

THE CURTISS MODEL D

BY
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Initial inspection of the Curtiss Model D aircraft at Old Rhinebeck Aerodrome reveals a biplane, deviating from the other flying pioneer designs in the collection, the Bleriot XI and the Hanriot, which sport single wings and are therefore considered “monoplanes.” Yet, the Model D’s unique features do not end there. Indeed, there is neither an open nor an enclosed fuselage, but, instead, an almost box kite-resembling assembly of bamboo, beams, and booms; a horizontal, deflecting surface extending in front of the pilot, reminiscent of a canard; a seat, with a shoulder high, half-circle brace which appears more like something one would wear than sit in; an aft-facing propeller, mounted behind it, which seems as if it could not be definitively determined which end had constituted the “front;” small, horizontal surfaces, located midway and behind, the two wings, leaving one to temporarily wonder if this were a triplane; a tailwheel, prevalent on early-century airplanes, replaced by a nose wheel and resulting in a tricycle configuration; and a small arresting hook below hinting at carrier-based naval aviation. These features, extensions of the ground-based transportation technology from which they had been derived, comprise geometrically-arranged design solutions to aerodynamic flight, and are innovations and expressions of the man who had conceptualized them all, Glenn Hammond Curtiss.

Born on May 21, 1878 in Hammondsport, New York, Curtiss, whose middle name had been given in honor of the city’s founding father, had, as a schoolboy, always been interested in mathematics and mechanics and had forged a life path which had closely paralleled that of the contemporary Wright Brothers. That path would ultimately lead to a mirror-cracking, nine-year lawsuit between the two.

Although his formal education had ended after the eighth grade, he had nevertheless had a penchant and passion for technical matters and, buoyed by this inspiration, had been entirely self-taught. Opening, like the Wrights, a local bicycle shop in the wine-cultivating, Finger Lakes region of New York State, he had first repaired them before designing and selling them, establishing, unknown to him at the time, a foundation upon which his interests and abilities would ultimately elevate him as high as the sky, by means of intermittently designed motorized bicycles, or “motorcycles,” light-weight engines, and the airplanes those engines would propel.

A national bicycle champion at 20, and the first person to be issued a US pilot’s license, he was a founding member of the Aerial Experiment Association (AEA) with the likes of Alexander Graham Bell, and won the Scientific American trophy by flying the first aircraft, the bow-winged *June Bug* biplane, for one kilometer on July 4, 1908. Although the event had lagged the *Wright Flyer* triumph at Kitty Hawk, North Carolina, by four-and-a-half years, it had been the first to be publicly demonstrated and verified.

But it had been only the first of many record-breaking flights and feats, none of which, like those of the competing Wright Brothers, had been performed in secrecy. Indeed, with the *Rheims Racer*, a development of the *June Bug*, Curtiss had been able to win the speed prize by flying at 52.63 mph in the Grande Semaine d’Aviation de la Champagne, in Rheims, France, competing

against such names as Latham, Farman, Bleriot, and Comte de Lambert, and even beating Bleriot in his native country by six seconds and garnering the Gordon-Bennett Trophy

In the United States, Curtiss had subsequently won the \$10,000 Hudson-Fulton Prize by piloting his *Albany Flyer* from Albany to Manhattan, and his NC-4 design, intended for the Navy, had made the first transatlantic crossing to the Azores in 1919, some eight years before Charles Lindbergh had flown the more northerly route to Paris. Acquisition and restoration of Samuel Pierpont Langley's ill-fated *Aerodrome* had even enabled him to successfully fly that design, thus validating its merits.

Curtiss, whose nationally-renowned Curtiss Aeroplane Company, the largest during World War I with two plants and more than 100 employees, had succeeded in making numerous, fundamentally important innovations and creating aeronautical designs during the early 20th century, and had, according to Augustus Post, Secretary of the former Aero Club, "worked his way up from the making of bicycles to the making of history."

The Curtiss Model D embodied all this experience. Most closely based upon the *Rheims Racer* of 1909, which itself had incorporated several Aerial Experiment Association design characteristics, it had significantly deviated from other concurrent aircraft. The *Rheims Racer* itself, having evolved into the larger design which had flown between Albany and New York and the ultimate Model D, had featured two identical, directly superimposed, cambered airfoil surfaces constructed of Baldwin rubber silk tacked to spruce ribs and laced to the frame, and mounted five feet apart, forming its biplane configuration.

Power, formerly provided by four-cylinder, air-cooled, 25-hp, vertical engines, which themselves had been little more than adaptations of automobile types, had later been replaced by the more capable V-arrangement, doubling the number of cylinders to eight and horsepower production to 50. Because of its continuous, full-power requirement, the rear cylinders, mounted in longitudinal configuration, had been more prone to overheating, requiring a cooling method change from the previous air to the present water. Although the eight-cylinder V-type necessarily bore a weight penalty over the earlier-generation of powerplants, it had offered continuous horsepower for considerable intervals, rendering Curtiss's biplanes the fastest then in existence.

Characteristic of these earlier designs had been two, 12-square-foot, interconnected ailerons which, in an attempt to deviate from the Wright-patented wing-warping method of inflight blanking, had provided transverse control, while two 24-square-foot elevators, forming a second, smaller biplane and mounted at the end of two bamboo outriggers, pivoted at their meeting point ahead of the pilot in a canard arrangement, effectuating a climb, or upward pitch, and descent, or downward pitch, by means of a respective pull or push of the control column.

The tailplane had been formed by a 15-square-foot, rigid, horizontal surface, providing a stabilizing keel, and a 6.6-square-foot, pivotal, vertical surface mounted at the intersection of bamboo outriggers and connected to the pilot's steering wheel through their hollow centers, facilitating yaw control.

The aircraft rested on pneumatic, springless, bicycle-like wheels.

All these design features had been incorporated in the later Curtiss Model D, whose ultimate configuration, echoing the methodology applied by the Wright Brothers, had been the result of a systematic approach to overcoming aerodynamic obstacles with design solutions.

The aircraft, with a 26-foot overall length, features neither an open nor an enclosed fuselage, but instead a geometric collection of spruce, ash, and bamboo serving as a common flight surface, control, and undercarriage attachment point, and is comprised of a trapezoid to support the forward elevator; a lower triangle for the pilot's seat, control column, and nose wheel; dual, horizontal airfoils for lift, below which are the main wheels; and an aft, tailboom-formed triangle extending to the vertical and horizontal tailplane. The engine, mounted between the two wings, is sandwiched between these forward- and rearward-extending geometries. Somehow resembling a box kite, which had been dawning, heavier-than-air aviation's only flying predecessor, it is a prime example of form following function.

Two interplane ailerons, tracing their origins to those developed by Curtiss during his Aerial Experiment Association involvement, had initially been mounted ahead of the cambered wings on the forward struts, but their inter-surface air foil disruption had necessitated their relocation to the rear ones, behind the wings. Unlike the wing-warping method, which had entailed the twisting of the entire airfoil, these "ailerons," which translate as "little wings" from the French, and initially appear like a third wing forming a triplane, hinge up or down, creating more lift on one side and inducing a bank in the opposite direction. Four moveable, triangular-shaped surfaces, mounted on the wingtips of the Curtiss *White Wing* aircraft, an AEA design, had constituted an earlier attempt to provide lateral control.

The "cockpit," consisting of little more than an exposed, wooden seat, a wheeled control column, and foot pedals, had been based upon the motorcycle and automobile from which the new pilot, according to Curtiss's ideology, would most likely transition. Mechanical controls should be a natural connection to the limbs, imitating the dexterity of the human form. Its controls were the key to the extension from one to the other, resulting in a human-machine interface, and the Model D uniquely introduced three car-like foot pedals.

The first of these, located on the left, released a spring-loaded "claw" beneath the airframe to snag, brake-like, dirt and grass, while the second, in the center, engaged the nose wheel brake, whose simple arrangement had entailed the release of a block which provided friction as it depressed the actual wheel, slowing its rotation. But the third of the three, located on the right, had, more than any of them, echoed automobile operation, replacing the traditional engine throttle and fully replicating the ground-based gas pedal.

Unlike a car's steering wheel, which turns its wheels, or an aircraft's yoke, which differentially deflects its ailerons, the Curtiss Model D's circular control operated the rudder for aerial banking, a movement traditionally controlled by foot pedals, while the column on which the wheel is mounted actuates the forward, single elevator for pitch, or longitudinal, control, by means of a simplistic bamboo pushrod connection.

The triangular-shaped surfaces extending above and below the horizontal elevator augment yaw-axis stability.

Aileron actualization, whose method had been introduced by the *June Bug*, is another example of motorcycle technology transfer, its pilot seat-attached shoulder yoke, akin to something one would "wear," pivots to either side in order to differentially deflect the aileron surfaces themselves, mounted on struts located beyond and between the main wings' trailing edges. The pilot only needs to lean toward the raised wing in order to return the airplane to its neutral position.

A radiator separates the pilot from the 80-hp, eight cylinder, V-configured, A-3 Hall-Scott engine built in 1911 and sports an aft-facing, two-bladed wooden propeller, which extends above and below the two trailing edges, thus earning the aircraft its designation of "Pusher." A long, cylindrical, almost torpedo-resembling fuel tank is installed below the upper wing.

The aircraft, although primitive in appearance, is actually advanced in operation, incorporating several Curtiss-designed innovations, inclusive of the shoulder yoke aileron control, the ailerons themselves, the foot controls, and the tricycle undercarriage.

Instrumental in the development of naval aviation, the Curtiss Model D, piloted by Eugene Ely, had been the first aircraft to operate from an aircraft carrier, taking off from the *USS Birmingham* on January 18, 1911 and landing on the *USS Pennsylvania* ten months later, on October 11, requiring the installation of an arrester hook to do so. Pontoon-fitted, it had also conducted water operations. A two-person military version, the Model D Type IV, had been acquired by the US Army Signal Corps, on April 27 of that year, and had been designated "Signal Corps Airplane Number 2." "Signal Corps Airplane Number 1" had been a Wright Brothers design.

The Curtiss Model D's unique flight control configuration and tail-heavy balancing require some degree of pilot familiarization.

Engine starting, like that of all early designs, is a two-person procedure, requiring the seated pilot to move the spark advance lever to the "retard" position and to lightly rest his foot on the throttle pedal, while the standing ground attendant, sandwiched between the rear tailbooms, turns the propeller extending from the eight-cylinder engine. After it has been turned, the spark lever is engaged and it rotates into air and noise circulating life.

The field staff, more than the aircraft's inherent capabilities, provide guided direction on the ground, since it is devoid of nose wheel steering, despite its novel, tricycle undercarriage configuration, and its rudder is ineffective at slow, initial speeds.

Full engine run-up, with the aircraft pointed toward the wind, ensures fouled plug clearance.

With the biplane pointed in the desired take off direction, and water and oil temperatures within safe ranges, the pilot signals the ground staff to release its grip and the foot-throttle pedal is completely depressed, at which time fuel is piped to the Hall-Scott engine and its full, 80-hp production is verified by its propeller rotation.

Up-elevator deflection, hitherto relieving the nose wheel of excessive ground pressure, is progressively diminished until the air, routed over and down the two cambered, fabric-covered wings with sufficient speed, reduces upper-surface pressure and they react by taking the path of least resistance--upward, and taking the geometric, beam-formed structure to which they are attached with them.

Surrendered to the air, which requires three axes of control, the Model D negotiates the wind with its shoulder yoke-deflecting ailerons, its column-connected canard elevator, and its steering wheel-activating rudder. The former, directly connected to the pilot's shoulders, is an interactive maneuver, rendering the aircraft very much an extension of him, as if it were a larger, aerial "body."

Because of its tail-heavy stability, it requires some degree of down-elevator deflection to maintain straight-and-level flight, and its wooden beam, flat-plate devoid geometry easily results in skids without corrective, coordinated aileron-and-rudder turns.

Aircraft drag, quickly resulting in stalls, and the shock absorber-devoid undercarriage, necessitates gentle, power-on landings.

Initial acquisition of a Curtiss Model D for the Old Rhinebeck Aerodrome collection had occurred in the mid-1950s when Cole Palen had attempted to purchase one from a museum in Connecticut, but it had been intermittently sold to someone else. Never deterred or daunted by obstacles, he had built one himself. Subsequently preparing it for an Air Force air show, and conducting nocturnal, high-speed taxi tests, however, he had pulled back on the canard elevator-deflecting column and the biplane had rotated into a virtually vertical climb, stalling and crashing back on to the ground with minimal personal injury.

He later built two more reproductions, one of which, completed in 1976 and powered by the original, 1911 Hall-Scott engine obtained from the Smithsonian Institution, had been intended for the Saturday "History of Flight" air shows and still flies today. It had been demonstrated in Hammondsport, New York, shortly after it had been completed to honor its original designer.

Like all of Old Rhinebeck's pioneer aircraft, it is restricted to a short hop above the rolling grass field.

Subjected to an extensive reconstruction in the spring of 2002, the aircraft received an upper wing center section refabrication, a new propeller, and an overhaul of its A-3 powerplant, which had entailed disassembly of its crankcase, magnetos, carburetor, cylinders, and heads, taking to the skies so configured on August 10 and making its first aerial circuit in its 27-year history from the Avalon Airport in Geelong during the 2003 Australian International Airshow.

Despite its primitive- and frail-appearing, wood beam, strut, and wire construction geometrically collected in the form of a biplane, the Model D, incorporating many significant, early, 20th-century innovations and advancements, was the product of Glenn Hammond Curtiss's systematic solution to aerodynamics and aerial flight. Its controls are an extension of the pilot who flies it. Its airframe, to which they are attached, is an extension of the man who designed it.

