

REVIVAL OF THE B



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WACO YMF-5

*Waco's last open-cockpit
civil biplane, and perhaps its
best, makes a comeback.*

BY J. JEFFERSON MILLER

Until recently, a flyable Waco YMF-5 was one of aviation's rarer treasures. Only 35 were built by the Waco Aircraft Company; few of those are still airworthy. Now, remarkably, this 1930s-vintage biplane is once again in production after a lapse of half a century. The YMF-5 (or simply F-5) is being produced in limited numbers by the Classic Aircraft Corporation of Lansing, Michigan. Four have been built so far. Ten more are on order. The company is headed by Richard S. Kettles and Michael L. Dow, who also own and operate General Aviation, Incorporated, a large and successful FBO in Lansing. Corporate turboprops and jets are their bread and butter. Biplanes—Wacos in particular—are their first and lasting love.

For the well-heeled sportsman-pilot of the 1920s and 1930s, the Waco biplane was, more often than not, the airplane of choice. The Waco name (pronounced wah-co) stood for Weaver Aircraft Company. George E. "Buck" Weaver, one of three founders, was a barnstorming pilot whose principal contribution to the business was to obtain financing for two struggling aircraft engineers—Clayton J. Bruckner and James E. "Sam" Junkin—in 1919. The pair used the money to buy surplus JN-4 Jenny parts and OX-5 engines and began building their own biplanes from them.

Weaver dropped out of the company in 1920 to take a corporate flying job. The two remaining partners struggled along, hopping rides and performing in air shows on weekends to meet the payroll of their small company. Bruckner reportedly performed as a wing walker in the Waco act. Such was life in the early days of the aviation industry. Junkin died of a heart ailment in 1926, just as the Waco biplanes were beginning to gain wide acceptance in the market. The company sold 164 OX-5-powered Waco 9s that year. In 1928, its best year, the company sold 653 Waco 10s. The Waco Taperwing, also introduced in 1928, became one of the best-known aircraft on the air show circuit. Flying one of these, company test pilot "Fearless" Freddie Lund reportedly became the first pilot to perform an outside loop.

The F-series Wacos, including the F-5, were products of the Depression. Compared with earlier models, they were slightly smaller, lighter and, initially, lower



WACO YMF-5

The seductive mystique of the biplane lingers on in the Waco YMF-5.



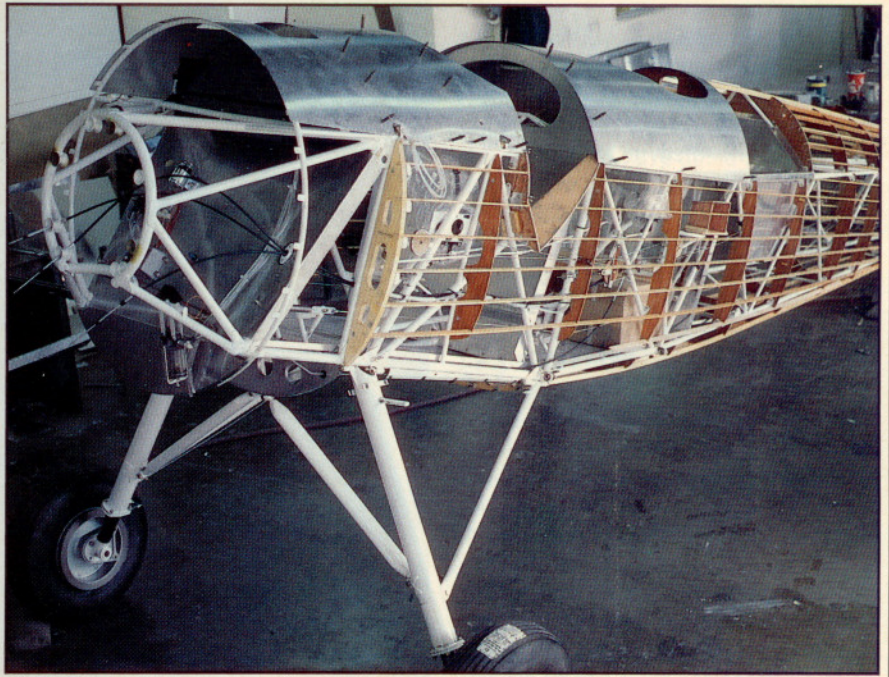
powered. They also featured refinements such as wings with a 50-percent stagger for better visibility and, on later versions, the Clark Y airfoil, which became the standard for light aircraft designs in the 1930s because of its high coefficient of lift and relatively gentle stall characteristics.

In 1929, a deluxe Waco 220 with a 220-horsepower Wright J-5 Whirlwind engine cost \$8,525; a 1930 Model F with a 125-hp Warner or Kinner radial could be had for \$4,250. The F-5, introduced in 1935, was the last open-cockpit biplane built for civil use by Waco. Later, the company built 600 open-cockpit UPF-7s, a military version, and it continued to build enclosed-cabin biplanes, but for Waco and the nation, the era of the open-cockpit biplane had virtually come to an end by 1936.

Waco built large transport gliders during World War II but never developed a marketable aircraft for the post-war years. Its one half-hearted attempt, the Aristocraft, was powered by a forward-mounted engine and pusher propeller linked by a long driveshaft. The airplane was a dismal failure, both technically and aesthetically, and was never certificated. Thereafter, Waco subsisted on subcontract work and the manufacturing of nonaviation products such as the Lickety Log Splitter, a mechanical wood chopper invented by Bruckner, before finally shutting its doors in 1963.

Perhaps if Bruckner had kept the concern going a little longer, Waco biplanes would have come back into vogue. As Kettles and Dow see it, there are today, just as in the 1920s and 1930s, many individuals who desire a unique sport airplane. These latter-day sportsman-pilots, the two entrepreneurs believe, are willing to pay a premium for an aircraft that not only is fun to fly, but also exudes the heady scent of nostalgia. Thus, Classic Aircraft was born with an idea, but not an airplane. Luckily for the fledgling company, there were many fortuitous twists in the F-5's road to revival. The first lucky stroke was locating the airplane's lost type certificate. The search led from old Waco records to an Ohio nature center, to the Bruckner heirs to the Federal Aviation Administration to the Smithsonian Institution.

Early on, it was determined from fragmentary documentation that Bruckner had transferred ownership of all Waco type certificates to the Civil Aeronautics Authority sometime after World War II, and that Classic Aircraft would therefore



need FAA permission to build airplanes under the F-5's certificate. The actual letter of transfer and the original certificates, however, could not be found. Bruckner, who died in 1977, had bequeathed many of his assets to the Bruckner Nature Center, which he had established several years earlier on the outskirts of Troy, Ohio (where all but the earliest Wacos were built). The nature center, however, had not received any type certificates and, wanting to avoid any possible liability, waived all claims to them, as did Bruckner's heirs. In the absence of these crucial documents, and given the uniqueness of the situation—the FAA had never before permitted a company to build an airplane under a government-held certificate—considerable bureaucratic foot-dragging ensued. It took a call from former congressman James Dunn (R-Mich.), a friend of Kettles's and a general aviation pilot, to then FAA Administrator J. Lynn Helms to jolt the FAA's review process into high gear. A few days later, on February 24, 1984, Classic Aircraft received approval to build the F-5, although the FAA retained actual ownership of the type certificate.

Only later, while searching through Smithsonian Institution archives for Waco blueprints, did the original certificates turn up, confirming government ownership. With the help of National Air and Space Museum archivists Robert B. Woods and Edward J. Pupeck, all 450 of the F-5's original drawings were tracked down in the files of the Smithsonian and in the FAA's New York regional headquarters. After studying the drawings, Classic Aircraft engineers found that 50 of them would not apply to a modernized version of the F-5. The remaining 400 had to be redrawn to bring them up to current standards of technical illustration. An additional 650 drawings were required, both to meet the FAA's standards of detail and to illustrate new systems for the Waco. In putting together an engineering team for the Waco, Classic Aircraft benefited from the hard times faced by other segments of the general aviation industry. An advertisement in the Lock Haven, Pennsylvania, daily paper netted three top engineers formerly employed by the Piper Aircraft Company.

Limited structural testing was required by the FAA. The tail section had to be load tested because its internal bracing was redesigned to improve strength and accommodate more horse-



power (up from 225 to 245). Also, conformity flight tests—to determine whether the airplane and engine performed as described in the original certification specifications—were required before production approval was granted. The F-5 was certificated under section 7A of the Civil Air Regulations (CARs), which requires that the aircraft be able to withstand loads of 5.3 Gs positive and 2.13 Gs negative in normal flight. The certification standards did not prohibit aerobatic maneuvers, nor did they specifically approve them.

Classic Aircraft built all new tooling for the airplane. New, more precise jigs and the use of tungsten inert gas (TIG)

WACO YMF-5

In their day, Wacos were esteemed for their pleasant handling qualities. A steerable tailwheel mounted on a longer strut improves ground handling and visibility over the nose.



paint for ultraviolet protection, one coat of primer and two coats of paint. Purchasers can select any colors they want. So far, half of the purchasers who have specified colors have opted for the deep red of the Waco pictured here.

The airplane is powered by a remanufactured (zero time) Jacobs R-755, derated from 275 to 245 hp. The eight-foot, eight-laminate Sensenich propeller is a work of utilitarian sculpture. Jacobs radials are still ubiquitous engines, found on Stearmans and other antique aircraft. The Jacobs Service Company of Payson, Arizona, which holds the type certificates for the engines, continues to do a lively business in rebuilding and parts support. It is prepared to build new engines should the demand ever become great enough.

The Shaky Jake, as the Jacobs radial is sometimes called, still gives something of a Magic Fingers massage to airplane occupants, but the engine has been much improved over the years, with the recommended time between overhauls rising from 200 to 1,200 hours for a newly remanufactured model. Tighter tolerances have resulted in far less oil being blown overboard during normal operation, and a new Waco need not be wiped down after each flight like a lathered horse after a hard ride. Ignition is provided by dual magnetos or a magneto and distributor, depending on the customer's choice. The distributor provides easier starting, particularly in cold weather, and lower idling. An Essex primer simplifies the starting procedure. Original Wacos had no priming system, according to Kettles. The engine is certified for fuel with an octane rating of 73 or higher and probably would run quite well on autogas; however, neither Peterson Flying Service nor the Experimental Aircraft Association, the two organizations offering supplemental type certificates for autogas use, have an STC for the Jacobs-powered Waco. The recommended fuel is 80-octane avgas; 100-octane also is acceptable. Fuel capacity is 49 gallons standard, 74 optional.

Ground handling has been improved by adding three inches to the tailwheel strut to provide better visibility during taxiing. A full-swivel, steerable tailwheel has been substituted for the previously non-steerable type. Hydraulic toe brakes replace an awkward arrangement in which a bar was pulled up while pressing on the rudder pedals to actuate the brakes. The pilot pressed on the rudder pedals evenly for even brak-



welding enable Classic Aircraft to build Waco fuselages to tighter tolerances than could be achieved through original production methods, according to Kettles. Classic Aircraft treats the insides of all aircraft tubing to a linseed oil bath to prevent corrosion. This was not done on earlier Wacos, and corrosion is one of the worst enemies a restorer of one of these aircraft faces. The wings are pieced together out of Sitka spruce for spars and ribs and mahogany and birch plywood for reinforcement where steel compression tubes attach. Wing leading edges are aluminum. Four coats of butyrate dope are applied to the airframe's Ceconite covering, three coats of silver

ing, or either pedal for differential braking. The new hydraulic system reduces the chance of ground-looping as a result of improper application of the brakes.

Windshields have been widened and raised to reduce wind buffeting on the heads of pilots and passengers. Shoulder harnesses are standard equipment in front and rear cockpits, as required by regulation. The front cockpit is designed for two passengers and is appointed in soft leather, looking something like the rumble seat of a classic automobile. The control stick in the front can be quickly removed from the cockpit. A throttle in front is standard. Cushions in both cockpits can be removed to make room for parachutes. A 7.5-cubic-foot metal baggage compartment behind the rear cockpit replaces the original canvas sling. It can carry up to 75 pounds of luggage.

One thing is certain about the rear cockpit of a Classic Aircraft Waco—Buck Weaver wouldn't know what to make of the avionics found there. The options list offers just about every type of avionics today's pilot could desire, including horizontal situation indicator, 3M Stormscope, intercom, stereo cassette player and Loran-C. Properly equipped, the F-5 may be flown IFR. Classic Aircraft pilots who have done so report that rain does not come into the cockpit in flight because it is deflected by the air flow. On the ground, of course, it is a different story.

A serious-looking array of avionics, however, does not detract from the pure fun of flying a Waco. It is an airplane that offers endless satisfaction to a pilot who is willing to learn the ways of a

biplane. Neophytes to this type of aircraft will have to learn to maneuver on the ground without benefit of forward references. Slow taxiing with a lot of S turns does the trick. Pre-takeoff preparation, aside from setting up the avionics, is a simple matter. Mag check at 1,400 rpm. Carb heat check. Oil temperature a minimum of 70 degrees Fahrenheit. Run the trim handle full forward, then back it off six turns to find the takeoff position (there is no trim indicator).

The tail can be raised almost as soon as you have applied full power, providing a welcome view down the runway. A little back pressure and you are airborne at 52 knots (60 mph). Climb away at 70 knots (80 mph) as the slow-turning engine chug-a-lugs at 1,850 rpm. Red-line for the engine and fixed-pitch prop is 2,050 in cruise flight, providing about 108 knots at 5,000 feet. The airplane does not have the responsive handling characteristics of a Pitts Special or simi-

For the well-heeled sportsman-pilot, a Waco biplane was, and is, the airplane of choice.

Waco YMF-5			
Base price: \$108,000		Max landing weight	2,650 lb
AOPIA Pilot Operations/Equipment Category:*		Fuel capacity, std	294 lb (288 lb usable)
Cross-country: \$117,000 approx.		Fuel capacity, w/opt tanks	444 lb (432 lb usable)
IFR: \$126,000 approx.		Fuel capacity, w/opt tanks	444 lb (432 lb usable)
			74 gal (72 gal usable)
Specifications		Performance	
Powerplant	Jacobs R755B2, 275 hp (de-rated to 245 hp)	Rate of climb, sea level	732 fpm
Recommended TBO	1,200 hr	Max level speed, sea level	110 kt
Propeller	Sensenich W96JA72, 96 in, wood, fixed pitch	Max level speed, 5,000 ft	106 kt
Length	23 ft 4 in	Cruise speed/range w/45 min rsv, std fuel (fuel consumption)	
Height	8 ft 6 in	@ 75% power, best economy	106 kt/307 nm (78 pph/13 gph)
Wingspan	30 ft	Limiting and Recommended Airspeeds	
Wing area	233.5 sq ft	Vx (best angle of climb)	57 kt
Wing loading	11.35 lb/sq ft	Vy (best rate of climb)	68 kt
Power loading	10.8 lb/hp	Vne (never exceed)	182 kt
Seats	3	Vr (rotation)	55 kt
Cabin length	7 ft 5 in	Vso (stall in landing configuration)	49 kt
Cabin width	3 ft	<i>All specifications are based on manufacturer's calculations. All performance figures are based on gross weight, unless otherwise noted.</i>	
Empty weight	1,905 lb	<i>*Operations/Equipment Categories are defined in June 1986 Pilot, p. 103. The prices reflect the costs for equipment recommended to operate in the listed categories.</i>	
Empty weight as tested	1,977 lb		
Gross weight	2,605 lb		
Useful load, as tested	673 lb		
Payload w/full fuel	457 lb		
Payload w/full fuel, as tested	385 lb		
Max takeoff weight	2,650 lb		

The Waco Aircraft Company was the oldest and one of the largest producers of civil aircraft in America before World War II, but for four years beginning in August 1941, Waco devoted its resources entirely to the war effort. The first airplane it built after the war was also its last. The Aristocrat was either way ahead of its time or simply a bad idea.

This four-place, high-wing monoplane featured all-metal wings (with full-span ailerons) and tail surfaces. The fuselage was fabric-covered steel tubing. The tricycle gear was retractable, the main wheels rising into streamlined fairings. Aileron and rudder controls were interconnected; like the Ercoupe, the Aristocrat had no rudder pedals.

The aircraft's most unorthodox feature, however, was its drive train. A 215-horsepower, six-cylinder Franklin engine, mounted in the nose, and a Hartzell two-blade, reversible-pitch pusher propeller, mounted on the top of a fin situated between



THE LAST WACO



larly nimble aerobatic aircraft, but, given the bulk of the airplane, control responses are fairly light and control coordination easy. In their day, Wacos were esteemed for their pleasant handling qualities. The F-5 does basic aerobatic maneuvers such as rolls and wing-overs nicely, and provides a stable, low-work-load platform for cross-country flying. Upright spins develop slowly and are recovered from easily by neutralizing the stick and applying opposite rudder. As stated before, no aerobatic maneuvers are prohibited. The airplane is not equipped with inverted fuel and oil systems, nor are they offered.

Landings are a challenge for any pilot not accustomed to having a big radial engine obliterate forward visibility in the flare. Practice and competent, patient instruction are the keys to mastering this skill. A 70-knot final approach provides good visibility over the nose without the need to slip to a landing, although slips are perfectly acceptable and safe in the Waco and useful for short-field approaches.

Though some of the newly built Wacos will be used for commercial purposes, such as sightseeing rides or banner towing, they are, for the most part, expensive toys. At prices exceeding \$100,000, only a lucky few will have the pleasure of owning a new YMF-5. Nevertheless, it is hard to begrudge those individuals their fun, because everywhere a gleaming Waco alights, it will generate interest and enthusiasm among pilots and non-pilots alike. The heyday of the biplane may have come and gone, but the mystique lingers on. □

the two vertical stabilizers, were connected by a drive shaft running through Bendix-Weiss constant-speed universal joints. Waco believed this unconventional arrangement would eliminate slipstream forces on the fuselage (supposedly resulting in improved performance), simplify access to the cabin and reduce interior noise levels.

The prototype first flew in March 1947, but only three months later, the project was shelved, and Waco withdrew from aircraft manufacturing forever. The company cited delays in the engineering and production of the prototype, the need for further unexpected development based on initial tests, increased costs of materials and components and uncertainty over the future of the civil aircraft market in light of conditions within the industry and the national economy. To hear this today, it seems that Waco may have been years ahead of its time after all.

—Seth B. Golbey