



Propeller Failure Precipitated Wright Flyer Control Loss

The first fatal accident involving a powered, heavier-than-air aircraft occurred during a demonstration flight in September 1908 for the U.S. Army Signal Corps. The pilot, Orville Wright, was seriously injured; his passenger, Lt. Thomas Selfridge, was killed.

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FSF Editorial Staff

About 1718 local time Sept. 17, 1908, a Wright 1908 Flyer struck terrain during a demonstration flight at Fort Myer, Virginia, U.S. The pilot was seriously injured, and the passenger was killed. The airplane was destroyed.

The Aeronautical Board of the [U.S. Army] Signal Corps said, in its final report, that the accident “was due to the accidental breaking of a propeller blade and a consequent unavoidable loss of control which resulted in the machine falling to the ground from a height of about seventy-five (75) feet.”

The pilot, Orville Wright, and his brother, Wilbur Wright, had designed and built the airplane, which was a derivative of an earlier airplane in which Orville Wright in December 1903 had conducted the first powered, controlled and sustained flight in a heavier-than-air aircraft.¹

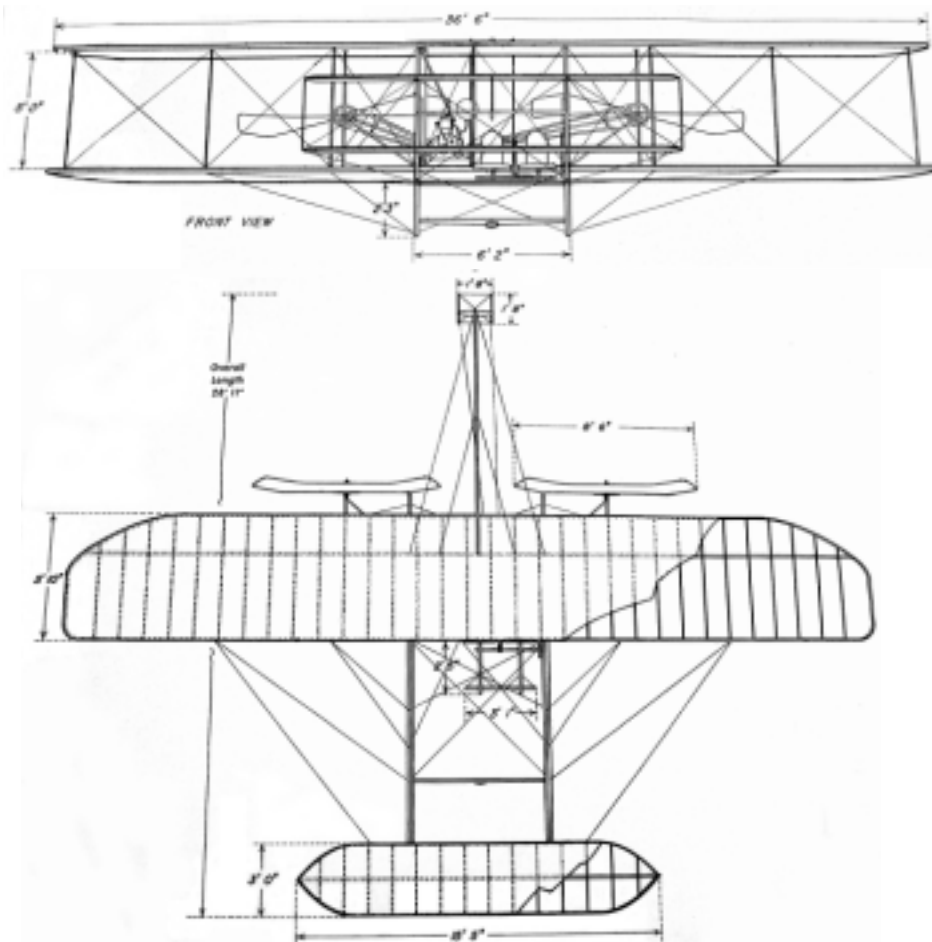
The Wrights — who owned a bicycle shop in Dayton, Ohio, U.S. — had entered a bid in the Signal Corps’ solicitation for a “heavier-than-air flying machine.”² Contract specifications issued by Brig. Gen. James Allen, chief signal officer, included the following:³

- “It is desirable that the flying machine should be designed so that it may be quickly and easily assembled and taken apart and packed for transportation in army wagons. It should be capable of being assembled and put in operation in about one hour.”



- “The flying machine must be designed to carry two persons having a combined weight of about 350 pounds [159 kilograms], also sufficient fuel for a flight of 125 miles [201 kilometers].”
- “The flying machine should be designed to have a speed of at least 40 miles per hour [mph; 64 kilometers per hour (kph)] in still air.”
- “The speed accomplished during the trial flight will be determined by taking an average of the time over a measured course of more than five miles [eight kilometers], against and with the wind.”
- “Before acceptance, a trial endurance flight will be required of at least one hour, during which time the flying machine must remain continuously in the air without landing. It shall return to the starting point and land without any damage that would prevent it [from] immediately starting upon another flight.”
- “It should be designed so as to ascend in any country which may be encountered in field service. The starting device must be simple and transportable. It should also land in a field without requiring a specially prepared spot and without damaging its structure.”
- “It should be provided with some device to permit a safe descent in case of an accident to the propelling machinery.”

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Wright 1908 Flyer

After conducting extensive stability-and-control experiments with kites and gliders, Orville Wright and Wilbur Wright, who operated a bicycle shop in Dayton, Ohio, U.S., constructed their first powered airplane in 1903. The brothers left no blueprints or detailed drawings of their airplanes. The following information was gathered from their notes, papers and correspondence, and from photographs of the airplanes.

The Wrights' 1903 Flyer had dual "planes" (wings) with a span of 40.3 feet (12.3 meters) and a maximum chord of 6.5 feet (2.0 meters). The wings were attached by 16 interplane struts that were 6.2 feet (1.9 meters) long. Total wing area was about 503 square feet (47 square meters). The airplane had a twin "horizontal rudder" (elevator) mounted ahead of the wings and a twin vertical rudder mounted behind.

The right wings were about four inches (10 centimeters) longer than the left wings to provide additional lift to support the engine and accessories, which were installed to the right of centerline and weighed about 34 pounds (15 kilograms) more than the "operator" (the pilot), who flew from a prone position left of centerline.

The Wrights and their mechanic, Charles Taylor, designed and built the water-cooled, four-cylinder in-line engine, which had a displacement of 201 cubic inches (3,294 cubic centimeters) and weighed about 179 pounds (81 kilograms) with fuel, oil, water and accessories (e.g., magneto, oil pump, radiator). The engine produced a maximum 16 horsepower (12 kilowatts) at 1,200 revolutions per minute (rpm) and 12 horsepower (nine kilowatts) at 1,020 rpm.

Fuel was gravity-fed to the engine from a 0.4-gallon (1.5-liter) tank mounted on a forward strut. The engine did not have a carburetor. A valve in the fuel line was adjusted before flight to provide sufficient fuel flow to run the engine. Before entering the engine, fuel was vaporized as it passed over the water jacket around the cylinders.

The wooden pusher propellers were 8.5 feet (2.6 meters) long and had a maximum chord of 7.5 inches (19.1 centimeters). The left propeller rotated counterclockwise, as viewed from the back of the airplane; the right propeller rotated clockwise. Driven by chains and solid-steel shafts, the propellers rotated at about 348 rpm at an engine speed of 1,200 rpm.

The airplane was launched from a ramp. The flight controls consisted of a padded hip cradle connected to both the wing-warping mechanism (which changed the angle of incidence of the outboard sections of the wings) and the rudder, and a lever connected to the elevator and operated by the pilot's left hand. A right-hand lever was used to stop a stopwatch (to record flight time) and activate the fuel-cutoff valve for landing. Instruments comprised the stopwatch and a "distance meter" driven by an anemometer.

On Dec. 17, 1903, Orville Wright conducted the first powered, controlled and sustained flight in a heavier-than-air aircraft at Kill Devil Hill in Kitty Hawk, North Carolina, U.S. Duration of the flight was 12 seconds, and distance traveled was 120 feet (37 meters). The brothers conducted three more flights that day, the longest — 59 seconds and 852 feet (260 meters) — by

Wilbur Wright. The 1903 Flyer was destroyed in a windstorm soon thereafter.

The Wrights built another airplane in 1904. It had similar dimensions but, at about 710 pounds (322 kilograms), was about 105 pounds (48 kilograms) heavier than the 1903 airplane. The additional weight included about 70 pounds (32 kilograms) of iron bars installed to move the center of gravity aft. The engine, with a slightly larger displacement, produced a maximum 16.9 horsepower (12.6 kilowatts) at 1,306 rpm while turning the propellers at 412 rpm.

In September 1904, the launching ramp was replaced with a catapult-like "starting derrick" — a 20-foot (six-meter) tower with drop weights of 1,200 pounds to 1,400 pounds (544 kilograms to 635 kilograms) connected by ropes and pulleys to a cart carrying the airplane on a rail.

The brothers conducted more than 100 flights in the 1904 airplane at Huffman Prairie (now Wright-Patterson Air Force Base) near Dayton. Each brother made a circling flight of five minutes duration, traveling about three statute miles (five kilometers) at an average speed of 35 miles per hour (mph; 56 kilometers per hour [kph]).

Among changes incorporated in the 1905 Flyer were the addition of two inches (five centimeters) to the wingspan and a reduction of the gap between the wings to 5.9 feet (1.8 meters). Stability was improved by enlarging the elevator and rudder, and by moving them farther from the wings.

In October 1905, Wilbur Wright conducted a circling flight of 38 minutes duration, covering 24 miles (39 kilometers) at an average speed of 38 mph (61 kph). After 1905, the Wrights did not fly again until May 1908.

The 1908 Flyer, also called the Model A, was the 1905 airplane modified with seats and an extended footrest to allow the pilot and a passenger to sit upright on the leading edge of the lower wing. Also installed was a slightly larger engine that produced 30 horsepower to 40 horsepower (22 kilowatts to 30 kilowatts). The airplane weighed about 800 pounds (363 kilograms).

The pilot sat in the outboard seat and operated a right-hand push-pull lever connected to both the wing-warping mechanism and to the rudder, and a left-hand push-pull lever connected to the elevator.

Several versions of the 1908 airplane were built and demonstrated to potential buyers in Europe and the United States. For example, wingspan was reduced to 36.5 feet (11.1 meters) for demonstrations to the U.S. Army Signal Corps in 1909.

The brothers established the Wright Corp. in 1909 and built several more airplanes, including the Model B, which had a single elevator mounted behind the twin rudder and was the first mass-produced airplane, and the Model R, a single-seat racer with an eight-cylinder engine and a top speed of about 80 mph (129 kph).

Wilbur Wright died of typhoid fever in 1912 at age 45. Orville Wright sold his interest in the Wright Corp. in 1914 but continued experiments that included the development of the first automatic stabilizing device for airplanes. He died in 1948 at age 76.♦

Sources: McFarland, Marvin W., ed. *The Papers of Wilbur and Orville Wright, Volume One: 1899–1905 and The Papers of Wilbur and Orville Wright, Volume Two: 1906–1948*. New York, New York, U.S.: McGraw-Hill, 1953. Kandebo, Stanley W. "The Wright Brothers and the Birth of an Industry." *Aviation Week & Space Technology* Volume 157 (Dec. 30, 2002).

- "It should be sufficiently simple in its construction and operation to permit an intelligent man to become proficient in its use within a reasonable length of time."

The Signal Corps also said that the price quoted in the winning bid would "include the instruction of two men in the handling and operation of this flying machine. No extra charge for this service will be allowed."

In their bid, the Wrights proposed a price of US\$25,000 for their airplane and for "flight instructions."⁴

The Signal Corps received 41 bids and accepted three bids, one of which subsequently was withdrawn. The corps awarded contracts to the Wrights and to Augustus Herring, who had bid \$20,000. The contracts required delivery of their flying machines to Fort Myer on or before Aug. 28, 1908. (Herring, who had constructed and flown gliders designed by Octave Chanute, had not developed a powered, heavier-than-air airplane when he bid on the Signal Corps contract. Ultimately, he did not deliver an airplane to Fort Myer and was found to have defaulted on the contract.)

At the time, the Wrights also were negotiating to sell airplanes to the governments of Britain, France and Germany. They decided that Wilbur would conduct demonstrations in Europe and that Orville would conduct the Signal Corps trials.

The Signal Corps log includes the following information about test flights and demonstration flights conducted by Orville after he arrived at Fort Myer on Aug. 20:⁵

- Orville's first flight, on Sept. 3, lasted 1 minute, 11 seconds, and the average speed was 36 mph (58 kph).
- On Sept. 8, he flew for 11 minutes, 10 seconds — "13 times around the field [i.e., the parade grounds]" — before landing "to obtain goggles and to make the footrest comfortable, as his feet would slide from one side to the other."
- On Sept. 9, a flight of 57 minutes, 31 seconds "was the world's record up to date for a ... heavier-than-air machine." The record soon was broken in a second flight of 61 minutes, 15 seconds (55 times around the parade grounds). Orville conducted a third flight with a passenger, Lt. Frank Lahm, of 6 minutes, 24 seconds, which was "the world's record for two men."
- On Sept. 10, Orville flew for 1 hour, 5 minutes, 52 seconds — 58 times around the parade grounds — at a maximum height of 200 feet.
- On Sept. 11, Orville made "two figure 8s" during a flight that lasted 1 hour, 10 minutes, 24 seconds.



Left-front view of the Wright 1908 Flyer shows the right propeller and chain drive, radiator, engine, fuel tank, seats for the passenger and pilot, and flight-control levers. Orville Wright stands behind the left wing. (Photo: Wright State University)

- A flight of 9 minutes, 6.3 seconds with a passenger on Sept. 12 was “a new record for the world.”

A *New York Herald* newspaper reporter who observed the Sept. 3 flight said that the airplane “bucked and jerked” as it was flown around the parade grounds.⁶ “The flight was neither smooth, birdlike nor graceful, but it was flying, not floating,” he said.

In an article published in 1927, the reporter said:

A generation accustomed to cross-ocean, cross-polar and cross-continent flying cannot realize the excitement which resulted from the first public Wright flights. Few people believed that the awkward, homemade, crude box-kite-like structure could fly. ... That a heavier-than-air machine could be practical, the man in the street simply didn't believe, and ten thousand of him went to Fort Meyer and stood around to scoff when the reserved little man from Dayton first sat in the 'aeroplane' ... to give his first demonstration. ... Nevertheless, he flew — and every daily [news]paper in the country carried a front-page story the next day.

Orville's passenger on the Sept. 12 flight was Maj. George Squire, who was quoted in the Sept. 13, 1908, issue of the *New*

York Herald as saying, “That was simply splendid. I want some more of that. I never enjoyed anything so much in my life.”

The Signal Corps log indicated that engine work was performed on Sept. 14 and that no flights were conducted that day, and that high winds prevented the airplane from being flown on Sept. 15 and Sept. 16.

The accident report said that on Sept. 17, “Mr. Wright was almost ready to begin his official trials, so he put on a set of new and longer propellers ... for the purpose of tuning up the speed of his machine preparatory to making his official speed trial. These propellers were probably nine feet [three meters] in diameter; the ones in use up to that time were probably eight feet, eight inches [two meters, 64 centimeters] in diameter.”

Lt. Thomas Selfridge, a Signal Corps aeronautical officer, was eager to make a flight with Wright before leaving Fort Meyer on Sept. 19 for dirigible duty in St. Joseph, Missouri. The high winds that had prevented flights from being conducted Sept. 15 and Sept. 16 had abated; a northeast wind of four mph (six kph) was recorded Sept. 17. The airplane was removed from its shed at 1646 and moved to the starting track.

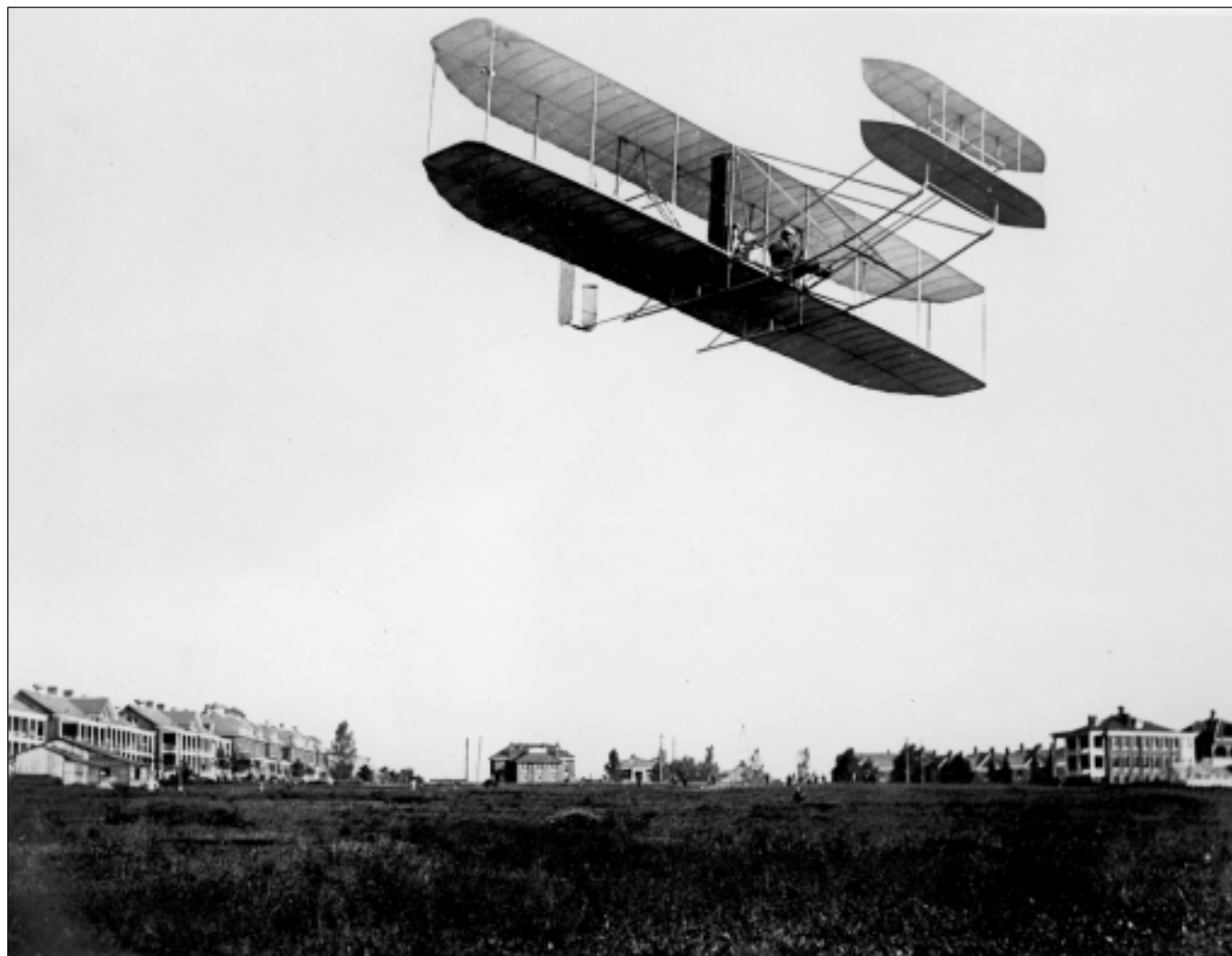
Among the observers was Dr. Leon L. Watters, who said that Wright and Selfridge “looked for all the world as though they were perched on an overgrown box kite. Their bodies were completely exposed, the engine directly behind them.”⁷

Lahm was standing with his horse near the airplane shed. Later assigned to head the investigation, Lahm included the following statement in the accident report:

It started at [1714], circling the field to the left as usual. It had been in the air four minutes and 18 seconds, had circled the field 4 1/2 times and had just crossed the aeroplane shed at the lower end of the field when I heard a report [loud noise] then saw a section of the propeller blade flutter to the ground. I judge the machine at the time was at a height of about 150 feet. It appeared to glide down for perhaps 75 feet, advancing in the meantime about 200 feet [61 meters]. At this point, it seemed to me to stop, turn so as to head up the field toward the hospital, rock like a ship in rough water, then drop straight to the ground the remaining 75 feet.

The report included information from interviews of several other witnesses, including the following:

- An artillery sergeant who was standing on the artillery guardhouse porch said that he observed “the rear rudder collapse and fall to the front and to the right; then, after the machine had advanced about 60 feet [18 meters], the broken propeller blade fell to the ground.”
- A mounted sentinel stationed at a cemetery gate about 90 feet (28 meters) from where the airplane struck the ground said that he “heard a loud noise [and] saw the propeller blade fly.” He observed the airplane begin to descend and then “drop rapidly headfirst,” with the front ends of the landing skids striking the ground first. The report said, “While the machine was falling, [the witness] was occupied trying to get out of the way with his horse. He said the men in the machine tried to talk while falling [and] that when he went up to the machine after it was on the ground, Mr. Wright’s head was hanging down between two wires which crossed on his chest. His right arm was



Orville Wright conducts a demonstration flight over the parade grounds at Fort Myer, Virginia, in December 1908. (Photo: Wright State University)

extended under [Lt.] Selfridge as though to hold him up. He exclaimed, ‘Oh, my arm.’”

- Another mounted sentinel said that he “heard a pop, looked up and saw the machine advance a certain distance, then drop straight down.”

Octave Chanute — a civil engineer who had conducted pioneering experiments with gliders, corresponded regularly with the Wright brothers and had observed many of their early flights — was standing 560 feet (171 meters) from where the airplane struck the ground.

“[Chanute said that] when the machine was 300 feet [92 meters] from him, the propeller flaked off or snapped, and the piece fluttered down to the ground,” the report said. “The aeroplane maintained its level for 60 to 100 feet [18 to 31 meters], then oscillated and pitched down, with the left side depressed, and disappeared from his view behind the bushes.”

Chanute told investigators that his examination of the broken propeller blade indicated that the wood was “brittle and overseasoned, or kiln-dried.” He said that he believed “the propeller blade had struck the upper guy [support] wire of the rear rudder and had torn the end of the wire from its attachment to the rudder.”

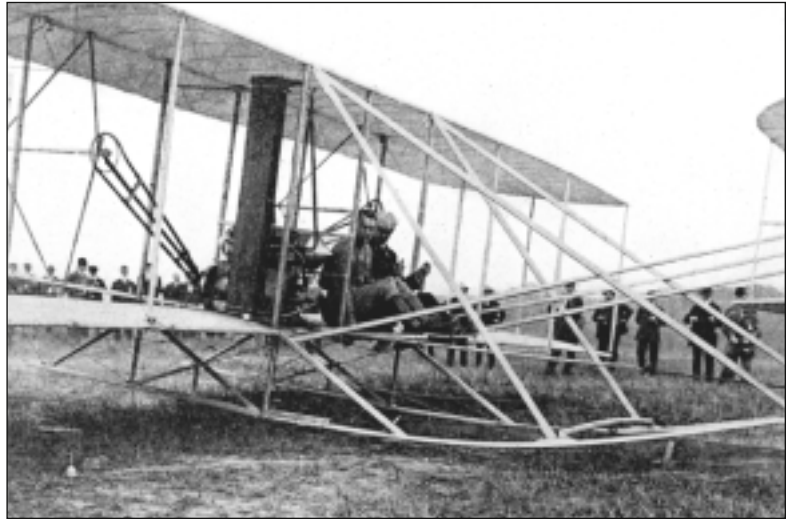
The report included the following statement by Dr. George Spratt, a friend of the Wrights who witnessed the accident:

The machine was completing the last quarter of the turn when the portion of the blade was thrown off. ... The machine completed the circle and was heading toward the starting derrick, the engine running and the flight apparently undisturbed. It proceeded about 200 feet [61 meters] and started to descend, assuming a negative angle (i.e., the chord of the surfaces became directed toward the earth).

Its elevation was probably 65 feet when the descent began. At about 25 feet above the ground, its angle of incidence became positive (i.e., the chord of the surfaces directed skyward). It did not gain sufficient horizontal velocity by the downward and forward pitch for support. It again took a negative angle of incidence and struck the ground. The forward framing struck first, the side to the left of the aviators slightly in advance of the side to the right. The angle at which the surfaces struck seemed to be about 40 [degrees].

Lahm interviewed Orville at the Fort Myer hospital on Oct. 31, 1908. Lahm included the following statement in the accident report:

He said he heard a clicking behind him about the time he crossed the aeroplane shed. He decided to land at once



Lt. Thomas Selfridge and Orville Wright (with hat) sit in the airplane before the accident flight on Sept. 17, 1908. (Photo: Wright State University)

but, as there was scarcely time to do it before reaching the cemetery wall, he decided to complete the turn and head toward the upper end of the field. He thought he was about 100 feet high at the time the propeller broke and that he descended more or less gradually about 40 feet, then the machine dropped vertically.

He shut off the engine almost as soon as the clicking began, then corrected a tendency to turn, which the machine seemed to have. All this time, the machine was coming down pretty rapidly. He pulled the lever governing the front rudder [elevator] as hard as possible, but the machine still tipped down in front, so he pushed the lever forward and pulled it back again hard, thinking it might have caught or stuck. ... He said he thought that the rear rudder had fallen sideways and the upward pressure of the air on it probably threw the rear of the machine up and the front down, and that this accounted for its failure to respond more readily to the front rudder. He stated that at a height of about 60 feet, the front end of the machine turned nearly straight down, and then it fell.

About 15 feet from the ground, it again seemed to respond to the front rudder, and the front end came up somewhat, so that it struck the ground at an angle of about 45 degrees.

The piece that separated from the propeller blade was 2.5 feet (0.8 meter) long. The report said that the piece had broken off the right propeller and had marks indicating that it had struck a wire supporting the rudder.

“This wire ... had marks of aluminum paint on it such as covered the propeller,” the report said. “The left propeller had a large dent, and the broken piece of the right propeller had a smaller dent indicating that the broken piece flew across and struck the other propeller. The upper right guy wire of the rear

rudder was torn out of the metal eye which connected it to the rear rudder.”

Lahm included the following statement in the accident report:

I am of the opinion that due to excessive vibration in the machine, this guy wire and the right-hand propeller came in contact. The clicking which Mr. Wright referred to [was] due to the propeller blade striking the wire lightly several times; then, the vibrations increasing, it struck it hard enough to pull it out of its socket and at the same time to break the propeller. The rear rudder then fell to the side, and the air striking this from beneath, as the machine started to glide down, gave an upward tendency to the rear of the machine, which increased until the equilibrium was entirely lost. Then the aeroplane pitched forward and fell straight down, the left wings striking before the right. It landed on the front end of the skids, and they as well as the front rudder were crushed.

Both Mr. Wright and [Lt.] Selfridge were on their seats when the machine struck the ground, held there by wire braces which cross immediately in front of the two seats. It is probable that their feet struck the ground first, and, as the machine dropped nearly headfirst, they were supported by these wire braces across their bodies.

After the airplane struck the ground, Lahm galloped his horse to the accident site.

I found Mr. Wright lying across the wires mentioned above, trying to raise himself but unable to do so. He was conscious and able to speak but appeared very badly dazed. He was cut about the head where he had struck the wires and possibly the ground.

[Lt.] Selfridge was lying stretched out on the wires, face downward, with his head supported by one of these wires. He died at [2010] that evening of a fracture of the skull over the eye, which was undoubtedly caused by his head striking one of the wooden supports or possibly one of the wires. He was not conscious at any time.

With the assistance of a couple of enlisted men, I removed Mr. Wright from the machine and placed him on the ground, where he was immediately taken charge of by army surgeons. ... Mr. Wright was found to have two or three ribs broken, a cut over the eye, also on the lip, and the left thigh broken between the hip and knee. He was in the hospital at Fort Myer for six weeks [and then] went to his home in Dayton, Ohio. [Lt.] Selfridge was buried with full military honors at Arlington Cemetery on September 25th.

Watters assisted U.S. Army surgeons in tending to Wright and Selfridge at the base hospital. He said that although Wright and Selfridge sat in front of the engine, “they suffered no injury from this heavy structure. It was the little cushioned seat which

loosened and struck Selfridge with such force near the base of the skull that a guy wire was forced deeply into the flesh of his face and neck.”⁸

After the accident, mounted sentinels were posted around the airplane “to keep back the crowd, a very difficult matter at that time,” said the report. That evening, the airplane was dismantled and stored in the shed; it later was shipped to the Wrights’ bicycle shop in Dayton.

Orville was in a wheelchair when he returned to his home Nov. 1, 1908.⁹ By Nov. 14, he was beginning to move about on crutches. In a letter to his brother that day, Orville said that he had been unable to get reliable information about the accident. The details in his account of the accident were similar to those that he had related to Lahm. Orville also said that he felt helpless when the airplane did not respond to the controls. He said that the airplane began to “right itself rapidly” about 25 feet above the ground and that he believed a safe landing could have been conducted if the recovery had begun a few feet higher.

In January 1909, Orville and his sister, Katharine, joined Wilbur in France. The brothers conducted flights in France and Italy, and returned home in May.

Wilbur came to a different conclusion about the cause of the accident. In a letter to Chanute on June 6, 1909, he said that his inspection of the accident airplane indicated that a curved section of the right propeller blade had cracked along its length, flattened and stopped producing thrust. The resulting imbalance caused the left propeller to move farther forward than normal and strike the rudder-support wire. The wire then wrapped around the blade and broke it off.

“The blade which broke off was not the one which originated the trouble,” Wilbur said. “The splitting of the propeller was the occasion of the accident; the uncontrollability of the tail was the cause.”



Selfridge is extricated from the wreckage while Signals Corps personnel and spectators at right attend to Wright. (Photo: Wright State University)

He also said that they were developing heavier and stronger propeller blades for the Flyer, and were bracing the propeller-axle supports to prevent the blades from striking the rudder-support wires.

In late June 1909, Orville returned to Fort Myer. With Lahm as his passenger, he successfully completed the endurance trial July 27 with a flight that lasted 1 hour, 12 minutes, 40 seconds. He successfully completed the speed trial on July 30 by conducting a flight with Lt. Benjamin D. Foulois as his passenger at an average speed of 42.58 mph (68.51 kph).¹⁰

Wilbur completed the contract requirements by providing flight instruction to Lahm and to Lt. Frederic Humphreys at College Park, Maryland, U.S.

“After approximately three hours of dual instruction, [we] were permitted to solo, after which [we] continued to practice to perfect [our] piloting technique,” said Lahm.¹¹

The Signal Corps officially accepted the Wrights’ airplane on Aug. 2, 1909.♦

[FSF editorial note: This article, except where specifically noted, is based entirely on the Aeronautical Board of the Signal Corps’ report *First United States Military Aircraft Accident, 17 September 1908, Mr. Orville Wright and Lt. Thomas E. Selfridge*. The 13-page report contains an appendix.]

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