An Artist Invents an Airplane

by Frederick Platt

One distinction the present age of specialization likes to draw is between the artistic and scientific mind, yet artist and scientist have throughout history crossed over into each other's domain. When at the turn of the century William de Leftwich Dodge grew interested in heavier-than-air flight, he felt unhampered by being among the leading American painters of his day. Instead he set about building a self-powered model that flew in the period just before manned aircraft would take off. His experiments had no bearing on the progress of aviation, for Dodge did not publicize them and the model was to sit neglected for 30 years until the Smithsonian Institution heard about and acquired it. What makes this specimen particularly important, though, is how forward-looking is a number of its features, far more advanced than its inventor's knowledge of aeronautics. Just as his mastery of the human form derived from sensing the bones and sinews beneath the skin, so he perceived what would make up a flying machine. The same instinct for the way things work that gave life to his art had also prospered this venture into science.

Leonardo da Vinci, the most prominent artist-scientist, had a lifelong fascination with flight. Much of his effort regrettably followed the obvious but mistaken path of the ornithopter with its flapping wings to which human muscles are unequal. He nevertheless invented the parachute, as well as designing a workable helicopter based on a Chinese toy. With its lone wing shaped like a screw, his idea was that it would screw itself into the air, which indeed it awkwardly would have done had he had a powerful engine. Fittingly he was among the aviation pioneers that his fellow artist read about while sailing home from Paris in 1899. Soon after this shipboard encounter, Dodge would resolve to construct no mere flying machine but ''one that could be stopped in the air and come down on a given place, also that could rise in a very short distance." (By coincidence it had been on a westward crossing in 1832 that the American painter Samuel F.B. Morse heard of the latest discoveries in electricity and decided that communication could travel a wire, leading to his development of the telegraph.)

Much more recent than Leonardo were the other experimenters of whom Dodge read—possibly in a magazine article. German engineer Otto Lilienthal had, until his death three years earlier from a crash landing, advanced greatly the fixed-wing glider so that it would be ready when a sufficient motor could be made. Samuel Pierpont Langley, the American astronomer who headed the Smithsonian Institution, began building models in 1891, flew one in the earliest powered flight five years later, and now was devising an aircraft to carry a man. In Paris, Dodge had already met two Americans in the vanguard of aviation. Octave Chanute was near 60 when he devoted himself to the problem, so took for his pilot the young Augustus Moore Herring, once a pupil of Lilienthal. Laboring in such secrecy that the artist could not have heard of them, Wilbur and Orville Wright made the Chute biplane the basis of their own gliders, which preceded the first manned flight in 1903.

William de Leftwich Dodge had been otherwise occupied. Born on March 9, 1867, in Bedford, Virginia, he spent his childhood principally in Chicago and most of his adolescence in Paris, where he would study painting under Jean Leon Gerome at the prestigious Ecole des Beaux Arts. During suitably impoverished days as an art student, Dodge demonstrated mechanical ability by patching his shoes, contriving an elaborate truss of string and wooden splints inside his battered but beloved top hat, and even filling his own teeth. Before reaching 25, he had been commissioned to decorate the interior of the dome atop the administration building, central structure of the Columbian Exposition, the world's fair held at Chicago in 1893. A subsequent work for the upper altitudes was his 1895-96 ceiling for the northwest pavilion of the Library of Congress, Washington, displaying a winged horse unconcerned with weight or drag. Such successes helped him decide to specialize in the mural, required by the magnificent architecture that marked the era in which he flourished.

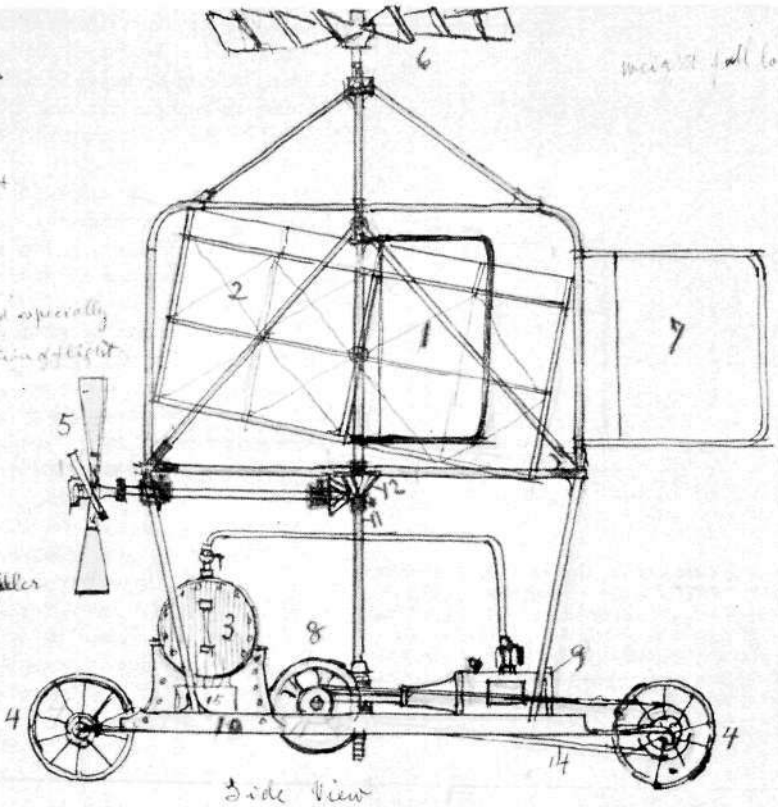
Settling in New York City, Dodge commenced his aeronautic experiments in his large studio at 51 West Tenth Street. Numerous drawings came first, followed by paper models powered by elastic, a stepping-stone used by some of his most illustrious predecessors. How these five or six models of his looked is unknown, since they and the drawings have been lost, but they flew as far as 30 feet. It was at this stage that he had the idea to make a craft that would halt in the air. From future correspondence, this would seem to mean descending vertically rather than hovering, nor was this a goal during the rest of his investigations. Constructing a model with its propeller at top, he released it from the 20-foot ceiling of his studio and was pleased to see it dropping slowly. Yet another paper model with a tractor propeller (one in front of the wing, as opposed to a pusher propeller in back) reassured him that horizontal flight was possible, so he was set to combine airplane with helicopter.

Work on his grand model began in spring of 1900. The design imitated the up-to-date gliders in his reading, but only superficially,

Readying the model for presentation to the Smithsonian Institution, Dodge in 1931 used pen and black ink to make these two unsigned sketches on one piece of light gray paper 19 by 12 inches. Above is a side view and below a "perspective view in flight"—which by the way is a master drawing. Both renderings he numbered according to the same key: (1) air brakes; (2) movable main wings; (3) boiler of galvanized iron; (4) wheels; (5) front propeller; (6) top propeller "to help lift and especially for coming down"; (7) rudder; (8) engine flywheel of cast iron; (9) the two brass cylinders of the engine; (10) aluminum chassis; (11) vertical shaft; (12) bevel gear for the front propeller; (13) stationary wings; (14) belt to drive the rear wheels; (15) alcohol lamp to heat the boiler.

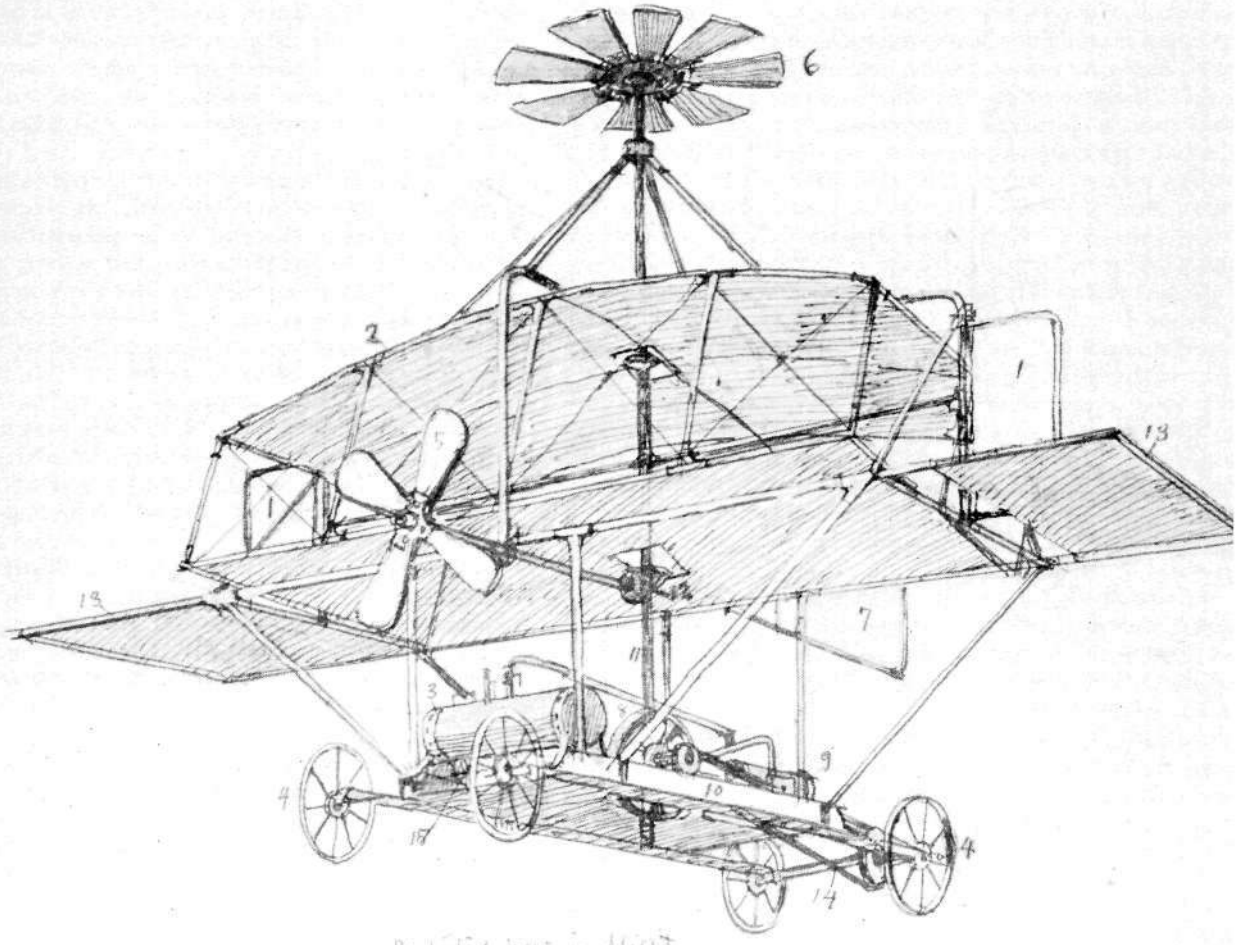
(National Air and Space Museum, Smithsonian Institution)

No 1 Vertical plane used for steering or turning
2 Main planes. B. plane moves up or down
3 Boiler.
4 Wheels. That run on the belt from engine shaft.
5 Front, pulling propeller
6 Top or lifting propeller. Auto Gyro to help left and especially for turning about
7 Tail plane to use in direction of flight
8 Fly wheel of engine
9 2 Cylinders of engine
10 Frame or chassis
11 Vertical shaft.
12 Beveled gear for front propeller
13 & 13 Stationary planes
14 Belt for wheels.
15 Alcohol lamps to heat boiler

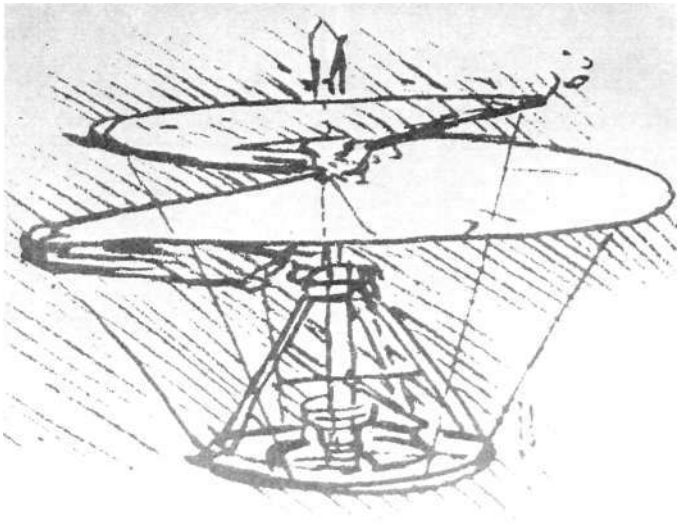


Weight full load about 250 lbs.

Side View



Perspective view in flight



Leonardo da Vinci, the artist most widely associated with flight, drew this famous proposal for a helicopter, never built, whose wing was shaped like a screw so that it would screw itself into the air. Beneath the spiral of flaxen linen sealed with starch, the craft was to be powered by four men scurrying in a circle, each pushing one of the horizontal bars that protruded from the vertical shaft. He also produced the earliest known design for the parachute, though most of his work in aviation was squandered on vehicles with flapping wings. (Bibliotheque de l'Institut de France)

since his grasp of their principles was slight. Chanute had stacked a pair of wings to double the lift area and had set a tail assembly well aft to prevent pitching. Though likewise creating a biplane, Dodge neglected to provide any sort of a tail except a rudder vertically mounted at center just behind the main wings, much too close to provide effective control. Neither did the painter know that lateral stability could be attained through the already long-accepted practice of placing the wings at a dihedral angle; that is, in a shallow V as seen from the front. Out beyond the main planes he instead added stubby, stationary, horizontal wings, one at each side of the aircraft, which were presumably intended to keep it from rolling. The bottom wing of the main pair was flat, while the top, far from a V shape, was arched down toward the tips for an unexplained reason.

More important than the side-to-side shape of a wing, however, is its shape in cross-section. Sir George Cayley (who also applied the dihedral angle) had recognized early in the 19th century that if a wing was curved on top and flat at bottom, the onrushing air would thin out as it traversed the longer and more tumultous upper surface to rejoin the air skidding under the lower, and the resultant suction would raise the wing. Enlightened inventors built cambered wings, but in the case of Dodge, who called wings by the contemporary term of "planes," they were precisely that. Stretching his silk flat on frames made from steel curtain rods, he relied on the lesser lift provided by the underside.

An aircraft wing is mounted at an angle of incidence, slanting slightly-downward from the leading to the trailing edge, so that the air crossing the bottom will be compressed and push the wing upward. On this model, the two main wings were fixed to each other in a single unit pivoted through its center. Variable incidence would be especially helpful were a horizontal landing being made, for a larger angle of incidence would both slow the forward motion while increasing the lift, in the manner a bird tilts its wings and indeed its whole body when settling to earth. Dodge's ingenious idea can be likened to the Wright Brothers' wing warping, in which the wings of wood and fabric subtly changed shape. After wings became rigid, this function was taken over by ailerons, movable flaps along the trailing edge near the wingtips. Such other designs, though, had the advantage that they could also be used for steering.

On how to steer, Dodge was again original. Above the horizontal planes at either side of the craft he placed vertical ones of similarly stubby shape, the difference being that these were hinged. They could be "used singly to turn around with" or if operated together "these vertical planes when adjusted at right angles would stop the plane in midair" to begin the vertical landing. Fifth and final of these stubby airfoils was the rudder, which also influenced direction. (Neither main wings nor control vanes nor rudder could actually be reset while the model was airborne, as would have been possible on the full-size flying machine.)

Most striking of the unusual features was the arrangement of two propellers, each commanding a separate dimension. In 1768 the French mathematician, J.P. Paucton, had proposed the *Pterophore* aboard which the crew by their own power would turn a pair of airscrews similarly positioned. Dodge can nonetheless be credited with not only conceiving a motorized version independently, but also building one. According to the flight plan that the painter envisaged, his manned craft would ascend like today's conventional airplane but in shorter distance, since the "propeller on the top with power to lift the machine" would run simultaneously during take-off.- Following the journey, the vertical planes would check the forward motion, "then by turning off the power and switching the power to the top propeller which pulls upwards, the plane would come down slowly to the designated spot on the ground." By speaking of "the top propeller which pulls upwards," the inventor reveals he had not foreseen that a helicopter would fly in the same way a fixed-wing airplane does. The thrust of a conventional craft moving forward pulls the wings through the air while a helicopter's horizontal blades, resembling a propeller, are in fact rotating wings that force themselves into the air.

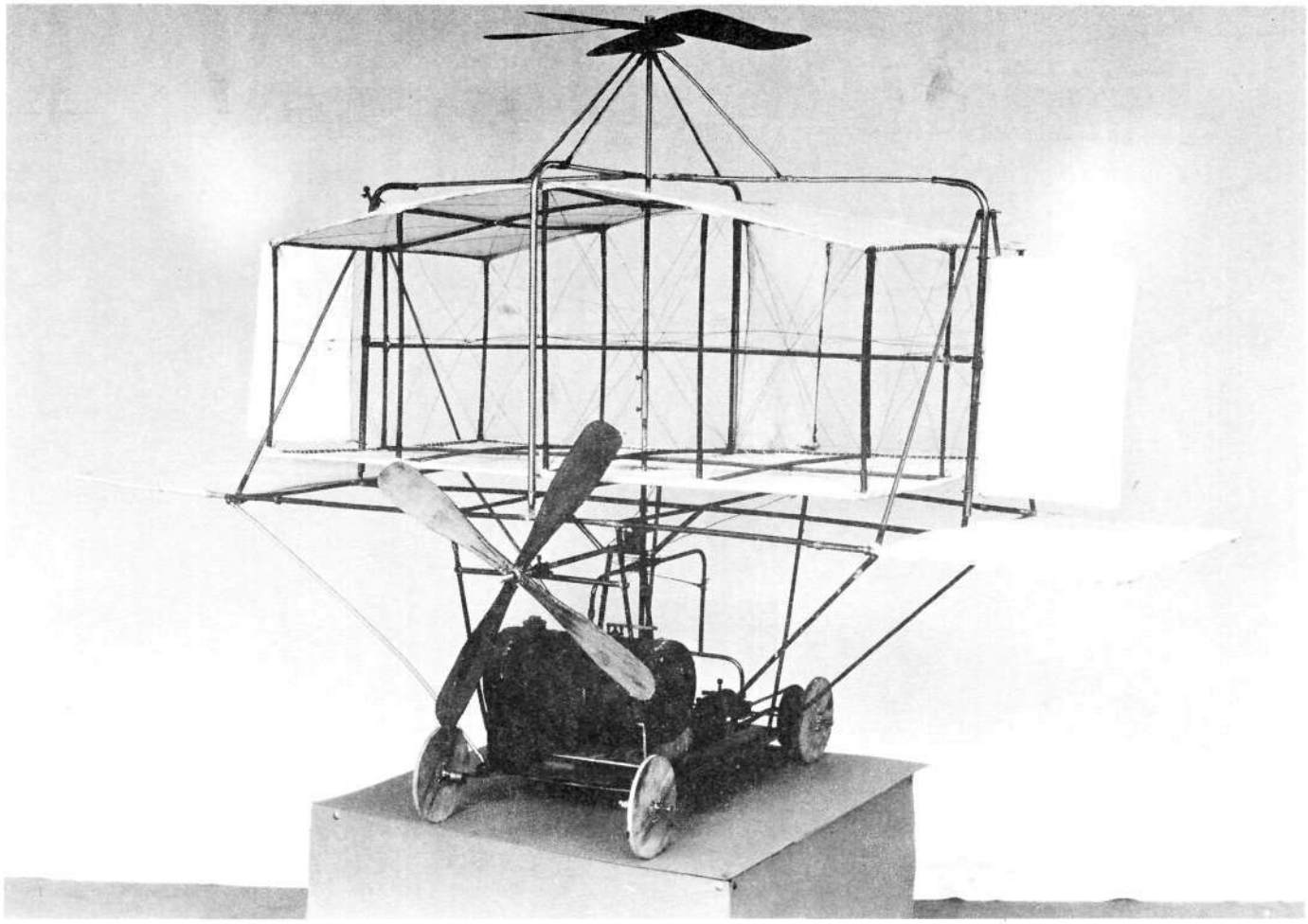
Arising on a long shaft through both main wings, the top propeller had five metal blades of large area. This rotor at 17.5 inches in diameter was too small to lift the craft independently, although it would have slowed its descent besides "helping it to leave the ground." With four narrow, nine-inch blades of wood, the front propeller was of better design aerodynamically. Maybe this insight was only accidental, inasmuch as the propeller was a replacement from years later when he spruced up the model for exhibit, while drawings made at that time show a stouter propeller that may have been original.

Sad to say, he had no new solution to the engine problem, which for generations had prevented powered, manned, heavier-than-air flight, not to become reality before the gasoline motor. Steam, its immediate and oft-tried predecessor, had a power-to-weight ratio too low for full-size flying machines—nor overly ample for models. "I used as power a small steam engine with two cylinders. I found, though, that the weight of the engine with boiler and alcohol to heat it was a great handicap as the weight was more than I expected." To increase stability through lowering the center of gravity, the engine was placed far below the wings. Streamlining went unconsidered.

His launching system was more sensible and advanced than those possessed by his more learned counterparts. Orville and Wilbur Wright's first airplane had two long skids as landing gear, which at takeoff rode a dolly that rolled along a wooden monorail; the brothers would not adopt wheels on their "flyers" until 1910. Langley's two test flights instead became baths in the Potomac after the aircraft snagged on the apparatus intended to catapult it from a boat on the river. Dodge simply had the motor turn not only the propellers but also the rear pair of the four wooden wheels on which the plane taxied until airborne.

"Dodge, you're crazy!" exclaimed fellow artist George Brant Bridgman. "Here you've got a chance to get the King Edward Hotel job and you waste your time fooling with an airship." Except for their knowing an "airship" meant a dirigible, this opinion would have been seconded by the many scientists who were positive that tinkering with aviation could lead nowhere. (A chief contribution by Langley was the respectability gained from so eminent a scientist taking the subject seriously.) Bridgman soon stood among the other friends invited to witness the hoped-for inaugural flight on one Sunday in May 1901. Air currents at least were no bother since the scene of the trial was to be inside the Tenth Street Studio.

Guests had arrived to find an elegant model wrought by the hand of an artist. Few must have anticipated a machine so large, standing

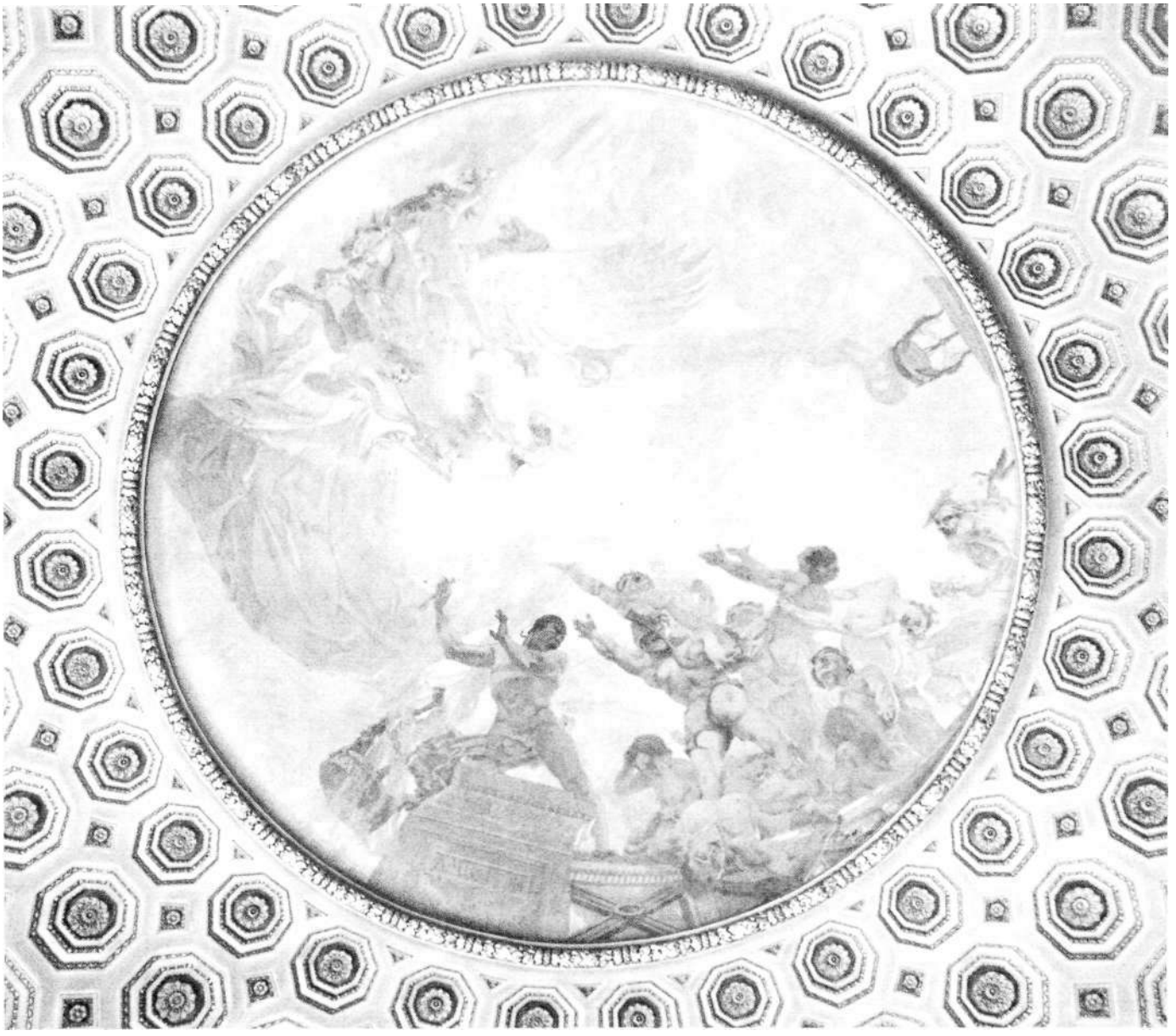


Among the unusual features of this airplane combined with helicopter was that its designer, William de Leftwich Dodge, was a leading American painter of his day. The propeller at front was for conventional flight, while the rotor at top not only assisted takeoff but also enabled vertical landing. On either side of the aircraft were air brakes, a pair of stubby, upright control vanes used singly for turning or together for stopping. Still another curious point was variable incidence, by which the lift was altered through tilting the two main wings. In 1901 the model flew approximately 25 feet as well as proving it could make a smooth descent. After 30 years of neglect, it was acquired by the Smithsonian Institution, which exhibited it until 1958. (National Air and Space Museum, Smithsonian Institution)

41 inches to the tip of the rotor shaft with an overall wingspan of more than four and one-half feet. Its inventor would estimate the weight at 25 pounds fully loaded with water and fuel. The boiler was fired up and both propellers started whirling together with the rear wheels. Released at one end of the room, the craft taxied nearly halfway across the 45-foot-long floor, then began its ascent to an altitude of two feet, which it maintained until crashing into a large picture and the opposite wall. The little airplane had flown, surprising all—none more than Will Dodge.

How picture and wall fared in the collision went unrecorded, but the model was twisted to the point that the next test had to await repairs and some other day. "By attaching the plane with a string to the ceiling 20 feet high and turning on the top propeller and letting it drop," Dodge recalled about that occasion, "it came down straight and very easily without damage." Slipping over a hook at the ceiling and then through his fingers, the string left no chance for

With cigarette butt and no-nonsense gaze, this powerful self-portrait by William de Leftwich Dodge (1867-1935) displays the honesty that gives credence to his claims of success for the airplane model. Dating from circa 1928, the picture is inscribed to his daughter and remains in the family. His inventive way with technology played its part here too, since he painted the likeness on a 28.75 by 20.5 inch sheet of metal that could be submerged in water overnight to keep the air from drying the oils until he had finished. (Virginia Museum of Fine Arts, Richmond. Gift of L Dodge Kimbrough)



Even before his sally into aviation, Dodge had created an aircraft in this winged horse. Painted in oils on a canvas 25 feet in diameter, *Ambition* was completed in 1896, shown at the Paris Salon for that year, then installed on the ceiling of the northwest pavilion at the Library of Congress, Washington, D.C. To the amusement of a jester holding a crowned skull, humanity is depicted with arms outstretched to the figures in full flight. (Library of Congress)

another crash, yet was subject to resistance weak enough that the craft was demonstrated accurately. A smooth descent did not mean it could rise vertically, but Dodge had never said it was supposed to. Extra altitude in the first flight and so soft a landing in the second may have been due to the ground effect, caused by the interrupted down flow from rotor to ground when a helicopter is near the earth.

No mention is made of torque, in which the motor conspires to turn the airborne fuselage with equal force but in opposite direction as it does the overhead blades. Helicopter designers know several means to compensate, but torque for the relatively massive model may have been inconspicuous in this short descent; extended air brakes would have helped keep the body of the craft from revolving. For this test the front propeller seems to have been disengaged, possibly through a temporary modification, since the airplane in its present state does not permit declutching (although the wheels could be freed by slipping off the belt that drove them). "I proved to myself and others," Dodge was by now convinced, "that my principles were sound."

Why should his claim of success on his first two tries be believed when the annals of flight abound in exaggeration? One strong if judgmental reason is the rugged integrity that those who knew him counted among his basic characteristics. It is unmistakable in his painting, where the world is viewed without affectation. Hardly would such a man reminisce about aerial exploits that never happened or under false pretenses allow the model to join the national collection. Further evidence lies in appraisal of the flying machine itself. Yet while a model after this design would have flown, a full-size version with a man in it would have remained squarely on the ground. Scant finances and abundant commissions kept Dodge from continuing the project, but maybe that was just as well. If "terribly disappointed by not being able to prove my ideas by building a large plane," he would have been headed for greater disappointment. Who can say, however, that the resourceful Dodge might not have come up with solutions?

He got the King Edward Hotel job in Toronto that Bridgman had worried about, which was followed by murals for theaters, world's fairs, government buildings, even private residences. Famed personages sat for portraits, and easel paintings of many subjects were produced in the impressionist style. Still no single calling could be

expected to contain Dodge, whose other activities included archaeological excavations. Meanwhile, the flying machine laid ignored, eventually making its way to his country studio alongside his house at Setauket, Long Island—both structures of his own design, of course. Thirty years after taking to the air, the plane was noticed during a visit by Romer Shawhan, an architect who had been a pilot in World War I. Asking his host about it, Shawhan was so startled at the explanation that, unbeknownst to the inventor, he wrote the Smithsonian Institution of what he had seen.

Returning home from Buffalo where he had been working on the murals for the new city hall, Dodge was astounded that night of August 21, 1931, to find a letter from the Smithsonian seeking details together with a photograph of the model. The artist felt highly honored and his ensuing letters to the National Museum are brimming with pleasure unconcealed. Over the next two months he got the craft in shape to have its picture taken. "The planes had to be recovered as the old silk was gone and I had to replace the front propeller, the wheels, and a few trusses of the framework. The little boiler was so full of holes from rust that I made a new one. Otherwise the model is exactly as it was 30 years ago," he wrote when restoration was complete. This long letter of November 12 also describes the history of his experiments, including a final one less successful. "After making these repairs I thought I could make the machine fly again and although I got the engine to go it did not have enough compression to develop sufficient speed to get off the ground. Another hindrance was that the setscrews that held the eccentric and piston rods to the shaft were so old that they shook themselves loose." Still his attempt to reenact the model's past accomplishments confirm their authenticity.

Undaunted by intervening improvements in aviation, Dodge rather touchingly speculates on an updated edition. He enclosed sketches of a monoplane with 250-hp engine, three wheels, and space for a pilot plus a passenger or two. Now the top propeller can "blow against" the single wing from immediately beneath it. "This plane would not be practical for great speed but more for safety in flying and in landing." Such suggestions, however, were not wholly behind the times. Although the conventional airplane by then was well developed, the helicopter stayed unfeasible until the last years of the 1930s brought designs by Henrich Foche in Germany and Igor Sikorsky in the United States. Meanwhile, its place was being held by the autogiro, invented by Juan de la Cierva, a Spaniard. A propeller was at front with what seemed a helicopter rotor at top, but these overhead blades, unconnected to the motor, revolved due to the forward motion of the craft. Hovering was impossible, yet an autogiro could proceed at slow speeds; takeoff and landing, though not vertical, could occur in a short distance. Observing that autogiros looked like his airplane but not comprehending their theory, Dodge came to say he had employed ' 'an autogiro method.'' If the administrators of the Smithsonian were a trifle downhearted to find out otherwise, they could not know that in fact the painter's device surpassed the latest advance.

An interoffice memorandum recommending acquisition of the flying machine opted to "define it as a combined airplane and helicopter." Furthermore, "the model embodies two other features of interest, namely variable incidence and air brakes. . . . The success of the model as early as 1901 proves his applied knowledge was correct, although in the light of present knowledge, several features of the model are crude." Its maker's "foresight. . . entitles his work to recognition." Barely a week after this request, the model was being shipped in two boxes and Dodge was following on the train for Washington, where on December 3 he reassembled his creation in the Aircraft Building. "I expect to see my children flying everywhere before I die," he had prophesied in 1901, and indeed both his son and daughter would be, even if their father had never gone up in an airplane by his death on March 25, 1935, in New York City. The model was exhibited from 1931 to 1958, then put in storage where once more the silk on the wings rotted away. In a recent decision hard to understand from a museum entrusted with safeguarding the nation's artifacts, the wings and control surfaces—two main reasons for the acquisition—were discarded, although the remainder was saved.

V/STOL (vertical/short takeoff and landing) aircraft are today a prime subject of flight research, even if the helicopter is still the only family member in regular use. Dodge's compound helicopter with front propeller and powered top rotor would materialize in such as the Fairey *Rotodyne* of the late 1950s, but has never passed the trial stage, since the wing disrupts vertical airflow, decreasing takeoff and hovering abilities. On other experimental V/STOLs, the propellers tilt upward, or the wing and propellers. Jet varieties arise by means of thrust deflectors. Aviation has progressed at supersonic speed since the painter made his experiments, and he would have been enthralled by it all. Science and art, though, remain to be adequately defined, so that the real question seems not the difference between scientist and artist but between the creative discoverer and the rest of humanity.

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Letters to the author from the artist's daughter, Sara Dodge Kimbrough, March 23 and April 7, 1980, and from officials of the National Air and Space Museum: Dominick A. Pisano, Reference Librarian, October 22, 1979; Catherine D. Scott, Librarian, April 2, 1980; Robert C. Mikesh, Curator of Aircraft Aeronautics, April 4, 1980; and Philip D. Edwards, Technical Information Specialist, April 11, 1980.

ABOUT THE AUTHOR

Frederick Platt is a writer specializing in American life between the Civil and First World Wars. His articles on varied aspects of the era have appeared in many magazines and his book on the nation's architecture during the period is in print. Currently he is writing a book on the works of American architect Horace Trumbauer (1868-1938). Research into the paintings of William de Leftwich Dodge led the author to investigate other sides of this multi-faceted artist, such as the aircraft that is the subject of this story. Mr. Platt lives at 2009 North John Russell Circle, Elkins Park, PA 19117.