The Aerodrome Fraud

By Peter Grier

Langley's aircraft broke apart into the Potomac nine days before the Wright brothers' successful flight. Glenn Curtiss later made sure it flew.

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At 4:45 p.m. on Dec. 8, 1903, a tandem-winged flying machine named the "Great Aerodrome" raced down the rails of its catapult toward the gathering darkness over the Potomac River. With it went the dreams and reputation of designer Samuel P. Langley, secretary of the Smithsonian and one of the most renowned American scientists of the age.

It was a burden the fragile aircraft could not bear. At or near the end of its run down the launcher, mounted atop a houseboat, the craft bucked from the rails. Pilot Charles M. Manly testified he felt an "extreme swaying motion," followed by a tremendous jerk. A photo of that instant shows the machine nearly vertical, clawing at the air, its rear crushed and dangling.

It flipped on its back and collapsed into the water. Manly barely escaped with his life.

Langley had worked on problems of aerodynamics for 17 years. He had successfully flown large powered models and overseen development of a radial engine that generated more than 50 horsepower, astonishing for that time. The War Department had granted him $50,000 for Great Aerodrome development.

But his status—and the US government's money—appeared to have vanished beneath the Potomac's icy waters. Newspapers were brutal. One suggested that if he had launched the Great Aerodrome bottom-up, it would have flown instead of dived.

Nine days later the Wright brothers made the first heavier-than-air, powered, controlled human flight at Kitty Hawk, N. C. Langley's place in aviation history seemed to be as an also-ran. He died in 1906 without working on flight again.

The Wrights always said they appreciated Langley's contributions.

"When they were wrestling with whether or not to enter this problematic field, the fact that someone with Langley's reputation believed that human flight was possible and had flown models proved to them the thing could be done. They recognized Langley's value as inspiration in that sense," said Tom D. Crouch, senior curator at the Smithsonian's National Air and Space Museum and author of numerous books on aviation's early years.

That was not the end of the Langley story, however.

The Great Aerodrome was resurrected and rebuilt more than a decade later by the Wright brothers' rival Glenn H. Curtiss. It eventually flew, in a manner of speaking, and the Smithsonian chose to call its former secretary's aerodrome the first aircraft "capable of flight."

For decades, the Smithsonian displayed it but not the Wright Flyer. The controversy was not fully resolved until 1948.

Many Talents and Passions

Langley was a man of great contradictions. As an employer, he could be impatient, even domineering. At the Smithsonian, subordinates knew to follow a few steps in his wake as a tacit acknowledgment of their relative position. On the other hand, he inspired staunch loyalty in some key aides. Chief assistant (and pilot) Manly finished Langley's *Memoir on Mechanical Flight* following his death and remained a lifelong defender of Langley's contribution to aeronautics.

As a scientist, Langley was a keen and exacting observer of reality. His freehand drawings of sunspots were so accurate and beautiful they were reproduced in textbooks well into the 20th century. Yet he loved myths, legends, folklore,

|1| The launch pad for Samuel Langley's aerodrome was a houseboat equipped with a spring catapult. Shortly after this picture was taken, the aerodrome plunged into the Potomac River. |2| Langley (r) and aerodrome pilot Charles Manly on the deck of the houseboat launch pad in December 1903.

Photo via NASA

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National Archives photo

and stories of magic. One evening at a Washington dinner party a socialite tried and failed to engage Langley in scientific conversation. Exasperated, she asked the great man what did interest him.

"Children and fairy tales," he said.

The unmarried Langley was happy home alone, reading vast numbers of scientific and general books by gaslight. All the same, he craved the company of intellectual and famous men. He dined at the White House and traveled to Europe to meet with his scientific peers every summer. Inventor Alexander Graham Bell, an aeronautic enthusiast himself, considered Langley among his closest friends.

"He was not an easy man to work for or to get to know," said Crouch.

Langley was born in 1834 in Roxbury, Mass. His father was a wholesale mer-

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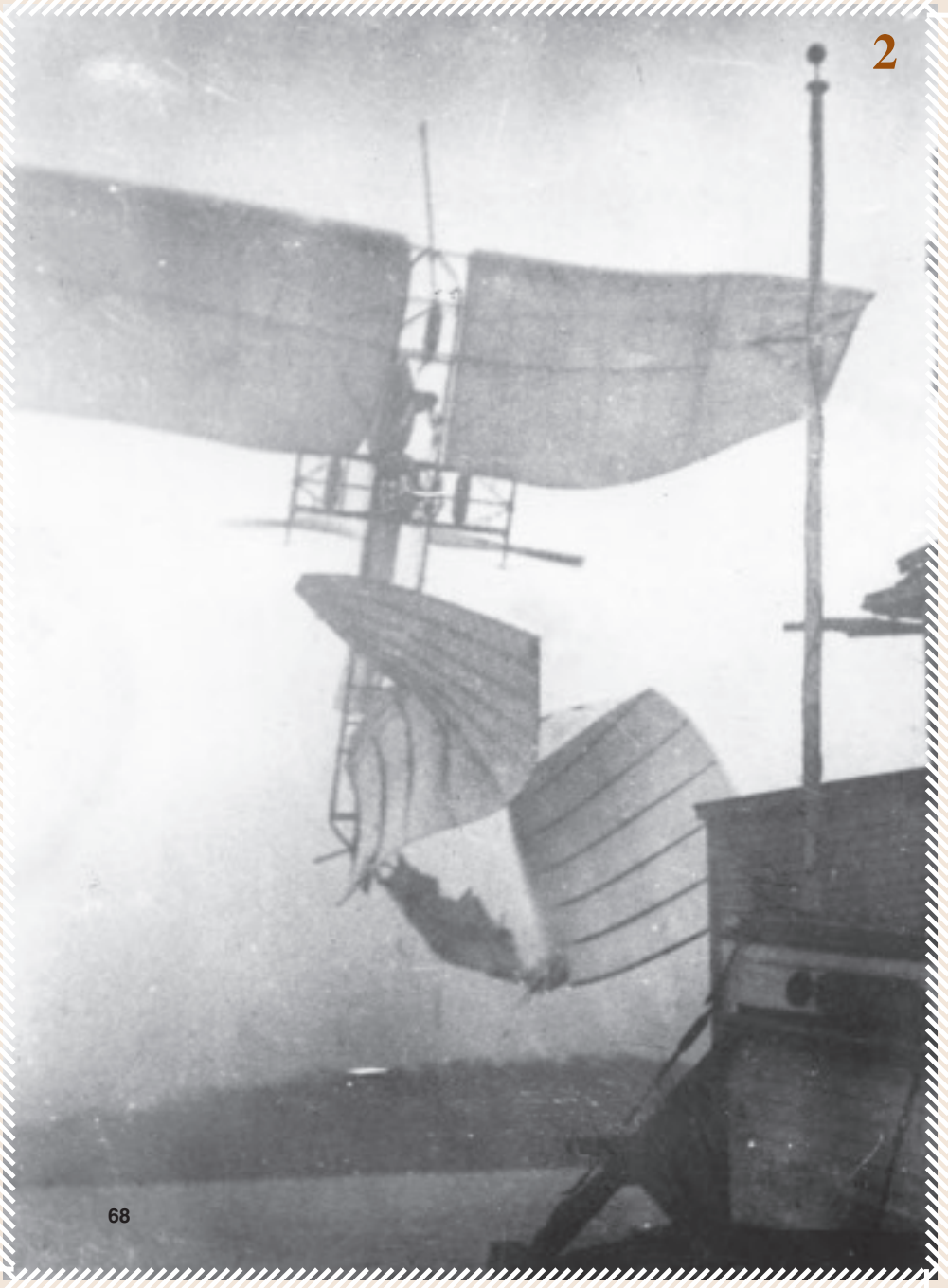
National Archives photos



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chant with deep New England roots. The young Langley attended Boston Latin School, training ground for children of the local elite. He showed promise of future scientific achievement at an early age: With his brother, John, he built instruments that enabled them to view such astronomical phenomena as the craters and seas of the moon, the phases of Venus, and the rings of Saturn.

After graduating from Boston High School Langley did not continue to Harvard, as did his brother and many of his peers. Instead, he traveled west to St. Louis and Chicago to be an architectural apprentice, learning valuable drawing and mechanical skills in the process.

Langley also learned architecture was not the profession for him. He moved back to New England, and after a grand tour of Europe with John, Langley obtained a position as assistant at the Harvard College Observatory. A year later he moved to the US Naval Academy in Annapolis, Md., to teach math and to restore the academy's small observatory.

In 1867 he received the break that was to make his career. He was appointed director of Pittsburgh's new Allegheny Observatory and chairman of astronomy and physics at Western University of Pennsylvania.

Pittsburgh was a backward town by Eastern standards. The university was small, the observatory but one

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telescope, a table, and a few chairs. Langley did not have an eminent education—indeed, he had little more formal schooling than did the Wright brothers, neither of whom received a high school diploma.

But he was ambitious and energetic. He would rise.

"From the beginning to end Langley was self-trained, both as an astronomer and as an engineer and builder," said Crouch.

Langley's first great success was both scientific and entrepreneurial. He recognized that an observatory, even one as humble as his own, possessed something valuable: the ability to determine the precise time. Fast-expanding railroads needed this type of knowledge to coordinate schedules. The era when towns could set local time by their own solar observations was dwindling away.

The Pennsylvania Railroad signed up as the Allegheny Observatory's client. Twice a day Langley sent the correct time via telegraph to the railroad's hundreds of stations. Other businesses soon signed up, providing money to improve the observatory equipment and free Langley for scholarly pursuits.

He focused on the sun. It fascinated him. He spent years observing sunspots, solar prominences, and the sun's corona and chromosphere. His descriptions of these phenomena became detailed classics of their time.

Langley's Law

Unsatisfied with existing instruments, he designed a kind of electrical thermometer he called a "bolometer" to measure changes in the temperature of various regions of the solar surface. He expanded his observations to determine the constancy and effects of solar radiation.

"The inventiveness of mind displayed by Mr. Langley in all his work was remarkable," wrote Charles D. Walcott, his successor at the Smithsonian, in a 1912 biographical memoir.

Langley later was showered with honorary doctorates and other honors. Scientific societies around the world were eager to hear him speak. But he increasingly felt isolated in Pittsburgh as steel and coke producers blackened the local skies. He accepted a job as an assistant secretary at the Smithsonian in 1886 and turned his attention to another scientific interest: flight.

Later in life, Langley would say he first became interested in flight as a boy while watching soaring hawks and buzzards in New England. But the spark that really lit his pursuit of powered flying machines occurred in August 1886 at the annual meeting of the American Association for the Advancement of Science in Buffalo, N.Y.

Langley attended a lecture where an amateur flight enthusiast named Israel Lancaster claimed to have produced small bird-like models able to stay aloft for upward of 15 minutes. The presentation was received poorly. The learned men present scoffed at Lancaster's claims, but Langley's reaction was different. Prevailing knowledge as to how birds fly was clearly lacking, he concluded. He decided to investigate the problem himself.

"He resolved, as a fundamental problem, to ascertain by scientific observation and experiment what mechanical power was required to sustain a weight in air and make it move at a given speed," wrote Walcott in 1912.

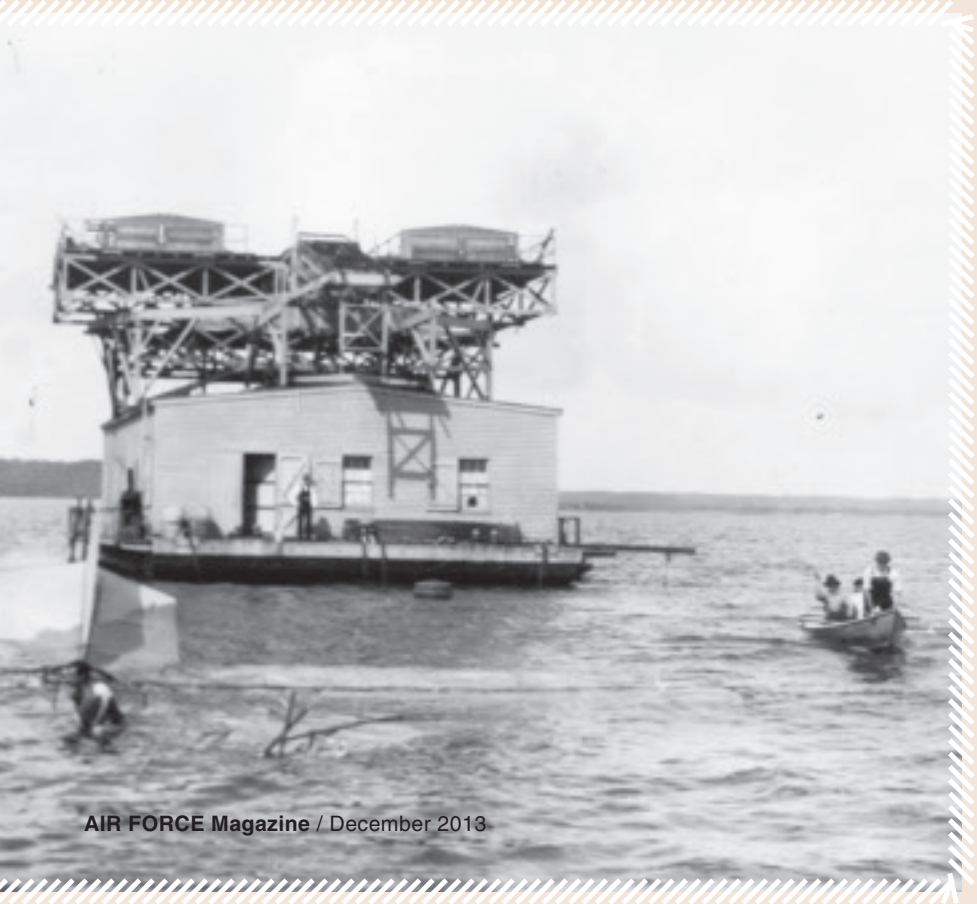
To provide basic data, Langley built a steam-powered whirling arm device. This allowed him to test the results of airflow over variously shaped metal plates. Using the arm, he discovered what he thought to be a basic principle of aerodynamics: The faster a plate "wing" moved through the air, the more its drag declined. The implication of this was that a wing would require less power to stay in the air—not more—the faster it flew.

Labeled "Langley's Law" by contemporaries, this assertion was in fact incorrect. It is true that drag due to lift decreases as speed increases, up to about 50 mph, but past 50 mph parasite drag, produced by the resistance of the air to the wing passing through it, becomes significant and steadily goes up.

"Langley, in short, had not conducted his experiments over a sufficiently broad speed range, and as a result his limited data led him to a fundamentally erroneous conclusion," wrote former Air Force historian Richard P. Hallion in his book *Taking Flight: Inventing the Aerial Age From Antiquity Through the First World War.*

Langley eventually moved to the construction of small gliders and rubber band-powered models. He built some 100 of these, many of them abstractly beautiful, jewel-like objects, but he could not get them to stay in the air more than a few seconds. Thinking more motive force might be the answer—as indicated by Langley's Law—he began to design models large enough to carry small engines.

By now he was secretary of the Smithsonian—a post he had acceded to



|1| The aerodrome leaves the catapult and falls into the Potomac on Oct. 7, 1903. |2| The aircraft breaks apart in midair immediately after being released by the catapult on another attempt, Dec. 8, 1903. |3| The wreckage of the aerodrome sinks into the Potomac River. Manly, the pilot, perches on a piece of debris waiting to be rescued.

Library of Congress photo

National Archives photo

|1| A mere nine days after Langley's unsuccessful flight in December 1903, Orville (at the controls) and Wilbur Wright (at right) flew the Wright Flyer at Kill Devil Hills, N.C., for 12 seconds. That flight is usually considered the first sustained, controlled, heavier-than-air, powered flight. |2| Wright brothers' rival Glenn Curtiss wanted to undermine their accomplishment by proving Langley's aerodrome could have, indeed, flown. Curtiss and two other pilots took to the air in 1914 in a similar—but heavily modified—aircraft. This began a feud between the Smithsonian museum and Orville Wright.

when the incumbent, naturalist Spencer F. Baird, died in 1887. He assembled a small team of expert carpenters, machinists, and other craftsmen in Smithsonian shops. Through trial and error Langley and his men eventually developed a basic plan: tandem wings, one behind the other, with a kite-like tail and twin pusher propellers powered by a one-cylinder steam engine.

He dubbed these models "aerodromes," mistakenly believing the word meant "air runners" in Greek.

"In fact, he had created a word that could only mean a place where aircraft could operate, i.e., an airfield—the first, unfortunately, of his many misapprehensions about flight," wrote Hallion.

With wingspans of up to 14 feet, Langley's model aerodromes were too large to operate from small fields in the nation's capital. They risked damage in hard landings due to lack of skids or wheels. Thus Langley decided to test them over water. Eventually he settled on a site at a wide spot in the Potomac, 33 miles downriver from Washington, near Chopawamsic Creek.

The aerodrome launch pad was a houseboat, which provided height to aid takeoff and could easily turn into the wind. A spring catapult provided speed.

Initial efforts were unsuccessful. The first aerodromes were too weak or underpowered to fly. Some became unmanageable in the slightest breeze. In 1895, aerodrome No. 5 provided a glimmer of hope by flying for a few seconds in several attempts. Then it, too, fell into the waters below.

On May 6, 1896, Langley and his crew prepared to try again. Langley's friend Bell, with camera, came along as a witness. A new aerodrome No. 6 was a quick casualty. A guy wire snagged on the catapult, breaking the left wing before the machine had even left the catapult track.

At 3:05 p.m., the crew readied for another try with aerodrome No. 5. Langley stood on shore watching. Bell floated in a small boat in the river. A mechanic tripped the launcher, the aerodrome ran down its track, and reaching the end, dipped toward the Potomac.

Then it recovered, lifted its nose, and flew.

Moving forward with an inclination of about 10 degrees, it moved north against a gentle wind, then turned to the right, passing almost over Bell, as it completed two circles. Reaching a height of 70 to 100 feet, its propellers ceased turning as the engine ran out of steam. It glided gracefully downward, landing about 140 yards south of the houseboat. It had stayed in the air about one minute and 30 seconds and traveled a total of about 3,300 feet.

Langley, Bell, and others present were stunned and exultant. After years of frustration, they had suddenly seen an epic moment in the quest for powered flight.

No. 5 duplicated this feat later in the day. No. 6, repaired, proved capable of similar flights in further tests that fall. If Langley had stopped at that point his image today might be far more heroic than it is.

"Those were the first significantly large, powered, heavier-than-air machines that had ever flown," said curator Crouch. "They had a 14-foot wingspan, very impressive."

Publicly, Langley said he had achieved all he had set out to do. Privately, he began looking for a means to fund an aircraft capable of carrying a man. The Smithsonian chief knew the federal government was his most likely source of support, and he enlisted Walcott, his well-connected friend, then head of the US Geological Survey, to lobby his case.

The timing was propitious. The Spanish-American War was looming and the US government was indeed interested in a machine that could scout enemy positions or even bomb them. Eventually, Langley won a $50,000 appropriation for the work from the Department of War.

From the first, the engine was perhaps his biggest problem. Langley did not know how much horsepower he would need to get his Great Aerodrome into the air, so he decided to simply develop as much horsepower as he could. He hired Stephen M. Balzer, a New York inventor, to produce an internal combustion engine producing at least 12 horsepower and weighing no more than 120 pounds.

Balzer proposed building a rotary engine with cylinders that would spin around a fixed crankshaft. This would eliminate the need for water cooling and a heavy flywheel. But he could never get the engine to do more than produce a few horsepower, despite years of effort and thousands of taxpayer dollars.

Eventually Langley's assistant, Manly, took over the engine himself, converting it to a radial with fixed cylinders. He refined it so well, it produced more than 50 horsepower. That was far more mechanical muscle than the Wright brothers had at their disposal.

But the Wright brothers knew an airplane was a complex machine in which lift, control, and propulsion all had to work together. Langley in essence was trying to shove something into the air with brute force.

"Langley undoubtedly had the world's best aeronautical engine in 1903, mounted in an airplane that was never going to fly," said Crouch.

The main reason for that was structural weakness. Langley envisioned his Great Aerodrome as a full-size version of his model aerodrome No. 5, but he did not take into account the problem of scale effect. Building a 50-foot wingspan version of a 14-foot wingspan machine produced something too fragile to fly.

"The main spar of that wing is about the size of a push broom handle," said Crouch. "If you're going to shoot it down a rail with streetcar springs, and you've got enough sail area to be a clipper ship, you can just imagine what's going to happen to the wings."

After years of work, the Great Aerodrome faced its first Potomac test on Oct. 7, 1903. With Manly at the controls, and the engine producing more than 50 horsepower, it sprang down the houseboat rails—and plunged nose first into the river. A reporter said it went down "like a handful of mortar." Langley and his crew felt the machine had snagged on the catapult. Photos show the forward wing collapsing at launch.

After repairing the damage, Langley and crew made their last-ditch try on Dec. 8, with winter weather closing in and Wilbur Wright at Kitty Hawk, awaiting Orville's return from Dayton, Ohio, with new propeller shafts.

The Great Aerodrome was heavily damaged on launch and by its fall into the Potomac. On the floor of the House, a member of Congress attacked him for building "castles in the air."

Langley took it hard. He was further battered when a trusted friend absconded with Smithsonian funds to Mexico. Langley died three years later, in Aiken, S.C., after a series of strokes.

A Fraud and a Feud

However, the Great Aerodrome did eventually fly—at least something that was physically similar to it did. The feat launched a controversy that lasted 30 years.

In 1914, the Wright brothers' rival, Glenn Curtiss, was looking for a way to get a Wright patent suit against him dismissed. He thought that if he could demonstrate the Great Aerodrome capable of taking to the air, it would undermine the Wrights' claims to first flight, defeating surviving brother Orville's patents as well.

Walcott, now secretary of the Smithsonian himself, lent Curtiss the old Langley wreckage. Curtiss essentially used this as the base for a whole new machine, adding many components, including pontoons for takeoff. He rerigged the bracing and ultimately put in a new engine as well.

"The final result bore only a vague visual similarity to the 1903 machine," wrote Hallion.

This Great Aerodrome did make skipping flights off Lake Keuka, N.Y., but they were not a great success. One ended with the rear wings collapsing. Still, Langley's remaining supporters hailed the results.

They showed that Langley "developed and built the first man-carrying aeroplane capable of free flight," wrote Albert F. Zahm, chief of the aeronautical division of the Library of Congress and an old friend of Langley, in a 1913 Smithsonian report.

Smithsonian officials unwisely took up this wording and promoted it on behalf of their former chief. They displayed the Great Aerodrome with a label reflecting Zahm's claim.

Orville Wright was infuriated. He sent the original Wright Flyer not to the Smithsonian, but to the Science Museum in London's South Kensington area.

The rift remained unhealed for years. It fell to Walcott's successor, Charles G. Abbott, to close it. He began with a 1928 Smithsonian report acknowledging Orville Wright's feeling "that the Smithsonian Institution has appeared to be engaged in propaganda with the object of exulting Langley at the expense of himself and his brother." While this report recognized that the museum's claims about Langley were not entirely correct, it did not disavow them completely.

Wright remained angry. Abbott enlisted famed flier Charles A. Lindbergh to lobby Wright for the return of the nation's greatest aeronautic artifact, but the trans-Atlantic aviator was not successful. Finally, in 1942, Abbott wrote another report acknowledging the injury done the Wrights and repudiating any claims to the Great Aerodrome's airworthiness.

Abbott ended by writing, "If the publication of this paper should clear the way for Dr. Wright to bring back to America the Kitty Hawk machine to which all the world awards first place, it will be a source of profound and enduring gratification to his countrymen everywhere."

Orville Wright never gave any indication that he had changed his mind, but on his death in 1948, executors discovered that in his will he had left the Wright Flyer to the Smithsonian.

Today the Wright Flyer is displayed at the center of an exhibit room at the Smithsonian Air and Space Museum on the National Mall. Langley's Great Aerodrome hangs from the roof of the Smithsonian's Steven F. Udvar-Hazy Center in Chantilly, Va., supported by wires, but airborne at last. ■

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