

CHAPTER 1

From First Seeds to Early Blossoms

The period before 1926 witnessed the beginnings of a number of activities that would become part of general aviation. First, pioneer aviators began to explore the limits of the new invention and potential uses for it beyond military and commercial applications. The first of these aviators were the birdmen and bird women of the exhibition era between 1910 and about 1915–16. After World War I, a second group of exhibition pilots emerged: the barnstormers. Second, as enthusiasm for flight grew, more and more individuals sought to take to the skies. Many early aviators were forced to learn to fly by trial and error. However, beginning around 1910, a number of flight schools opened up around the country. Third, at many of the early airfields hosting flying schools, individuals also offered fuel, maintenance, and other services. These were the first of what have since become known as fixed-base operations and those running them as fixed-base operators. Others looked for additional ways to earn a living in aviation. They were the pioneers of aerial surveying and photography, crop treatment, and corporate flying.

Shaping much of what happened by providing the opportunities for and setting the limits to aerial activity were the planes and their power plants. Through World War I, both aircraft and power plants were rare and expensive to purchase and maintain. The three most important aircraft types were those produced by the Wrights, Glenn Curtiss, and Louis Blériot. In addition, a number of individuals around the country produced aircraft based on those types and, to a certain extent, on their

own designs. Some of these pioneers survived to emerge as important general aviation aircraft manufacturers. Others, in a demonstration of both the wide-open and highly risky nature of early aircraft manufacturing, soon moved on to other endeavors. Powering these first aircraft primarily were Wright engines (found mostly in Wright aircraft), Curtiss engines (found mostly in Curtiss aircraft) and imported French Anzani and Gnome/LeRhone engines. Again, a number of individuals also produced aircraft power plants of their own design.

Between the war and 1926, the most common aircraft types used in general aviation were the plentiful and inexpensive military-surplus trainers: the Curtiss JN-4D “Jenny” and the Standard J-1. Although a number of new general aviation aircraft were designed and built during the early 1920s, most fell victim to economics. As during the prewar period, all of these aircraft were of wood and fabric construction. However, by the end of this early period at least two companies, Travel Air and WACO, were beginning to build personal aircraft with steel-tube fuselages.

The period between 1903 and 1926 thus proved to be an important formative one. While general aviation did not fully emerge until the mid-1920s, the seeds for future general aviation activity were planted in the first quarter of the twentieth century and many of the first blooms began to come forth.

The Origins of General Aviation: The Birdman Era through World War I

By the time the Wright brothers began their quest to solve the problems behind the achievement of heavier-than-air flight, the idea of a flying machine was one that more and more people were beginning to take seriously. Other pioneer experimenters—such as Otto Lilienthal, Octave Chanute, and Samuel Langley—had lent respectability to the pursuit of heavier-than-air flight. Balloons and, more importantly, dirigibles had proved to the public the reality of lighter-than-air flight. Heavier-than-air flight thus seemed a more realistic next step. Even as the Wrights succeeded at Kitty Hawk, North Carolina, and worked to perfect their craft on the Huffman Prairie outside of Dayton, Ohio, those close to the development of aeronautics in the early twentieth century began to speculate on what uses might be made of heavier-than-air craft.

The Wrights themselves saw military and commercial applications

(transporting freight, passengers, and the mail) as the most likely uses for their invention—uses that would assure them a return on their investment. However, the airplane was a frail and unproven technology in its infancy, and while the Wrights succeeded in gaining military sales both at home and abroad, they and other pioneer aviators also sought to profit from the sport or exhibition use of their aircraft, so they opened up some of the first flight training facilities.

The Wrights, Glenn Curtiss, and others formed exhibition teams to travel around the country and demonstrate their flying machines. Once the Wrights had successfully demonstrated their invention in Europe and at Fort Myer, Virginia, the American people craved their own look at this new wonder. Local aviation enthusiasts organized air meets all across the country, and both the Wrights and Curtiss were able to charge premium prices for the appearance of their airplanes and pilots. The Wright and Curtiss fliers competed not only against each other, often for prize money, but also against European pilots and their airplanes. Large and enthusiastic crowds were on hand to greet them everywhere.

These pioneer aviators discovered both the possibilities and the limits of profiting from aviation by using aircraft for entertainment. As first, simply the promise of seeing one of these miraculous flying machines was enough to draw thousands of people to aviation meets. Soon, however, the public began to demand more. In part out of a desire to continue to draw large crowds and in part out of their genuine enthusiasm for flight, pilots began to push their fragile craft to their limits. Dips and dives and eventually loops and rolls became standard fare. Pushing the limits, though, came with a high price tag: crashes were common and often resulted in fatalities. The high death rate itself began to dampen some of the public's enthusiasm for exhibition flying. Yet, no matter what stunts the pilots devised, the American public soon came to view flying as somewhat commonplace. Exhibition flying peaked in 1910 and 1911, and although air shows continued through 1913 and 1914, by 1915–16 the first era of exhibition flying was at an end.¹

Lincoln Beachy emerged as one of the most famous and daring of these early exhibition pilots. Beachy, born in 1887, came to aviation from what became a somewhat familiar path. He started with bicycles, then moved to motorcycles and finally got interested in balloons. After learning the fundamentals of balloon flight, Beachy quickly moved into dirigibles. By 1906 he was on the exhibition circuit flying his own craft, nicknamed the “Rubber Cow.” Beachy continued to pilot his dirigible on the

circuit for a number of years. In 1910, however, he saw a French aviator flying a Farman airplane. Sensing that the future lay in heavier-than-air flight, Beachy sought lessons at the Curtiss Flying School. After a somewhat difficult start, Beachy completed the course and by the end of 1911 was the highest earning performer among the Curtiss birdmen.

Beachy specialized in highly risky and thrilling maneuvers. He became widely known for his dips, dives, loops, and spins. By 1913, however, Beachy began to sense that the business of exhibition flying was perhaps a bit too dangerous. During that year he “retired” no fewer than three times, once after accidentally killing a young woman spectator. Following his third retirement, Beachy returned to the exhibition circuit partnered with racecar driver Barney Oldfield. The two toured the country racing aircraft against automobile. Beachy also continued to pursue his stunt flying. In early 1915, while test flying a new acrobatic monoplane, Beachy crashed and died. He was not the first of the exhibition pilots to lose their lives. In fact, the number of deaths had grown so high that by the time Beachy died many had come to the conclusion that exhibition flying was simply too dangerous, too deadly. The large number of deaths on the circuit eventually contributed to the end of the early exhibition era.²

The men who flew for the exhibition companies were among the first formally trained pilots in the United States. Both the Wrights and Curtiss had basically taught themselves to fly. The process had been long and dangerous and they were all probably quite lucky to have survived it. They realized that for the airplane to be practical it not only had to fly, it also required someone at its controls who knew how to fly it. By 1910, both the Wrights and Curtiss were selling aircraft to the military and showing off their exhibition companies. In order to train the pilots the military needed to fly their new purchases as well as those for their own exhibition companies, the Wrights and Curtiss each opened flight training schools. Most of the early students were either pioneer military aviators or would-be birdmen like Lincoln Beachy. However, the schools soon began to attract others drawn to aviation, as well. Students included a number of wealthy individuals who needed to learn how to operate their newly purchased flying machines. The schools accepted both men and women as students, but excluded African Americans. Although a number of pioneer aviators continued to teach themselves to fly, and pilot licenses were not required until 1926, a number of flight schools began operating successfully around the country.³

While both military and commercial aviation for the most part would be closed to women throughout much of the twentieth century, they were able to find a niche, albeit a small one, in general aviation. As noted, the early exhibition era included not only intrepid birdmen like Lincoln Beachy, but also a number of bird women. Like their male counterparts, they delighted in flying and participated fully in pushing aviation technology to its limits. In doing this, though, they shared the fate of many of the birdmen. One of the most famous bird women of this era was Harriet Quimby, who in 1911 became the first American woman to earn a pilot license. The following year she gained international fame as the first woman to fly an aircraft across the English Channel. Shortly thereafter, however, she was killed in a fall from an aircraft she was piloting. Other pioneer women fliers, such as Katherine and Marjorie Stinson and Ruth Law, managed to live through the exhibition era while setting aviation records as they engaged in the same type of stunt piloting done by the men.⁴

Katherine and Marjorie Stinson, along with their brother Eddie, in addition to continuing their exhibition careers, opened an early flying school. Katherine had learned to fly at the Max Lillie Flying School in Chicago and Marjorie trained with the Wrights. Both women thus had licenses and a familiarity with more formal flight training. When war broke out in Europe in 1914, the Stinson family realized that there might be an opportunity to use the new airfield they had just opened near San Antonio, Texas, as a flight-training center. In addition to the fact that the U.S. military often employed civilian flight schools to train military aviators, in 1915 the Canadian government sought to find a way to train airmen for service in the British military. As a result, the first graduates of the Stinson School of Flying, all trained by Marjorie Stinson, were Canadian citizens. During 1915 and 1916 the school attracted not only more Canadian flight students, but also a number of young men interested in flying for the U.S. military. Although the Stinson family invested much in equipment and worked hard at maintenance, training operations were hard on the school's aircraft. Eventually, a combination of accidents, the fact that the U.S. military had opened its own training fields, and the wartime ban on civilian flying forced the school to close in 1917. Stinson Field remained, however, and eventually evolved into Stinson Municipal Airport, an important satellite airport in San Antonio. As owners and operators of an airport and flying school, the Stinson family became one of the first fixed-base operators in the country.⁵

During World War I, Katherine Stinson attempted to find a role for women in aviation that went beyond exhibition flying and flight training. In 1918, the U.S. Post Office began experimenting with using airplanes to move the mail. At first the planes and pilots were borrowed from the military, but the Post Office soon began to buy its own planes and hire its own pilots. Although the experiment began with a number of problems and missteps, the idea of an airmail service captured the public's attention. Following an exhibition tour of Canada, Katherine Stinson returned to the United States and presented herself to Post Office officials as a potential airmail pilot. Not willing to take no for an answer, Stinson eventually convinced the Post Office to give her the opportunity to fly the mail. On September 26, 1918, Stinson, along with an escort pilot and plane, flew the mail route between Washington, D.C., and New York City. The next day, she and her escort flew back to Washington. Her flight, although of some importance, failed to permanently break the gender barrier barring women from flying the mail. For reasons never fully explained, Katherine Stinson resigned immediately after her one and only airmail flight. Stinson's health may have been the deciding factor: within months of her resignation she began a six-year battle with tuberculosis. She never played an active role in aviation again, particularly after her marriage in 1928, and women's place in aviation remained in general aviation.⁶

The few companies involved in aircraft manufacture before World War I saw the military as their prime market. Nonetheless, the Wrights, Curtiss, and others also sold aircraft to individuals. Given the cost of their machines, the personal aircraft market was limited primarily to the wealthy, although many of the early exhibition pilots used their earnings to purchase their own planes. One of the most prominent of the early wealthy aviation enthusiasts was Harold McCormick of Chicago. Heir to the McCormick Reaper fortune, Harold McCormick belonged to the Chicago Aero Club and in 1911 not only helped plan a major air meet, but also allowed the Aero Club to develop the area's first airport, Cicero Field, on 180 acres of land he owned. McCormick even tried his hand at aircraft design. The strange looking craft flew, but not very well. Within two years McCormick's attention had shifted from land-based aircraft to water-based aircraft or hydroplanes. In 1913, he purchased a hydroplane from Glenn Curtiss. That first machine was destroyed in a crash, but McCormick quickly bought a second and hired a pilot so that he could use the plane to commute from his home to Grant Park, near

his downtown Chicago office. His enthusiasm soon waned, however, and McCormick withdrew from aviation in 1915.⁷

McCormick's commitment to the Aero Club field was also limited. In 1913, only two years after permitting use of the site, McCormick sold the land upon which the Aero Club had developed Cicero Field. Although it closed in 1916, Cicero Field was a hotbed of aviation activity in the Chicago area during its short life. The field was so heavily used that the Aero Club hired a manager, Andrew Drew, and paid him \$40 per week to serve as the region's first airport manager. Max Lillie operated his flying school on the field from 1911 until his death in 1913. The Aero Club used the field for testing pilots before issuing them a license. In addition to Katherine Stinson, pioneer aviators Glenn Martin, Norman Prince (who served in the Lafayette Escadrille), and Chauncy "Chance" Vought all learned to fly at Cicero Field.⁸

Although a number of individuals shared McCormick's enthusiasm for flight, few had the means for indulging it. Many of them wanted to join the ranks of the birdmen. For them, the best chance of getting airborne was to build their own airplane. The field was fairly wide open despite the Wright-Curtiss patent fight. The Wrights closely guarded their design and any use of it, whereas Glenn Curtiss freely allowed others to copy his early aircraft, making it possible for people with a desire to fly and a certain amount of mechanical aptitude to at least briefly set themselves up as aircraft manufacturers. For example, three brothers from Omaha, Nebraska, found their way into aviation and exhibition flying by building their own version of a Curtiss airplane.

Brothers Otto, Charles, and Gus Baysdorfer arrived in Omaha with their parents in 1887. Otto opened a bicycle shop in the early 1890s, but soon focused his efforts on another hot new technology, the automobile, completing the first one built in Nebraska in 1897. Another new technology caught the attention of the mechanically minded brothers three years later. In 1900, Charles witnessed a balloon flight at a local festival and two years later forged a friendship with noted balloonist John Waldorf Hall, who offered to train him. By 1903, Charles was out on the air show circuit, flying his balloon and parachuting from it. A year later, a severe bout of typhoid fever forced him to return to Omaha in order to recuperate. While he was home, he convinced his brothers to join him in aviation.

The brothers built and successfully flew their first flying machine in 1908, a dirigible named *The Comet*. By the following year, however, the

nation was abuzz with news of the Wright brothers' and Glenn Curtiss's success with heavier-than-air-flying machines. Like many of those longing to get airborne, the brothers modeled their first aircraft after Glenn Curtiss's 1908 *June Bug*.⁹ The brothers gained firsthand experience with Curtiss flying machines in July, 1910, when the Curtiss exhibition team came to Omaha. They had the opportunity to see a working airplane up close and were able to talk with the mechanics and pilots. By November, the brothers were ready to take their airplane out for its first flight. Charles, the only brother with any kind of flying experience, was at the controls.

The Baysdorfers conducted their flight tests in an open field near the small town of Waterloo, Nebraska. As news of their achievement spread, people began to travel out to watch. Once they felt they had perfected their new craft, Gus (as mechanic) and Charles (as pilot) joined the Moisant Exhibition Company and began traveling on the air show circuit. Gus soon tired of life on the road and returned home, but Charles continued to fly for several years. In 1916, while performing as a stunt pilot in an early movie, Charles crashed and destroyed his airplane. He decided it was time to retire from aviation and moved to Florida. Between 1910 and 1916, the Baysdorfers built perhaps four aircraft. Charles used one on the exhibition circuit and Katherine Stinson, according to local sources, bought another. However, just as the brothers had moved from bicycles to automobiles, from automobiles to dirigibles, and from dirigibles to airplanes, they soon moved from airplanes to other interests. Charles took up fishing in Florida and Otto and Gus ran the family machine shop in Omaha, where they continued to work on other new inventions.

The Baysdorfers built their aircraft primarily as a vehicle for participating in the lucrative world of exhibition flying. They represented the many individuals who sought fame and fortune in the aviation industry only to find that the opportunities involved a great deal of personal risk.¹⁰ There were others, however, who began to think about building aircraft solely for what they believed would become a large market for personal aircraft. The wealthy could afford to buy airplanes from the same companies producing aircraft for the military, but a number of pioneer aircraft manufacturers began to dream of building planes that less affluent buyers could afford. Among them was Clyde Cessna, who got his start in aviation before World War I and, unlike the Baysdorfers, emerged from that conflict as one of the earliest manufacturers of general aviation aircraft.

Born on December 5, 1879, in Hawthorne, Iowa, Clyde Cessna moved to Kansas with his family in 1881. By the time he reached his teenage years, Cessna had earned a reputation for his considerable mechanical abilities. His talent came in handy after he and his brother Roy bought their first automobile, a one-cylinder, four-horsepower affair that proved very inappropriate in Kansas' sandy soil. Cessna bought a second automobile, an eight-horsepower Reo, in 1907. As he gained more experience with automobiles, he developed a desire to learn more about them. He soon made friends with an Overland car dealer and by 1910 was earning a living managing a dealership in Enid, Oklahoma. The following year he traveled to Oklahoma City to attend an air show, where he witnessed the flight of a Blériot Type XI monoplane. Convinced that he wanted to fly and that a monoplane was the best way to do it, he immediately sought to purchase his own airplane.

Cessna traveled to New York City and visited the Queen Aeroplane Company, which built reproductions of the Blériot Type XI. After spending several weeks at the plant learning about aircraft construction and going up for a few flights, Cessna arranged for the company to ship his new \$7,500 aircraft home to Enid. He planned to assemble the craft himself and fly it at a local fair on March 5, 1911. He failed to make that scheduled flight. Over the next two years, Cessna struggled with his new airplane, which proved far more difficult to fly and maintain than he had anticipated. Despite long struggles with the power plant and innumerable crashes, he learned much about airplane construction and flying. By 1913, he was ready to build the first aircraft of his own design.

Cessna's 1913 aircraft was clearly based on the one he purchased in 1911, but it proved to be a major improvement over the earlier machine. Although Cessna had purchased his first aircraft with the idea of flying it in exhibitions, his career as an exhibition pilot proved less successful than he had hoped. He planned to fly in several exhibitions in 1913, but by that time he had also convinced himself that there was a market for personal aircraft. He and his brother Roy traveled to Wichita, Kansas, in October, where they announced—somewhat prematurely as it turned out—that they planned to start manufacturing aircraft and open a flying school.

Cessna built a second monoplane of his own design the following year, and during the 1914–16 flying seasons continued to travel the air show circuit. He did not, however, give up on the idea of starting an aircraft factory and flying school. His chance to realize that part of his

ambition finally came in 1916. A group of Wichita businessmen, many of them members of that town's local Aero Club, invited Cessna to come to their city. When he arrived they offered him factory space and the use of seventy-three adjacent acres for a flying field. Cessna and his Cessna Aeroplane Exhibition Company accepted the offer and moved to Wichita, where he established his factory and flying school in early 1917. Although Cessna received a number of inquiries about his airplanes and about flight training, timing was against him: the United States entered World War I in April. While Cessna continued to earn some money flying at exhibitions, and a few civilians learned to fly at his new school, the war brought a temporary end to civilian aviation. Cessna returned to farming in 1918, but he did not give up on his dream of building an affordable aircraft. Nonetheless, he knew that its fulfillment would have to await the return of peace.¹¹

General Aviation Takes Root, 1919–26

The end of World War I marked the beginning of a new period of aerial enthusiasm: the age of the barnstormer. Surplus military aircraft provided a large and inexpensive supply of aircraft for a new group of aviators eager to share the wonders of aviation with the American people. Even though surplus military aircraft in many ways flooded whatever market there was for general aviation planes, a number of pioneer manufacturers hoped to appeal to what they believed would be a growing demand for affordable personal aircraft. In addition, experiments sponsored by various branches of the federal government demonstrated that there were a number of practical uses for aircraft, including crop dusting and aerial surveying. Pioneer air taxis and charter services pointed the way toward corporate flying.

The world of these gypsy fliers—or barnstormers, as they came to be known—was different from that of the prewar birdmen. The country's earliest fliers had been able to command up to \$1,000 per day simply for getting airborne. Moreover, even though air show crowds demanded ever-greater stunts between 1910 and 1916, the pay remained high as both planes and pilots remained rare. Neither was as precious a commodity by the early 1920s. Both planes and pilots were in greater supply thanks to wartime training programs. While a few prospered, many more struggled to earn a living while keeping their hard-to-maintain aircraft

in flying condition as they competed for the public's attention. Beginning in 1918, a small number of elite pilots captured the nation's imagination while flying the airmail. These men, like the birdmen before them, emerged as popular heroes as their exploits matched or surpassed everything the barnstormers did. Yet, while both groups sought to promote aviation, their actions more often than not produced caution rather than excitement.¹²

Although the surplus military aircraft used by the barnstormers and airmail pilots provided greater safety and performance than the fragile, kitelike airplanes of the prewar period, accidents and fatalities remained all too common. As noted, the public demanded ever more spectacular stunts. The barnstormers, eager to engage the public, enthusiastically obliged. However, when their efforts ended in failure and death, the impression they left with the public was not an enthusiasm for flight, but a fear of aviation. Like the birdmen before them, the barnstormers received intense criticism. Their actions, some argued, were inhibiting rather than promoting aviation's growth. Simply put, the aviation industry would not grow as long as the American people were afraid to fly.

In addition to the competition they faced from airmail pilots for the hearts and minds of the American public, barnstormers faced competition from another quarter as well. In part due to efforts to focus the public's attention on the safety and reliability of aircraft, attention gradually shifted from the daring barnstormers and their hair-raising stunts to the somewhat better equipped and more narrowly focused air racers. Even before World War I, many in both the United States and Europe argued that air races—quests by pilots to go farther and faster—would promote aviation more responsibly than the colorful exhibition pilots. After the war, organized air races focused on distance and speed captured more and more of the public's attention. These air meets, held in both the United States and Europe, attracted the best pilots and the most advanced aircraft. The barnstormers in their increasingly obsolete Jennies and Standards could take aviation into the nation's remotest corners, but the air races emerged as the major aviation events.¹³

Although barnstorming did not bring the same degree of fame and fortune as that granted to the earlier birdmen and women, it nonetheless attracted former military pilots and a host of others seeking to take to the skies. Young Charles Lindbergh started his storied career in aviation as a barnstormer. Lindbergh longed to learn how to fly. To earn money for both flight training and his first aircraft, Lindbergh learned

to parachute and wing walk. While traveling on the exhibition circuit, he received a few flying lessons. Once he had scraped together sufficient money, he bought his own airplane. Unfortunately, he lacked the funds to pay for additional flight training. After his first attempt at solo flight nearly ended in disaster, a fellow barnstormer took pity on him and provided him enough training to start his new career.¹⁴

Women also joined the barnstormers' ranks. Most of them, however, focused on racing and record setting rather than performing elaborate stunts. One who sought to match the spectacle of her male counterparts was Ruth Law. Law, one of the early bird women, earned her pilot license in 1912 and soon joined the air show circuit. During World War I she flew exhibitions in order to raise money for the Red Cross and to support Liberty Loan drives. When the war ended, Law realized that the vast number of male pilots trained by the military had turned aviation into a far more crowded field. She and her husband decided to take a different tack and took her show overseas to the Far East. Upon returning to the United States in 1920, Ruth Law's Flying Circus performed a number of breathtaking stunts—including a plane-to-car transfer. The work was dangerous, though. One morning in 1921, Ruth Law opened her newspaper and saw a story announcing her retirement. Despite the fact that her Flying Circus earned up to \$9,000 per week, her husband had decided it was time to stop tempting fate. He told her that he had given the story of her retirement to the newspaper. Rather than argue, Law gave up her career in aviation.¹⁵

Bessie Coleman took up aviation about the same time Ruth Law retired. Coleman, an African American born in 1893 to a former slave, became fascinated with flight during the war, and in 1919 began a search for a flight instructor. After discovering that no one in the United States would teach her to fly, Coleman—encouraged by Robert S. Abbott, founder and editor of the *Chicago Defender*, a prominent African-American newspaper—went to Europe, where she earned her pilot license at the Federation Aeronautique Internationale in Paris on June 15, 1921.

She returned to the United States and began flying on the exhibition circuit. Her ultimate goal was to earn enough money to open a flight school where other African-American women could learn to fly. Coleman followed the air show circuit for the next five years. Along the way she not only impressed many with her flying ability, she also won a few small victories for equality. In Texas, for example, she succeeded in getting air show officials to allow African Americans to use the same entrance gate

as whites. They were still segregated once they were inside, but just being allowed to use the same gate was a step forward. Coleman, however, did not live to accomplish her ultimate goal: establish a flying school. "Queen Bessie," as she became known, died when she fell from her plane while practicing to make a parachute jump for an air show in Orlando, Florida, on April 30, 1926. Although she did not realize her ambition of teaching other African-American women to fly, Coleman succeeded in blazing a path for African Americans in general aviation. Others, both male and female, would follow.¹⁶

Although surplus military aircraft dominated the general aviation market in the early 1920s, there were many who believed that there was a market for affordable, better-performing personal aircraft. Such airplanes could be sold to some of the more successful barnstormers as well as to other individuals hoping to buy their own aircraft. As early as 1919, Jacob Melvin "Jake" Moellendick, a Wichita, Kansas, businessman, saw the opportunities in postwar aviation. He and a small group of Wichita businessmen funded the Wichita Airplane Company. Initially, the company sought to earn money from the exhibition circuit, to provide flight training, and to operate an air taxi and joyride service. Moellendick, however, soon saw a need for an aircraft different from the available Standards and Jennys, an aircraft with a greater load and passenger capacity. Hoping to be the first to produce such an aircraft, Moellendick sent his firm's manager to Chicago to convince airplane designer Emil Matthew "Matty" Laird to come to Wichita. Moellendick eventually lured Laird, his brother Charles, and another young man, George "Buck" Weaver, to Wichita to join his fledgling company. Laird's new aircraft, the Swallow, made its first successful flight in April, 1920.

The company planned an initial production run of ten aircraft, but orders soon eclipsed the original production plan and the company had to hire additional employees to meet the demand. One of its first new hires was Lloyd Carlton Stearman, a former navy pilot with a strong desire to learn aircraft engineering. Another early employee was ex-barnstormer and salesman Walter Herschel Beech. Between 1920 and 1923, the company produced and sold forty-three aircraft. By that time, however, it had begun to experience some internal problems. Weaver left in 1921 for Ohio, where he used the experience he had gained in Wichita to start the Weaver Aircraft Company. Matty Laird left in 1923. With his departure, the company reorganized and began operating as the Swallow Airplane Manufacturing Company in January, 1924. By the end of

the year, however, disagreements between Stearman, Beech, and Moellendick led the younger men to leave the company. Stearman had wanted Swallow to move from wood to steel-tube construction. Moellendick insisted on using wood. Stearman and Beech, wishing to form their own aircraft manufacturing company, turned to local aviation pioneer Clyde Cessna. He was intrigued by their ideas and in early 1925, Stearman, Beech, Cessna, and local banker Walter Innes Jr., formed the Travel Air Manufacturing Company.

Travel Air sold its first aircraft in the spring of 1925, and orders for additional planes soon taxed the company's resources. Yet despite its early success, disagreements arose. Travel Air produced biplanes, the design favored by Stearman and Beech, whereas Clyde Cessna wanted to produce a monoplane. Using his own resources, Cessna designed and tested a successful monoplane in June, 1926. That design evolved into Travel Air's first monoplane, the Type 5000. Even though Travel Air had adopted a monoplane design, Cessna was still anxious to build his own kind of airplane: an affordable personal aircraft. He left Travel Air in early 1927.

Wichita served as an important incubator for general aviation aircraft manufacturing during the first half of the 1920s. By 1926, the city had seen or would soon witness the creation three pioneer general aviation manufacturers: Swallow, Travel Air, and the Cessna Aircraft Company. While the personal or light aircraft industry would not enter its so-called golden age until after the enthusiasm generated by Charles Lindbergh's nonstop New York to Paris flight in 1927, a base clearly had been built by the mid-1920s.¹⁷

Similarly, the base for a number of new, practical uses of aircraft was also laid in the early 1920s. The early experiments were done not so much by private individuals, but by the military or under the sponsorship of various branches of the federal government. Among the activities explored were crop dusting, forest-fire patrols, and aerial surveying. Although each of these activities was initiated in the public sector, by the mid- to late-1920s private sector individuals had begun building on these early experiments.

In 1921, the state of Ohio faced something of an agricultural emergency. Catalpa sphinx and catalpa midge threatened widespread destruction. The state's Agricultural Section joined Army Air Service personnel at McCook Field in Dayton to devise a way to deliver chemicals by air to treat a grove of catalpa trees near Troy, Ohio. Within minutes, the pilot,

flying a plane equipped with experimental “dusting” equipment, had completed what would have taken field hands hours using conventional methods. News of the successful effort spread quickly. Over the next few years, the Air Service continued to support other experiments involving aerial crop dusting. By the mid-1920s, private interests began to recognize the value of delivering chemicals by air, and a number of crop-dusting companies soon appeared on the scene. They included the Huff-Daland Airplane Company (which also saw an opportunity to sell its airplanes), the Southern Dusting Company, and the Quick Aeroplane Dusters. Most of the activity centered in the South, where the main target was the boll weevil.¹⁸

In addition to conducting crop-dusting experiments, the military and other branches of the federal government explored a number of other potentially practical uses for aircraft. The Department of Agriculture used aircraft to help it compile crop estimates. The Coast Guard used aircraft to help guide commercial fishermen to schools of fish, aircraft were used for forest-fire patrols, and the U.S. Coast and Geodetic Survey began using aircraft to conduct aerial photographic surveys to help it meet its mandate to provide updated charts of seaboard cities and the coastline of North America. While private interests did not become involved in many of these types of activities until after 1926, the government’s efforts did serve to demonstrate a number of potential uses for aircraft.¹⁹

Planes and Power Plants

Although there has always been something of an overlap between general aviation aircraft and airplanes used for military and/or commercial purposes, this was particularly true between 1910 and 1926. Aircraft used for exhibition and personal flying were, in many cases, the same planes, or versions of the same planes, used for other purposes—particularly military purposes. Between 1910 and 1926, the planes themselves evolved from craft with open, kitelike structures to more robust vehicles, while the materials used—wood, fabric, and wire—remained constant. Not until the end of this period was there a move toward steel-tube construction in smaller aircraft. Throughout, the engine remained the most troublesome and expensive part of an airplane. Aircraft engines continued to be underpowered and unreliable. Moreover, with the exception of

the World War I—surplus Curtiss OX-5 engine, they were expensive. Certain manufacturers began to design and build aircraft for the emerging general aviation market, but their high prices—driven in most cases by the cost of engines—kept the market for new aircraft small. The result was that surplus military aircraft dominated the market in the early 1920s.

Through 1916, the three primary aircraft types were those made by the Wrights, Curtiss, and Blériot. Wright aircraft built between 1910 and 1916 (by which time Orville, the surviving brother, had sold the company he and Wilbur founded) were open structured, two-place biplanes. The pilot and passenger sat upright on seats placed on the lower wing. The wing-warping system and elevator were manipulated by two hand-held control sticks. A bar moved by the pilot's feet controlled the rudder. While the earliest Wright planes were canards, with the elevator at the front of the aircraft, later models moved the elevator to the rear of the aircraft with the rudder. All were "pusher" aircraft, with chain-driven twin propellers mounted at the rear of the wings. The earliest models employed skids for landing gear; later models added wheels.

Wright engines powered all Wright aircraft. These engines, evolved from the one that powered the original Kitty Hawk Flyer, are best described as having been adequate. The original Wright aircraft engine, built by Charles E. Taylor to the brothers' design specifications, was a four-cylinder inline engine that operated while lying on its side. The engine provided sixteen horsepower when first started. Once in operation, it offered a steady twelve horsepower, which provided just enough power while running wide open to get the Kitty Hawk Flyer aloft. The post-1903 descendants of that first engine incorporated throttle controls and a normal carburetor. By the time the original Wright company ceased its initial manufacturing run, the engine line had evolved through a thirty-horsepower, four-cylinder engine and a sixty-horsepower, six-cylinder version.²⁰

In many ways, early Curtiss aircraft structurally resembled the Wright models. Both were open-structured pusher biplanes in which the pilot and passenger sat exposed on the aircraft's lower wing. There were, however, important differences. The most important one was the control system. The Wright aircraft induced roll by warping or twisting the surface of the wings, whereas Curtiss aircraft induced roll by use of an aileron, a small control surface initially placed between the wings. The Curtiss aileron was a distinct improvement over the Wright's wing-warping method, especially when aircraft designers began building larger and

faster aircraft. The wing-warping system quickly proved something of a technological dead end at that point.

When the Wrights developed their first aircraft they left the purchase or development of an adequate power plant to the last. In contrast, Glenn Curtiss's first exposure to flying came about because of his expertise with engines. In 1904, "Captain" Thomas Scott Baldwin approached Curtiss and asked him to develop an engine for his dirigible. The engine was a success and, bitten by the flying bug, Curtiss joined the Aerial Experiment Association headed by Alexander Graham Bell. Curtiss's earliest aircraft engine was a V-8 similar to the one on the motorcycle he used to set the land speed record in 1906. He then produced a four-cylinder engine (E-4) generating fifty horsepower and an eight-cylinder version (E-8) producing a hundred horsepower, both of which were air-cooled. Curtiss's later prewar engines were water-cooled V-8s that evolved into the famous (or infamous) OX-5, introduced in 1910. The OX-5 emerged as one of the most important engines during the early 1920s—not so much for its power or reliability, but because it was cheap and plentiful. The OX-5 powered one of the two main training aircraft used by the U.S. armed forces: the Curtiss JN-4D Jenny. As a result, the military ordered the engine into mass production. When the war ended, the by-then technically obsolete engine was available in large numbers.²¹

The third type of aircraft available in the United States was the Blériot Type XI monoplane. In addition to having a single wing rather than two, Blériots differed from Wright and Curtiss aircraft in other significant ways. Blériots were tractor-type aircraft rather than pushers, with the engine and propeller located in the aircraft's nose in front of the pilot, who sat inside a partially enclosed fuselage. The elevator and rudder were located at the tail end of the fuselage. Although the Blériot employed the Wright's wing-warping system, it used the now standard "stick" to control the plane's pitch and roll. The Wright control system used dual sticks for pitch (elevator) and roll (wing warping). The early Curtiss used a stick to control pitch (elevator) and a shoulder yoke to control roll (aileron).²²

In addition to these three major types of aircraft, the pioneer birdmen employed a number of other airplanes. However, almost all of these were based on the Wright, Curtiss, or Blériot designs. These prewar aircraft, like those built by the Baysdorfers in Nebraska and Cessna in Kansas, were built in very small numbers—often for use by the builder, although Cessna did plan to manufacture planes for what he hoped would be a significant personal aircraft market.

As noted above, Wright aircraft used Wright engines and Curtiss aircraft used Curtiss engines even though other domestic engines, such as the Etheridge, Roberts, and Hall-Scott, were available. Their supply was limited, however, because, with only minor exceptions—the Hall-Scott was used on the Standard—they were not used by any of the major U.S. aircraft-manufacturing firms. In addition, expensive imported engines were available. The most common of these were the Gnome and LeRhone rotary engines, and the Anzani fan and then radial engines—all built in France.

Following World War I, whatever general aviation aircraft market there was found itself flooded with surplus trainers, particularly Curtiss JN-4D Jennies and Standard J-1s. The Jenny, with its OX-5 engine, proved to be especially popular because a basically new aircraft and engine could be purchased for under \$500—considerably less than its competitors. The wartime trainers were quite different than the prewar designs, reflecting the technological strides made during the war. Both were tractor-type aircraft with fully enclosed fuselages. In terms of construction, however, they shared important similarities with their prewar predecessors: both were made of wood, fabric, and wire, and both were biplanes.

Engines remained the most difficult challenge. As noted, the ninety-horsepower Curtiss OX-5 was plentiful and cheap. Engines with more horsepower and greater reliability were available, but their cost was prohibitive for the general aviation market. If one could afford it, one could replace a plane's OX-5 with a Wright-Hispano Suiza (or Hisso) engine. Built under license by Wright Aeronautical, a descendent of the Wright brothers' original firm, the Hisso was far more reliable and twice as powerful as the OX-5. However, these benefits did not come cheaply. Imports, especially the Anzani, remained available, but they, too, were expensive.²³

Many of the general aviation aircraft built during the early 1920s were designed to use the cheap, readily available OX-5 engine, and this engine choice drove design. The heavy OX-5 required an airplane with considerable lift. Therefore, a two- or three-place biplane was the most common design.

Despite the tight market and the limitations posed by engine cost, a number of innovative designs emerged shortly after the war. These included the Loughhead S-1, the Curtiss Oriole, the Bellanca CF, and the previously mentioned Cessna monoplane. The Loughhead S-1, designed by Jack Northop, employed molded plywood construction. The result

was a cigar-shaped, monocoque (“single shell”) fuselage. Northop and the Loughhead brothers (the brother who remained in the aviation business later changed the spelling of his last name to Lockheed) hoped their plane would be affordable and appeal to a large market. In the end, however, its high price discouraged sales. The Oriole was Glenn Curtiss’s attempt to build a small aircraft for the personal aircraft market. Similar to the other small planes being produced at the time, it also fell victim to economics. Wings built for the plane, however, were purchased and used by Harold Pitcairn for his first production aircraft. The Bellanca CF, designed by Italian immigrant Giuseppe Bellanca, grew out of the partnership between the designer and a group of Omaha, Nebraska, investors eager to bring the aviation industry to their city. Although the manufacturing venture soon failed, the CF proved to be a highly successful, if expensive, design. The CF, one of the first successful enclosed cabin monoplanes built in the United States, fathered a series of remarkable planes, including the Wright-Bellanca 2 that Charles Levine and Clarence Chamberlin flew from New York to Berlin two weeks after Lindbergh reached Paris. Thus, despite the innovative nature of each of these aircraft’s design, their price tags—ranging from \$3,000 to \$5,000—kept the number produced and sold low.²⁴

By the mid-1920s, a few U.S. general aviation manufacturers began to employ steel-tube fuselage designs following Anthony Fokker pioneering the use of metal in aircraft construction in Europe. A campaign of sorts emerged during the period promoting the use of metal. Although many proponents claimed that all-metal aircraft would be safer (or at least be perceived as safer) in a fire than one constructed of wood, fabric, and wire, their argument was not entirely grounded in technical considerations. In many ways, aircraft were viewed as modern machines, and metal as a modern material. Wood, on the other hand, was associated with old-fashioned, craft-style construction. Metal proponents apparently came to believe that modern aircraft should be constructed of a modern material, even though the use of metal increased both material and labor costs.²⁵ As noted, Cessna, Stearman, and Beech founded Travel Air specifically for the purpose of building aircraft with steel-tube fuselages. They were not the first when it came to personal aircraft, however. The real pioneer was WACO.

George Weaver was an early participant in the Wichita aircraft scene when he joined the Laird brothers in 1921. His stay in the city was brief, however, and he soon returned to Ohio, where he had barnstormed im-

mediately after World War I. There, he and two friends, Elwood “Sam” Junkin and Clayton Brucker, formed the Weaver Aircraft Company, which soon became known by its trade-name formed from the company’s initials, WACO. After Weaver died in 1924, Junkin and Brucker reorganized the firm as Advance Aircraft, but kept the trade name. In late 1929, following another reorganization, the company changed its name to the WACO Aircraft Company. The first aircraft built by the company was constructed of wood and fabric. However, in April, 1925, the firm introduced the WACO Model 9, constructed with a welded steel-tube fuselage. The Model 9 was a fabric-covered, three-place, open-cockpit biplane powered by an OX-5 engine. Although it originally sold for \$2,500, the company built and sold thirty by August.²⁶

The first decades of the twentieth century witnessed the rapid development of the Wrights’ invention. Military, commercial, and general aviation uses of aircraft emerged during this period. Both the aircraft and their applications, however, remained very much in their experimental phases through the mid-1920s. This was as true in general aviation as it was in military and commercial aviation. Yet all three areas were on the verge of exponential growth. During the next two decades, general aviation would grow dramatically and enter into what many consider to have been its golden age.