The Flightline

Volume 54, Issue 2 Newsletter of the Propstoppers RC Club, AMA 1042, April 2024

Inside This Issue

President's Message

Gentlemen,

We had a nice turnout at the April meeting despite the cold. You will note considerable improvements to both fields in both their appearance and size. We are planning to continue this work. We have started to angle the North end of the main runway at Elwyn so there will be no need to make a final turn over the house and trees. Once it is rolled, we will ask Chuck to start cutting it regularly.

Please look at our Facebook page and check out our new picnic tables and increased parking area.

Special thanks to Paul Pujol and Giles Cannon for their work at both fields. At least seven other members have pitched in from time to time over the last few months.

AMA is working with US Senator Casey and our US Reps to attempt to get a permanent waiver from TFR's for outer ring AMA sites. That would include both of our fields, and Valley Forge. Please keep an eye on the Government Relations pages in Model Aviation for updates. AMA did an excellent job for our clubs throughout the FAA Reauthorization process.

May you all experience blue skies, calm winds, and warm days during this year's flying season!

See you at the fields,

Mike

Fields at Elwyn and CA are now fully open for members and guests, 8 AM to sunset every day all year round. (CA-electric only, Elwyn - Sunday mornings from 8AM to Noon electric only.

We respectfully ask all members to stay in compliance with all Health Department recommendations. The fully vaccinated are no longer required to wear a mask at the field.

Please respect those who are continuing to wear masks or who are not vaccinated, by maintaining social distancing.

LOA with Philadelphia International:
Please comply with the following rules to stay in compliance with our FAA Agreement:

- Maximum altitude 400 feet
- In case of Fly-Away call 215-492-4123 immediately. This is a direct line to the TRACON Office at Philadelphia International Airport.

Tuesday morning breakfast at the Tom Jones Diner starts at 9:00am Flying outdoors at Ewyn or indoors at Brookhaven Community Center Gym follows at 10:00.

Members and guests must complete a waiver of liability form to fly at Brookhaven Gym.

Propstoppers RC Club of Delaware County, Pennsylvania.

Club Officers

President:
Mike Black

Vice President:
Paul Pujol

Secretary:
Michael Black

Treasurer:
Pete Oetinger

Membership Chairman:
Ryan Schurman

Safety Officers:
Eric Hofberg
Ryan Schurman

Newsletter Editor:
Larry Woodward

FacebookEditor:
Ryan Schurman

Webmaster:
Michael Black

Propstoppers Web Site;
www.propstoppers.org

Contact: Propstoppers@gmail.com

Indoor Flying at the Brookhaven Gym

The Brookhaven Community Gym is open to members Tuesdays at 10:00-11:00.

Indoor pilots must sign a waiver of liability form.

Minutes of the Propstoppers Model Airplane Club

General Membership Meeting Minutes from April 4, 2024,

Call to order: 11:03 am at CA Field. 16 active members, including all members of the board, were present. 2 guests (Former member Kenny Merlino, and Alexis Chile, childhood friend of Lamar's who is looking to join the club)

Treasurer's Report: $8,900 in bank

Membership: Ryan reported membership currently at 58 members, 2 youth.

Website: Pete reported he is working with Mike to perform a major update of the Website . There are many detailed items to work out but this process is underway.

Newsletter: Larry hopes to have a Spring issue out by the end of April.

Safety: No issues reported.

New Business:

Field Work –

Grass cutting has begun for the season.

Elwyn – the runway is going to be widened so that pilots can setup a landing trajectory further away from the homes at the hill end of the highway.

CA Field – Parking area extended and removal of trees and brush at the school end as well.

Picnic tables will be sought out by the club and provided for the new area to be enjoyed.

Picnic Dates

May 18 (waiver) rain date 19th

June 15th raindate 16th

1/1/2025 – Freeze Fly

Drexel

No communication but waiting to hear from the school for next round of kids.

Member interest in allowing rc cars and the formation of a track at CA field discussion. No official vote taken but there was general interest in allowing this for members as long flight remains the focus and takes precedence.
Insurance requirements will be looked into.

New Members

Welcome to new member, David Hall.

Kenny Merlino, former club member and friend, graciously provided free airplane parts of all kinds to clubs members.

TFRs

AMA lobbying with local congress people supporting a permanent TFR waiver for clubs like ours. TBD on outcome of this effort.

Please use UASidekick for all TFR information as it is the recommended app for the hobby with live updates.

TFRs can sometimes be shortened or lengthened and AMA and others do not always post timely updates or updates at all.

Adjourned: 11:30am

Editor's Notes:

By Larry Woodward

It was not my intention from the start, but this issue has turned out to be, more or less, dedicated to the history of aviation.

I didn't have much material to work with to start and then I came across a clipping sent to me by Dave Harding about a 19th century British aviation pioneer named Sir George Cayley, 1773 - 1857.

In reading about his accomplishements I was intrigued by two things. First, that the basic ideas he pioneered, are exactly the the same concepts that we focus on with every model we build and flight we take. Second, not unsurprisingly, that I had never head of him.

He, unilaterally, conceived and codified the three essential elements of aviation, Lift, Power and Control. He built and flew the first true man-carrying glider and was the first to design apparatus and experimentation that applied genuine scientific process to the study of flight. His research and publications formed the backbone of nearly all successful aviation history to follow.

The Wright brothers were heavily dependant on his work as the model for their own research and design. Not to discount their considerable skill and accomplishment, their work seems to be, perhaps, more about working out the details than "inventing" the airplane.

So, as I looked for more information about Cayley, I came across a great section of the Encyclopedia Britannica devoted to the history of aviation. It formed the basis of my main article in this issue. I found it very interesting to put together.

Please let me know if you find it of interest. If so I will continue with, perhaps shorter, similar articles covering further time frames in the history of aviation.

TFR, New apps and procedures:

Be sure to check out Mike's explanation of new apps and procedures for monitoring TFR conditions located in the **Endnotes and Links** section at the end of the newsletter. The B4UFly app is no longer applicable.

Larry

Member Profile

Meet new member Keith Watson

Hello Propstoppers,

My name is Keith Watson. I am a returning member. I was a member in the late '90's and early 2000's.

During my absence I have been flying at "Fun Fly" events and regularly attending the NEAT Fair each year.

I aspire to advance my skills beyond my simple sport flying level and advance to more aerobatic skills.

I am including a picture of myself with my favorite plane in hanger. That's technically not my hanger in the picture, or my plane. But, I do have an SR-71 on a slightly smaller scale in my own hanger with twin 40mm Electric ducted fans.

I look forward to flying with everyone.

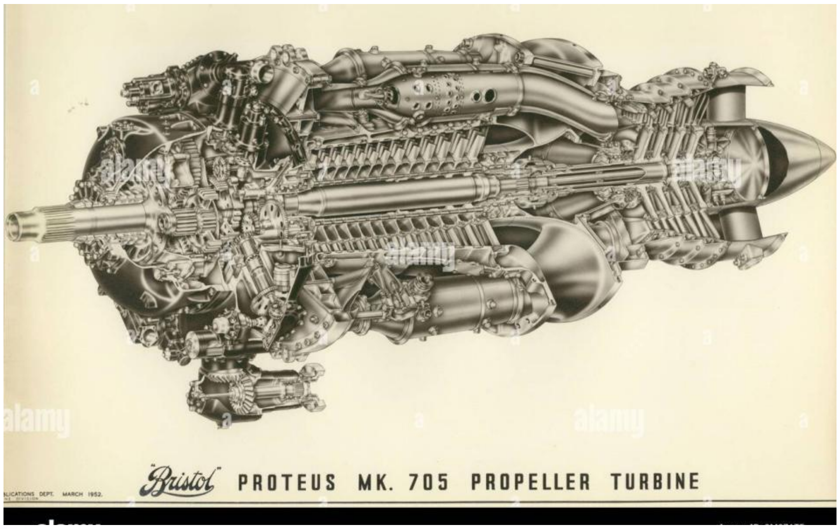
Keith

Member Profile

Meet new member Dave Hall

Wallingford

I first got interested in model aviation when I was very young. We lived near Heathrow Airport, London and my parents worked for BOAC - the precursor to British Airways. I literally grew up with aviation as my Dad was a flight engineering instructor. When I was at a young age he used to explain to me how a turboprop engine worked. He did this with amazing peel away transparencies that the engine manufacturers had released for instructional purposes.

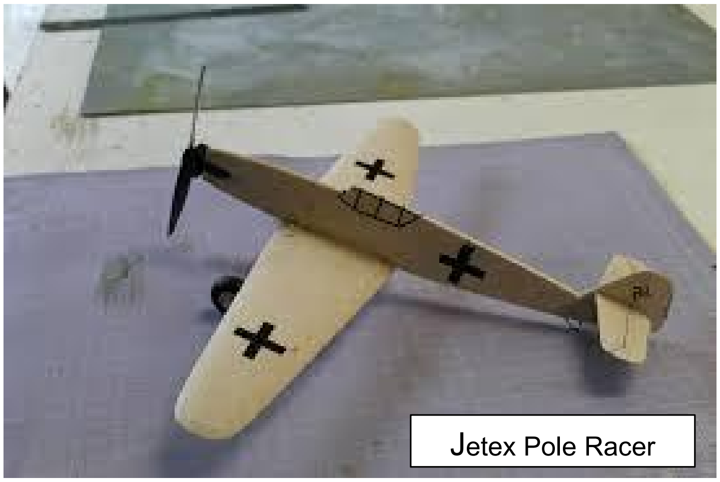


Dad used to make very realistic static models and built a Bristol Freighter out of cardboard and balsa wood that was large enough for my brother and I to put hot wheels sized cars inside.

I scratch built a free flight glider from plans when I was about 12 and lost it on its second flight.

Bristol Freighter

At that time I belonged to a very active model airplane club but really did not have the money to build the control line combat and team race models that club members used to fly competitively but I used to tag along as a young supporter. My


Jetex Pole Racer

contribution to club activities was building Jetex powered round the pole racers.

There were some long breaks in my aero modeling activities. This first happened when as a teenager I found more alluring activities. Fishing with school friends, going to places like Eel Pie Island (Rolling Stones etc.) and working at weekends so I could afford to buy a motorcycle as soon as I could legally take it on the road.

Then I joined the UK Merchant Marine as an apprentice navigator. Eventually I worked my way through the ranks and passed the exams for an unlimited Captains license. My wife and I could then afford to live in the Cotswolds, a beautiful and very scenic part of England bordering the River Severn.

My wife and I both joined a local gliding club and while learning to fly in the lift and thermals along the hills and ridges we became aware that others were flying RC model gliders just below us! Eventually I bought a trainer type RC glider kit and then became hooked on building and flying slope and thermal soarers. I joined the local RC club in the mid 1970's and it was a lot of fun. The club is still in existence and Propstoppers members may find a visit to the website fun.

https://scsa.org.uk/index.htm

In 1982, in connection with my work, we moved to the US. I tried, to some extent, to keep my aero modeling activities going but work and family did not allow the time for me to stay current. In 1995 we bought a sailboat so that we could sail on the Chesapeake and have family time with our two sons. We eventually bought a larger boat and went as far as New England and then the Bahamas - this when we first attempted to retire. Eventually, and close to retirement proper, I joined Valley Forge Signal seekers, but by then my eyesight was not so good. I found that, just like riding a bike, I could still fly an RC model but Valley Forge was a long way to go and because of my sight issues it was no longer a relaxing hobby.

Thanks to a very good ophthalmologist my eyesight is 20/20 again and I felt the need to get back into old hobbies. My wife mentioned she had seen people flying models at the Elwyn Field and I searched on AMA and found Propstoppers, which worked right in with my need to get back into the hobby. I visited the fields and met some friendly members, joined and so here I am.

I enjoy building old style balsa models and intend to build, a still in the box, balsa glider kit that I bought back in the early 1980's but never had the time to build. I will build it with an electric motor and hope to fly it later this season. It is a Sagita 900 and in its day was well regarded. On eBay such kits might currently sell for $400+. I also have a DJI drone which is an amazing piece of fun technology. I would like to learn to fly an aerobatic model.

The Tuesday breakfast meet at Tom Jones diner in Brookhaven is fun and I enjoyed flying my second hand Vapor at the Brookhaven Gym afterwards. So far with respect to full size I have flown my old Radian and a new Aeroscout, at Elwyn. This was with friendly and much appreciated help from Paul Pujol and others. I worry about getting the car stuck at the other field and will wait for the ground to firm up there. Everyone I have met at Propstoppers is very friendly and helpful.

I enjoy meeting other members and in the coming year I want to learn to competently fly the McTwist which I am just completing and a new Neptune EDF delta I just splurged on. I am working on setting up the differential throttle on the McTwist and it has me a bit baffled. I found a helpful video on YouTube but then realized that because I had updated the software on my DX9 the 9 y.o. video was not entirely relevant. Part of the fun seems to be learning how all the bells and whistles work on these new fangled transmitters?! Maybe I can interest my eldest grandson in the hobby by asking him if he can help me figure out how to program the differential throttle?

Boeing MQ-28

Boeing shows off it's revolutionary Autonomous Jet Fighter

Submitted by Dave Harding

MQ-28 Ghost Bat

The Australia-developed Ghost Bat provides a test bed for the autonomous flying sought by the U.S. Air Force. Designed to fly with crewed jets and on pre-programmed missions, it has a nose cone that can be swapped out with different equipment.

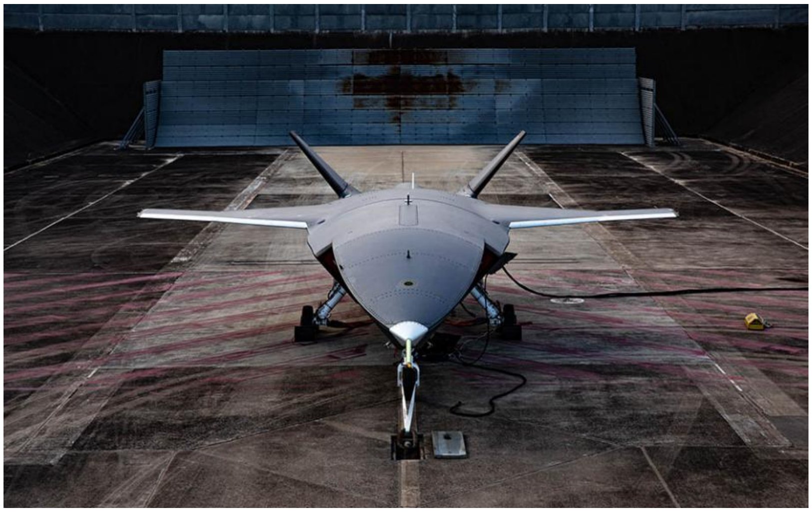
The Boeing MQ-28 will provide a disruptive advantage for allied forces' crewed and uncrewed missions. It will:

- Provide fighter-like performance, measuring 38 feet long (11.7m) and able to fly more than 2,000 nautical miles.
- Integrate sensor packages onboard to support intelligence, surveillance and reconnaissance, tactical early warning missions and more.
- Use artificial intelligence to fly independently or in support of crewed aircraft while maintaining safe distance between other aircraft.

Wall Street Journal
BY Doug CAMERON

Pilotless jet fighters that can fly 30 feet above the ground to their targets or straight toward a barrage of enemy missiles are being developed by the U.S. Air Force to help deter China. The soaring cost of existing military aircraft and advances in flying software have the Air Force pivoting toward a new generation of pilotless jets to bolster a fleet that its leaders say is the smallest and oldest since it became a separate service in 1947.

The Air Force wants at least 1,000 of the mini-fighters now being developed, including hundreds within five years. They would escort and protect crewed aircraft such as the F-35 fighter and the new B-21 bomber, carry their own weapons to attack other planes and targets on the ground and act as scouts and communications hubs.



The "Collaborative Combat Aircraft," or CCAs, are part of a $6 billion program being pursued by Boeing, Lockheed Martin, and others. The air Forceplans to choose two of the companies to start building the Ets.

The Air Force has had big drones for years.General Atomics' Reapers and Predators have been extensively used to fire missiles in the Middle East, piloted remotely Black Hawk helicopters and P-16 fighters also have been flown autonomously. Small drones have transformed the battlefields over Ukraine and parts of the Middle East, but larger jet-powered versions are viewed as crucial to tackle the vast distances in the western Pacific. "They offer a lot of things that traditional crewed planes just aren't designed to do." Air Force Secretary Frank Grumman said.

The Ghost Bat and the Fury are between 20 feet and 30 feet in length-half the size of Lockheed Martin's ubiquitous F-16. The new jets reflect strides made in flying software, using artificial intelligence to build programs based on thousands of hours of combat flying. The technology that allowed planes to be piloted from the ground has been superseded by software allowing planes to fly autonomously and adapt to changing conditions.

San Diego-based Shield AI developed software that helped an uncrewed F-16 programmed with AI to regularly beat some of the best Air Force and Navy pilots in simulated dogfights as part of a Pentagon-backed test.

The Air Force wants to tap into the technology, allowing pilots to control the new drones remotely from their cockpits. Ground controllers also could handle as many as 10 of the drones, while others could be pre-programed to fly in swarms, overwhelming enemy defenses or confusing them to draw fire.The lack of crew allows drones to fly riskier maneuvers, Air Force officials and flying.software developers said. Shield AI's software offers the ability for Jets to skim the ground at 600 miles an hour, said Brandon Tseng, the company's founder and president. It should also make them cheaper, the Air Force and defense executives said. The Air Force is targeting $20 million to $30 million for each jet, though industry executivest expect it to eventually come down to around $10 million or less. That compares with around $100 million for an F-35 or more than $750 million for the new B-21 bomber.

The CCA program is a key test of the Defense Department's efforts to break from traditional military programs. Air Force acquisition chiel Andrew Hunter said the CCA program takes lessons from past programs that have struggled to harness new technology, notably the F-35 program. The first CCAs are intended to be stripped-down models, keeping costs low and introducing new technology when it is ready, rather than while it is still being tested. Companies bidding for the CCA contract are also being told to minimize complexity, including only what is required for missions rather than every eventuality.

The average Pentagon program takes seven years from contract award until service entry, and the F-35 took twice that. Only five years is being planned. Air Force officials said one obstacle to broader adoption of uncrewed jets is starting to erode, the pilots themselves. The options of piloting drones from the cockpit, remotely from the ground or autonomously with pre-planned flight programs has reduced resistance among seasoned fliers, Newer recruits brought up on videogames have also tipped the balance. "We're eager to get them because they're gonna save our lives,"Air Force Secretary Kendall said of the new drones.

History of Flight

Part 1, The Invention of the Airplane

Excerpted and edited by Larry Woodward

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Accessed 21 April 2024.

Written by

Roger E. Bilstein,

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Fact-checked by

The Editors of Encyclopaedia Britannica
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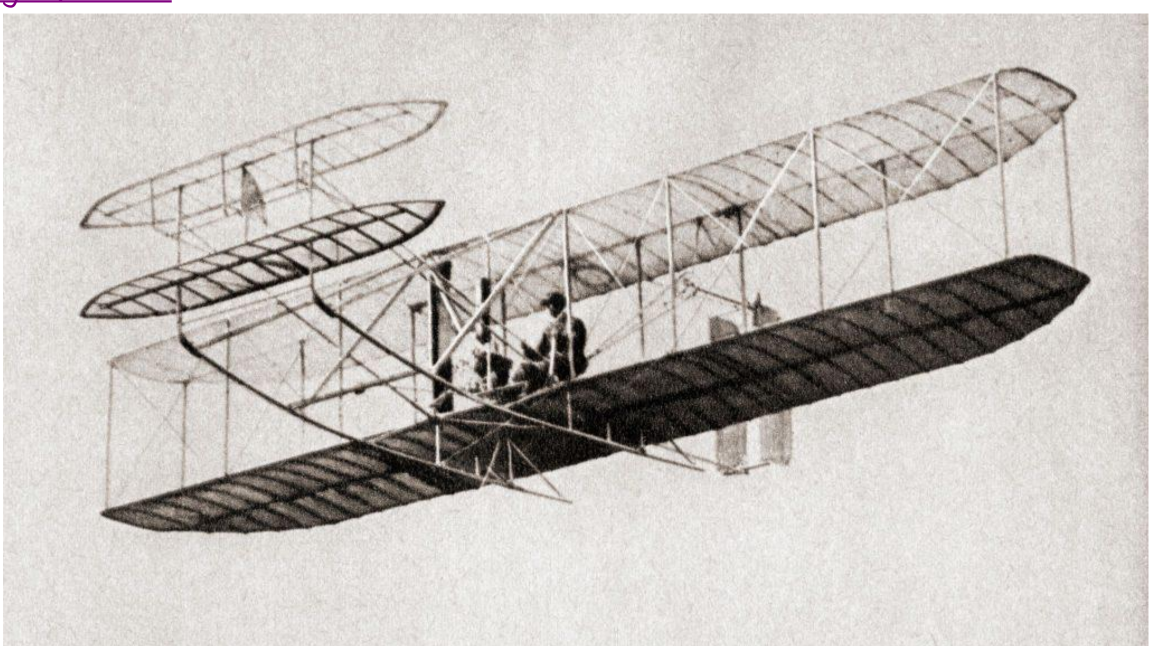
In the history of flight, the most important landmarks and events include an understanding of the dynamic reaction of lifting surfaces (or wings), building absolutely reliable engines that produce sufficient power to propel an airframe, and solving the problem of flight control in three dimensions. At the start of the 20th century, the Wright brothers demonstrated that the basic technical problems associated with heavier-than-air flying machines had been overcome, and military and civil aviation developed quickly afterward.

Wright flyer, 1905



(Read the biography of Wilbur Wright that his brother, Orville, wrote for Britannica in 1929.)

The invention of the airplane

On the evening of Sept. 18, 1901, Wilbur Wright, a 33-year-old businessman from Dayton, Ohio, addressed a distinguished group of Chicago engineers on the subject of "Some Aeronautical Experiments" that he had conducted with his brother Orville Wright over the previous two years. "The difficulties which obstruct the pathway to success in flying machine construction," he noted, "are of three general classes."

Those which relate to the construction of the sustaining wings.

Those which relate to the generation and application of the power required to drive the machine through the air.

Those relating to the balancing and steering of the machine after it is actually in flight.

This clear analysis—the clearest possible statement of the problem of heavier-than-air flight—became the basis for the Wright brothers' work over the next half decade. [100 years earlier George Caley first articulated and studied this three legged stool of theoretical concerns which supported and directed the course of aviation research and development from that point on. Editor] What was known at that time in each of these three critical areas and what additional research was required are considered below.

Construction of the sustaining wings: the problem of lift

The dream of human flight must have begun with observation of birds soaring through the sky. For millennia, however, progress was retarded by attempts to design aircraft that emulated the beating of a bird's wings. The generations of experimenters and dreamers who focused their attention on ornithopters—machines in which flapping wings generated both lift and propulsion—contributed nothing substantial to the final solution of the problems blocking the route to mechanical flight. Thus, the story of the invention of the airplane begins in the 16th, 17th, and 18th centuries, with the first serious research into aerodynamics—the study of the forces operating on a solid body (for instance, a wing when it is immersed in a stream of air). Leonardo da Vinci and Galileo Galilei in Italy, Christiaan Huygens in the Netherlands, and Isaac Newton in England all contributed to an understanding of the relationship between resistance (drag) and such factors as the surface area of an object exposed to the stream and the density of a fluid. Swiss mathematicians Daniel Bernoulli and Leonhard Euler and British engineer John Smeaton explained the relationship between pressure and velocity and provided information that enabled a later generation of engineers to calculate aerodynamic forces.

George Cayley's glider, 1853

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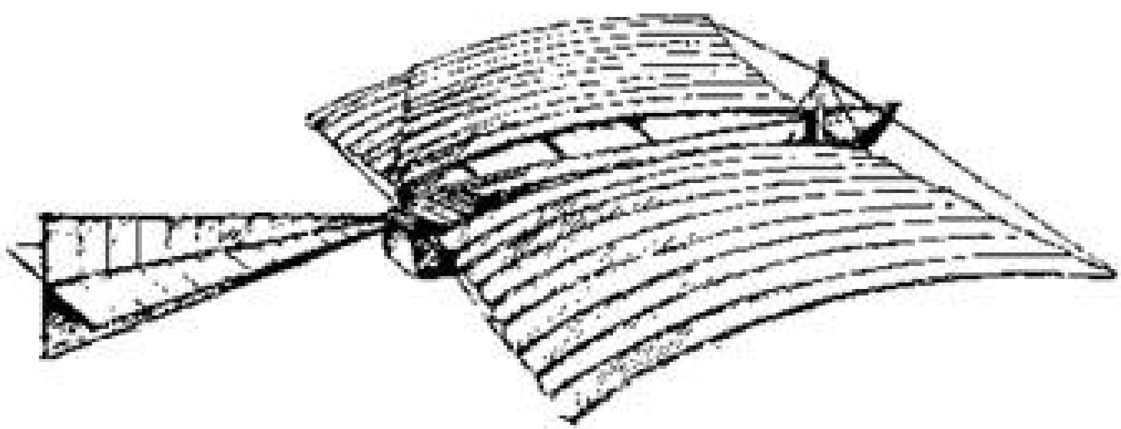
George Cayley, an English baronet, bridged the gap between physical theory, engineering research, and the age-old dream of flight. He gathered critical aerodynamic data of value in the design of winged aircraft, using instruments developed in the 18th century for research into ballistics. Cayley was also a pioneer of aircraft design, explaining that a successful flying machine would have separate systems for **lift**, **propulsion**, and **control**.

While he did produce designs for ornithopters, he was the first experimenter to focus on fixed-wing aircraft. Cayley found the secrets of lift in the shape of a bird's wing, surmising that an arched, or cambered, wing would produce greater lift than a flat wing because of lower pressure on top of the curved surface (see Bernoulli's theorem). His observations of birds in flight led him to recognize the superiority of relatively long and narrow (in modern terminology, high-aspect-ratio) wings for soaring.



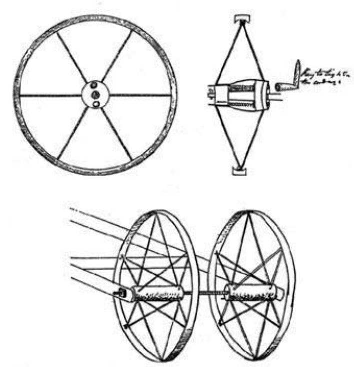
As a practical matter, however, he designed biplane and multiplane wings (the first of their kind) by means of providing maximum surface area in a strong and easily braced structure.

Addressing the first meeting of the Aeronautical Society of Great Britain in 1866, Francis H. Wenham provided a concise and forceful restatement of Cayley's most important ideas regarding wings. Five years later, in cooperation with John Browning, Wenham built the first wind tunnel, a device that would have a profound effect on the study of wings and the development of improved airfoils. Horatio Phillips, a fellow member of the Aeronautical Society, developed an even more effective wind tunnel design, and he patented (1884) a two-surface, cambered-airfoil design that provided the foundation for most subsequent work in the field.

English aeronautic pioneer George Cayley established the modern notion of a fixed-wing aircraft in 1799, and he designed a glider that was safely flown by his reluctant servant in 1853 in the first recorded successful manned flight

:Photo left: Replica of Caley's 1853 first successful manned flight.

[Like many formidable "thinkers" of the time, Caley was not just a one trick pony focused exclusivey on flight. Among many accomplishments he is also credited with the invention of the tentioned wire wheel.



Lilienthal glider

Beginning in the 1870s, Otto Lilienthal, a German mechanical engineer, undertook the most important studies of wing design since the time of Cayley. His detailed measurements of the forces operating on a cambered wing at various angles of attack provided precise bits of data employed by later experimenters—including, in the United States, the engineer Octave Chanute and the Wright brothers—to calculate the performance of their own wings. Having published the results of his research, Lilienthal designed, built, and flew a series of monoplane and biplane gliders, completing as many as 2,000 flights between 1890 and the time of his fatal glider crash in August 1896.

At the outset of their own aeronautical experiments, the Wright brothers carefully studied the work of their predecessors and decided that there was little need for them to focus on wing design. “Men already know how to construct wings…,” Wilbur explained in 1901, “which when driven through the air at sufficient speed will not only sustain themselves but also that of the engine, and of the engineer as well.”

Wright gliders

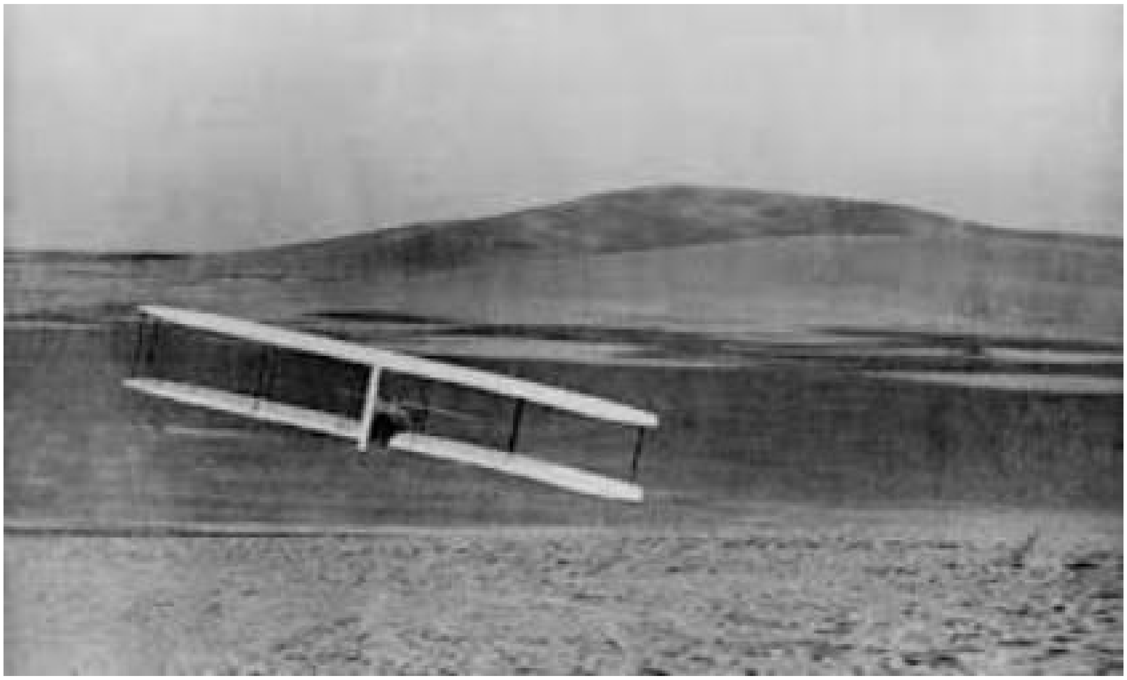


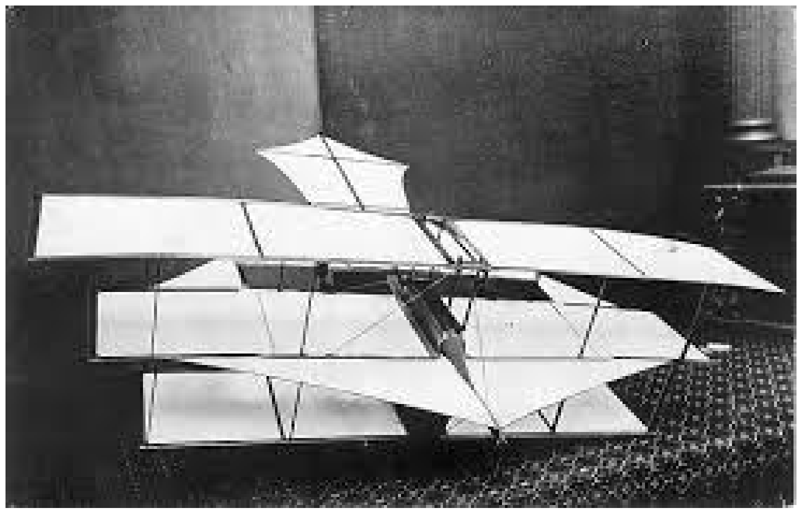
Photo left: Wilbur Wright executes a banking turn to the right in the Wright brothers' first fully controllable glider, at the Kill Devil Hills, North Carolina, October 24, 1902.

Two years of experimenting with gliders, however, demonstrated the need to pay considerably more attention to wing design. Beginning in November 1901, the Wright brothers used a wind tunnel of their own design to gather information that enabled them to calculate the values of lift and drag for an entire series of airfoils at various angles of attack and to measure the performance of wings with differing aspect ratios, tip shapes, and other design features. That information culminated in the Wright glider of 1902, a breakthrough machine whose wing design enabled the Wright brothers to take the final steps to the invention of the airplane.

The generation and application of power: the problem of *propulsion*

At the beginning of the 19th century, sustained powered heavier-than-air flight remained an impossibility because of the lack of suitable power plants. The level of technology that would permit even limited powered flight lay over a century in the future. Clockwork mechanisms and other sorts of spring-powered systems were clearly unsuitable for human flight. While electricity powered several airships during the last quarter of the century, the poor power-to-weight ratio of such systems made it difficult to imagine an electrically propelled airplane.

The aeronautical potential of propulsion systems ranging from hot-air engines to gunpowder to compressed air and even to carbonic-acid power plants was discussed during the course of the century. The Australian Lawrence Hargrave, in particular, experimented with compressed-gas propulsion systems. Nevertheless, steam and internal-combustion engines quickly emerged as the choice of most serious experimenters. As early as 1829, F.D Artingstall constructed a full-scale steam-powered ornithoptor, the wings of which were smashed in operation just before the boiler exploded. A lightweight steam engine developed by the English pioneer Frederick Stringfellow in 1868 to power a triplane model aircraft survives in the collection of the Smithsonian Institution, Washington, D.C.



Russian Alexandr Mozhaysky (1884), Englishman Hiram Maxim (1894), and Frenchman Clément Ader (1890; see Ader Éole and Ader Avion) each jumped full-scale steam-powered machines off the ground for short distances, although none of these craft was capable of sustained or controlled flight.

Photo above: Ader Avion (Replica)

Langley aerodrome of 1903

In the United States, Samuel Pierpont Langley achieved the first sustained flights in 1896 when he launched two of his relatively large steam-powered model aircraft (see Langley aerodrome No. 5) on aerial journeys of up to three-quarters of a mile (1.2 km) over the Potomac River.

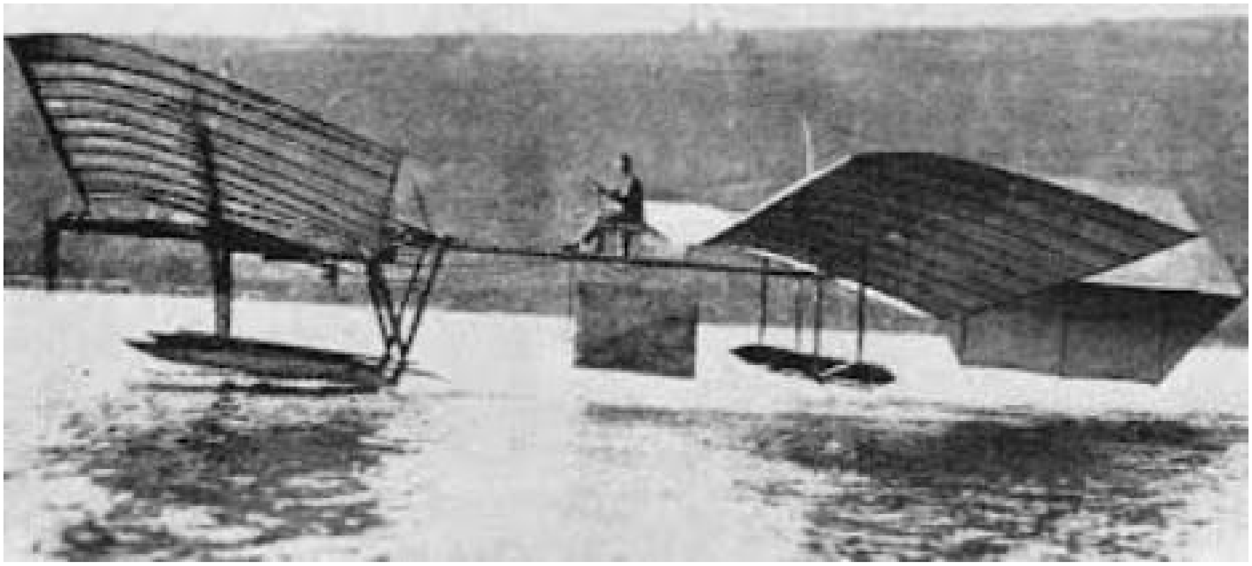


Photo below: The unsuccessful launch of Samuel Pierpont Langley's full-sized manned aerodrome from a houseboat on the Potomac River, Oct. 7, 1903. The pilot, Charles Matthews Manly, is just visible behind the forward pair of wings

As the end of the 19th century approached, the internal-combustion engine emerged as an even more promising aeronautical power plant. The process had begun in 1860, when Étienne Lenoir of Belgium built the first internal-combustion engine, fueled with illuminating gas. In Germany, Nikolaus A. Otto took the next step in 1876, producing a four-stroke engine burning liquid fuel. German engineer Gottlieb Daimler pioneered the development of lightweight high-speed gasoline engines, one of which he mounted on a bicycle in 1885. German engineer Karl Benz produced the first true automobile the following year, a sturdy tricycle with seating for the operator and a passenger. In 1888 Daimler persuaded Karl Woelfert, a Lutheran minister who longed to fly, to equip an experimental airship with a single-cylinder gasoline engine that developed all of eight horsepower. The initial test was marginally successful, although the open-flame ignition system presented an obvious danger to a hydrogen-filled airship. In fact, Woelfert perished when an internal-combustion engine finally did set a much larger airship on fire in 1897.

At the beginning of their career in aeronautics, the Wright brothers recognized that automotive enthusiasts were producing ever lighter and more powerful internal-combustion engines. The brothers assumed that if their gliding experiments progressed to the point where they required a power plant, it would not be difficult to buy or build a gasoline engine for their aircraft.

They were essentially correct. Having flown their successful glider of 1902, the Wright brothers were confident that their wings would lift the weight of a powered flying machine and that they could control such a craft in the air. Moreover, three years of experience with gliders, and the information gathered with their wind tunnel, enabled them to calculate the precise amount of power required for sustained flight. Unable to interest an experienced manufacturer in producing an engine meeting their relatively narrow power-for-weight specifications, the brothers designed and built their own power plant.

Charles Taylor, a machinist whom the brothers employed in their bicycle shop, produced a four-cylinder engine with a cast aluminum block that produced roughly 12.5 horsepower at a total weight of some 200 pounds (90 kg), including fuel and coolant. It was by no means the most advanced or efficient aeronautical power plant in the world. Langley, who was also building a full-scale powered flying machine, spent thousands of dollars to produce a five-cylinder radial engine with a total weight equal to that of the Wright engine but developing 52.4 horsepower. Langley produced an engine far superior to that of the Wright brothers—and an airplane, the aerodrome No. 6, that failed to fly when tested in 1903. The Wright brothers, on the other hand, developed an engine that produced exactly the power required to propel their flyer of 1903—the world's first airplane to demonstrate sustained flight.

first flight by Orville Wright, December 17, 1903

Orville Wright beginning the first successful controlled flight in history, at Kill Devil Hills, North Carolina, December 17, 1903.

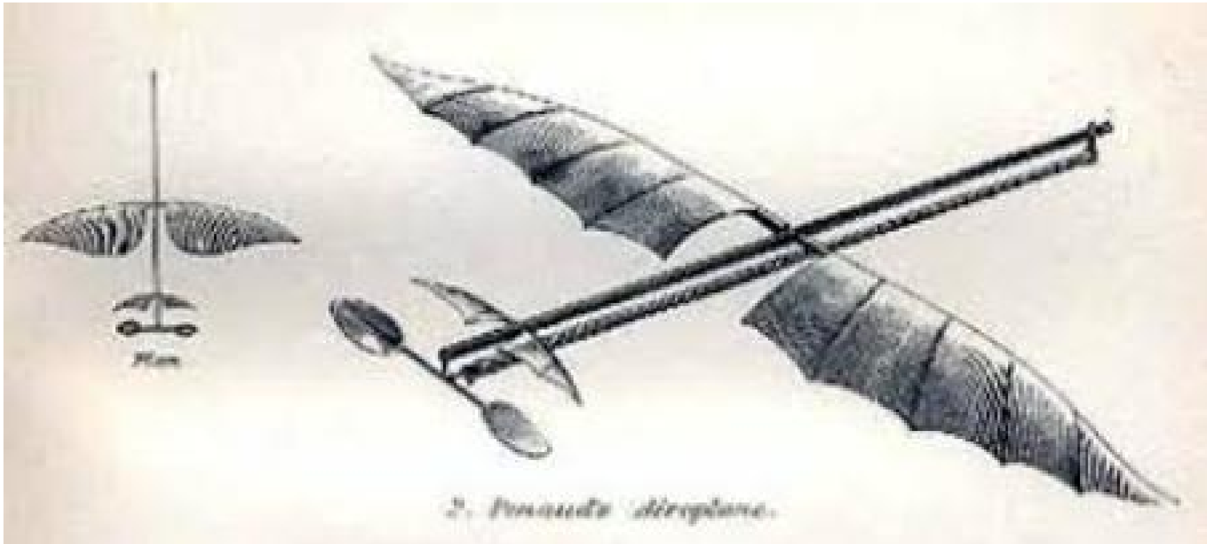
The design of the propellers for the 1903 airplane represented a much more difficult task, and a much greater technical achievement, than the development of the engine. The propellers not only had to be efficient but had to produce a calculated amount of thrust when operated at a particular speed by the engine. It is important to recognize, however, that once powered flight had been achieved, the development of more powerful and efficient engines became an essential element in the drive to improve aircraft performance.

Balancing and steering the machine: the problem of control

Having decided that the design of wings and the development of a power plant were fairly well in hand, the Wright brothers focused on the element of control. Other experimenters had given some thought to the subject. Cayley was the first to use an elevator for control in pitch (directing the nose up and down). Throughout the second half of the 19th century, airships had used rudders for yaw control (directing the nose to the right and left).

It was far more difficult to conceive of a way to control an aircraft in roll (that is, balancing the wingtips or banking the aircraft). Moreover, most experimenters were convinced that the operator of a flying machine would find it difficult or impossible to exercise full control over a machine that was free to operate in all three axes of motion at once. As a result, far more thought had been given to the means of achieving automatic or inherent stability than to active control systems.

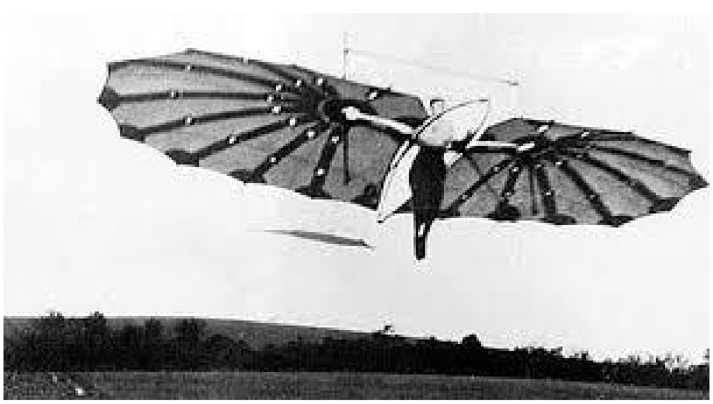
Cayley, for example, suggested dihedral wings (wingtips angled up from the midpoint of the wing) as a means of achieving a measure of stability in roll; he also recommended the use of a pendulum to control pitch. French aviation pioneer Alphonse Penaud was the first to produce an inherently stable aircraft, the Planophore (1871), which featured a pusher propeller powered by twisted rubber strands. The hand-launched model featured dihedral wings for stability in roll and a horizontal surface set at a slight negative angle with regard to the wings to provide stability in pitch. With the addition of a vertical surface for stability in yaw, this was the approach taken by virtually all experimenters with model aircraft, including Langley.



Planophore 1871

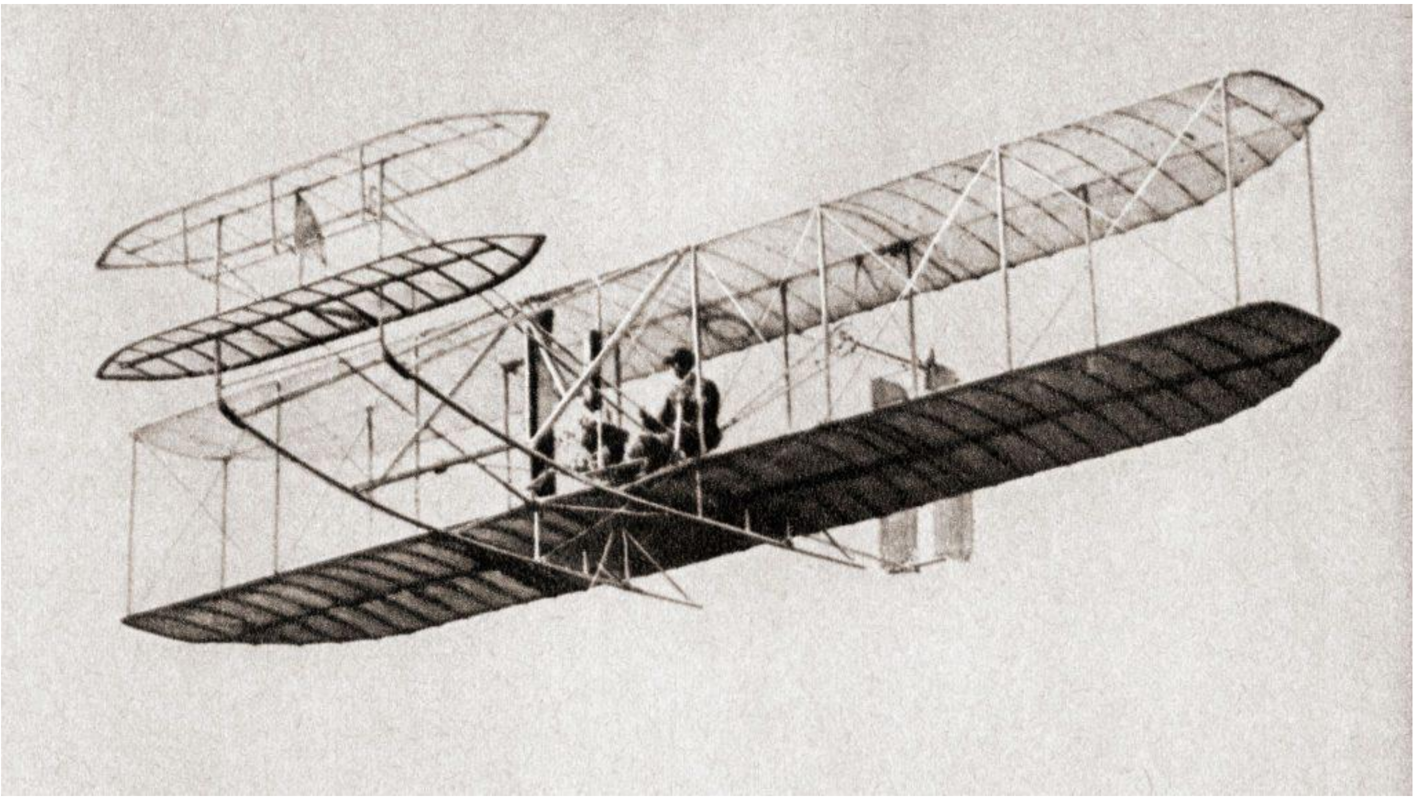
Model builders were forced to employ automatic [passive] stability, but those experimenters who built and flew gliders had to develop active flight controls. Virtually all of the pre-Wright brothers glider pilots, including Lilienthal, used hang-gliding techniques, in which the pilot shifted his weight in order to alter the position of the centre of gravity of the machine with regard to the centre of pressure. Weight shifting was dangerous and limiting, however. If simple movements of the operator's body were to have a significant impact on the motion of the machine, the wing area had to be reasonably small. This limited the amount of lift that could be generated. Moreover, it was by no means difficult for such an aircraft to reach a stall or some other uncontrolled position from which weight shifting could not effect a recovery—as demonstrated by the deaths of Lilienthal (1896) and the English experimenter Percy Pilcher (1899) in glider crashes.

In 1896 English aviator Percy Sinclair Pilcher designed, built, and flew the Pilcher Hawk, a monoplane glider with birdlike wings.



Determined to avoid those problems, the Wright brothers created a positive control system that enabled (indeed, required) the pilot to exercise absolute command over the motion of his machine in every axis and at every moment. Others had rejected that goal because they feared that pilots would be overwhelmed by the difficulty of controlling a machine moving in three dimensions. The Wright brothers, however, had recognized how easily and quickly a bicycle rider internalized the motions required to maintain balance and control, and they were certain that it would be the same with an airplane.

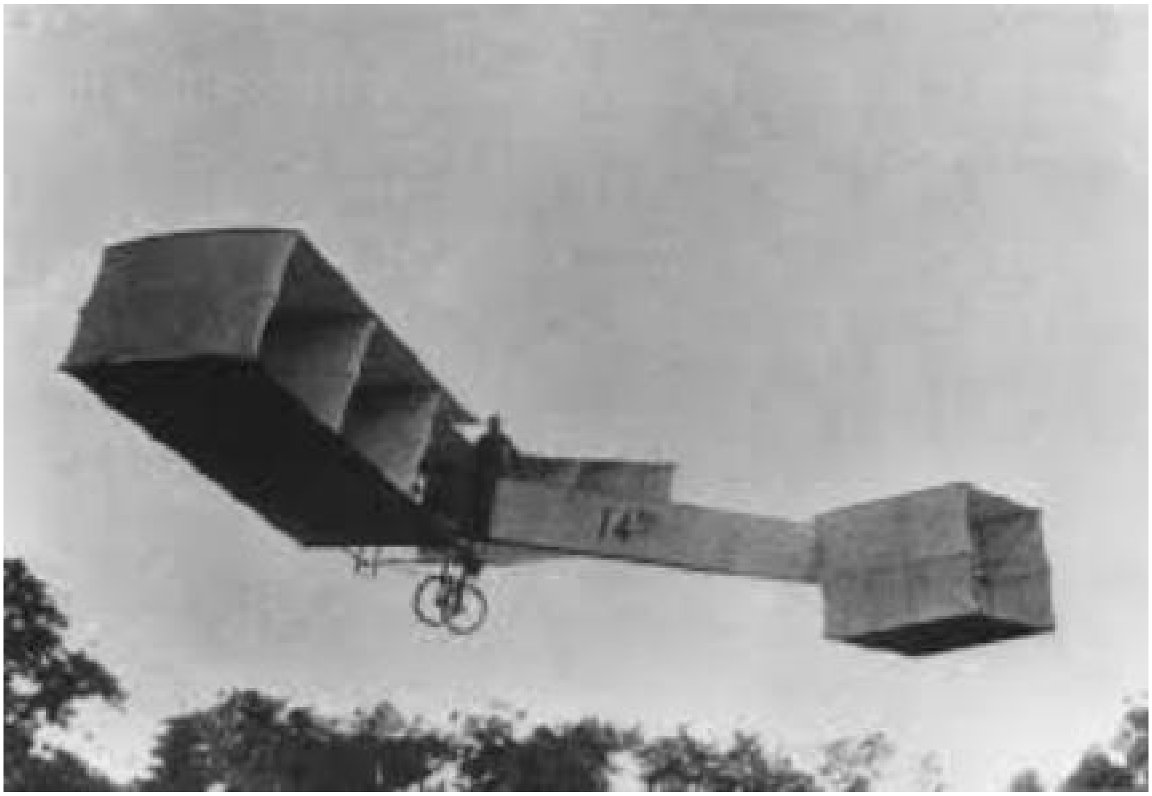
Recognizing the dangers inherent in attempting to rely on control of the centre of gravity, the Wright brothers devised a system to control the movement of the centre of pressure on the wing. They achieved this by enabling the pilot to induce a twist across the upper and lower wings in either direction, thus increasing the lift on one side and decreasing it on the other. This technique, which they called “wing warping,” solved the crucial problem of roll. Meanwhile, an elevator (a horizontal surface placed at the front of the aircraft) provided the means of pitch control. When the Wright brothers introduced a rudder to their design in 1902, this device was used to compensate for increased drag on the positively warped side of the aircraft. In 1905 they disconnected the rudder from the wing warping system, enabling the pilot to exercise independent control in yaw for the first time. The Wright flyer of 1905 is therefore considered to be the first fully controllable, practical airplane.



Other aviation pioneers

The work of the Wright brothers inspired an entire generation of flying-machine experimenters in Europe and the Americas.

The Brazilian experimenter Alber to Santos-Dumont, for instance, made the first public flight in Europe in 1906 in his 14-bis.



Frenchman Henri Farman made his first flight the following year in the Farman III, a machine built by Gabriel Voisin. Farman also completed the first European circular flight of at least 1 km (0.62 mile) early in 1908.

On July 4, 1908, the American Glenn Hammond Curtiss, a leading member of the Aerial Experiment Association (AEA), organized by Alexander Graham Bell, won the Scientific American Trophy for a flight of 1 km in the AEA June Bug.

The Santos-Dumont, Voisin, and Curtiss machines were all canard (elevator on the nose) biplanes with pusher propellers that were clearly inspired by what the designers knew of the work of the Wright brothers.

By 1909 radical new monoplane designs had taken to the air, built and flown by men such as the French pioneers Robert Esnault-Pelterie and Louis Blériot, both of whom were involved in the development of the "stick-and-rudder" cockpit control system that would soon be adopted by other builders. Blériot brought the early experimental era of aviation to an end on July 25, 1909, when he flew his Type XI monoplane across the English Channel.

Photo left: French aviation pioneer Robert Esnault-Pelterie designed, built, and was the first to fly the R.E.P. No. 2, in 1908.

The following five years, from Blériot's Channel flight to the beginning of World War I, were a period of spectacular growth and development in aviation. Concerned about the potential of military aviation, European leaders invested heavily in the new technology, spending large sums on research and development and working to establish and support the aircraft and engine industries in their own countries.

Photo rightt: Louis Bleriot Type XI monoplane.

In addition to practical developments in the areas of propulsion and aircraft structural design, the foundations of modern aerodynamic theory were laid by scientists and academics such as Ludwig Prandtl of Germany. With the possible exception of flying boats (see Curtiss Model E flying boat), an area in which Curtiss continued to dominate, leadership in virtually every phase of aeronautics had passed by 1910 from the United States to Europe, where it would remain throughout World War I.

List of select pioneer aircraft

The table provides a comparison of select pioneer aircraft.

Pioneer aircraft

airplane	maiden flight	wingspan	length	weight
Ader Éole	1890	14 metres (45 feet 10 inches)	6.5 metres (21 feet 4 inches)	296 kg (653 pounds)
Lilienthal standard glider	1894	7.9 metres (26 feet)	4.19 metres (13 feet 1 inch)	
Chanute biplane glider	1896	4.9 metres (16 feet)	1.2 metres (4 feet)	14 kg (31 pounds)
Langley aerodrome No. 5	1896	4.3 metres (14 feet)	4.3 metres (14 feet)	11.8 kg (26 pounds)
Pilcher Hawk	1896	7.1 metres (23 feet 4 inches)	5.6 metres (18 feet 6 inches)	23 kg (50 pounds)
Ader Avion III	1897	17 metres (56 feet)		400 kg (882 pounds)
Wright flyer	1903	12.3 metres (40 feet 4 inches)	6.4 metres (21 feet 1 inch)	274 kg (605 pounds)
Santos-Dumont No. 14-bis	1906	12 metres (39 feet 4 inches)	10 metres (33 feet)	160 kg (350 pounds)
Voisin-Farman I	1907	10.2 metres (33 feet 6 inches)		520 kg (1,150 pounds)
June Bug	1908	12.9 metres (42 feet 6 inches)	8.4 metres (27 feet 6 inches)	
R.E.P. No. 2-bis	1908	9.6 metres (31 feet 6 inches)	8 metres (26 feet)	420 kg (925 pounds)
Bleriot XI	1909	8.52 metres (28 feet 6 inches)	7.63 metres (25 feet 6 inches)	326 kg (720 pounds)
Farman III	1909	10 metres (33 feet)	12 metres (39 feet 4 inches)	550 kg (1,213 pounds)
Curtiss Model E flying boat	1912	12.2 metres (40 feet)	7.9 metres (26 feet)	677 kg (1,490 pounds)

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A Moment in Flight:

Flight Video by Pedro Navarro

Editor

Click below to see this issue's Moment in Flight.

P-51 Mustang & Rachel Ben Am

Endnotes and Links

TFR Notices

The B4UFLY APP will now take you directly to the FAA website, because it has become the parent organization for the TFR Apps. If you go to the FAA site, you will see several APPS.

UASidekick is now the preferred provider. Download it from your Play Store. Open the APP. Locate an AMA field on the map. Drop a pin on it by touching the map on the site you want. A white inset screen will pop up. Touch the Drop B4UFLY Pin button. If the map turns red, there is a pending or active TFR. Page down to get the details. The only tricky part is that the times are displayed in UTC, which is the same as Greenwich Mean Time, so you must subtract 4 hours for our time zone.
Once you use it a few times it will become second nature.

DO NOT RELY on the emails from AMA for notifications as they **do NOT** update on weekends and there have been many changes to TFR's on weekends. Occasionally, the times change, and sometimes the TFR's get deleted. AMA does a pretty good job during the work week, but no one is there on the weekends to send out changes.

https://www.uasidekick.app/

Mike Black