricycle landing gear and a steerable nose wheel.

Hawley Bowlus designed it, and the marketing was sponsored by the Nelson Engine Co. as a vehicle for their 2-cycle 4-cylinder engine. The powerplant developed 25 hp at 3900.

Seven Dragonflys were built.

Specifications

Span	47.3 ft.
Area	169 sq. ft.
Aspect ratio	13.25
Empty weight	580 lbs.
Payload	360 lbs.
Gross Weight	940 lbs.
Wing loading	5.56 lbs./sq. ft.

Structure: Molded plywood cockpit pod, aluminum boom, 2-spar wood wing with plywood D-tube, fabric cover aft of spar.

Performance

L/D max	est. 18
Climb @ 48 mph	235 fpm
Take-off, Sea Level	900 ft.

The National Soaring Museum Annual Ralph S. Barnaby Lectures

Date	Lecturer/Title/Location
Oct. 23, 1973	Ralph S. Barnaby "Barnaby Reminisces" Franklin Institute, Philadelphia, PA
Oct. 5, 1974	Stanley W. Smith "Gliders & The Space Program" Dayton, OH
Nov. 1, 1975	A. J. Smith "The Competitive Spirit in Conjunction With Master of the Wind" McLean, VA
Oct. 29, 1976	Karl Striedieck "1,000 Miles Along The Alleghenies" Falls Church, VA
Nov. 12, 1977	E. J. Reeves "Early Days of Soaring in Texas" Dallas, TX
Sept. 9, 1978	Karl Striedieck & Tom Smith "World Gliding Championships: Chateauroux, France" Elmira, NY at Dedication of the National Soaring Museum Building
Nov. 17, 1979	Dr. Paul McCready, Jr. "The Soaring Background of the Cross Channel Man-Powered Flight of June 12, 1979" Los Angeles, CA
Nov. 8, 1980	Dr. Richard P. Hallion "Gliders in the National Air & Space Museum" Boston, MA
Oct. 17, 1981	Thomas Page "Thinking About Safety" Chicago, IL
Oct. 9, 1982	Dr. John W. Firor "The Living Atmosphere in Which We Soar" NCAR, Boulder, CO
Nov. 5, 1983	Ralph S. Barnaby "The Pioneers & Early Days of Soaring" Princeton, NJ
Nov. 10, 1984	Dr. Oran Nicks "There's More To Come" Dallas, TX
Nov. 9, 1985	John W. Laister "Kaleidoscope of Events in Jack Laister's Career" St. Louis, MO
Oct. 25, 1986	Paul E. Garber "The Wright Brothers" Elmira, NY
Nov. 7, 1987	Dr. Steven Bussolari "From Myth to Reality: The Daedulus Human Powered Flight Project" Seattle, WA
Oct. 29, 1988	Paul Rudolph Opitz "Development of the DFS: Rigid Tow for Cargo Gliders" Hampton, VA
Sept. 9, 1989	William S. Ivans "Soaring: A World Perspective" Elmira, NY at the Dedication of the National Soaring Museum Expansion
Nov. 3, 1990	Dr. Joachim Kuettner Colorado Springs, CO
Oct. 12, 1991	Shirley Sliwa "Ralph S. Barnaby" Elmira, NY