The Goodyear Duck

Preparing for the postwar, civilian market, Goodyear designed the GA-1 Duck, a slick two-place amphibian.

An amphibian that never left the nest

BY PETER M. BOWERS

It is most unusual for a major aircraft manufacturer to design an advanced-technology airplane that fills the requirements of an eager market, acquire an approved type certificate (ATC) for it, build a small quantity, give it extensive public exposure and then not market it in spite of the demand. Strange as it may seem, that is exactly what the Goodyear Aircraft Corporation of Akron, Ohio, did with the "Duck" between 1944 and 1949.

In 1910, the Goodyear Tire & Rubber Company, a major U.S. producer of tires and rubber goods since before the turn of the century, established an aviation division (as a result of its production of rubberized balloon cloth) and soon was building balloons. By the end of World War I, it was solidly established as a designer and builder of nonrigid airships, or blimps.

(In 1923, Goodyear joined with the Zeppelin organization to form the Goodyear-Zeppelin Corporation around a nucleus of 13 airship experts who emigrated to the United States from Germany. The company was dissolved at the outbreak of World War II, but the Goodyear Aircraft Corporation still builds blimps for its advertising fleet.)

During World War II, the demand for military airplanes brought a number of nonairplane-building firms into the business, and Goodyear was among them. The first airplane that it built, in a new factory, was the Vought F4U "Corsair" fighter. But by 1944, before most other manufacturers began to work up new designs, Goodyear was preparing for the postwar civil market. It designed and built a slick little two-place amphibian, the GA-1 Duck. (An interesting question that has recurred over the years is how many amphibians have been called "Duck"?) This was primarily a research project to evaluate new construction techniques, not a sneaky way of developing a postwar commercial design while wartime restrictions on manpower and materials were still in effect.

Goodyear figured that the major postwar market would be personal aircraft, so it developed the GA-1 to see how its processes would adapt to that class of aircraft. As a private-owner aircraft, the design stirred up more interest on the part of engineer J. Byron Jones, of Goodyear's research and development department, and Dr. Karl Arnstein, one of the original Zeppelin émigrés who was vice president of engineering for Goodyear Aircraft, than any of their military or pure-research designs.

In layout, the GA-1 was a traditional monoplane amphibian, with a pusher engine mounted above the hull, wing-tip floats under each fully cantilevered, tapered wing and retractable (including the tailwheel) landing gear. Construction was all metal except for partial fabric covering on wing and tail surfaces and molded wood veneer and plastic (another new Goodyear process) for the wing-tip floats.

The GA-1 had two seats, side by side, in a cockpit immediately ahead of the wing. Two control wheels projected from a cantilever instrument panel that doubled as a main structural member. The windshield-cum-canopy was unique in that it retracted aft and down into the hull to leave a completely open cockpit for boarding, handling mooring lines and fishing. The hull had simple lines with a single step and a straight bottom from the afterbody all the way to the rudder. The wing used a single main spar, with an NACA 23015 root airfoil tapering to an NACA 23009 at the tip. To reduce the tapered wing's tendency to stall at the tip first (without resorting to the difficulty of building "wash-out" wings), Goodyear installed fixed leading-edge slots over the portion of the span covered by the ailerons. The GA-1 wing was not fitted with flaps.

The landing gear was clean and simple. A torque tube through the hull supported the shock struts and wheels in the manner of the prewar Spencer "Air Car" and the Republic "Seabee" (March 1982 *Pilot*, p. 107), except that the assembly pivoted forward for retraction, not aft. For streamlining, the wheels were enclosed in large bul-

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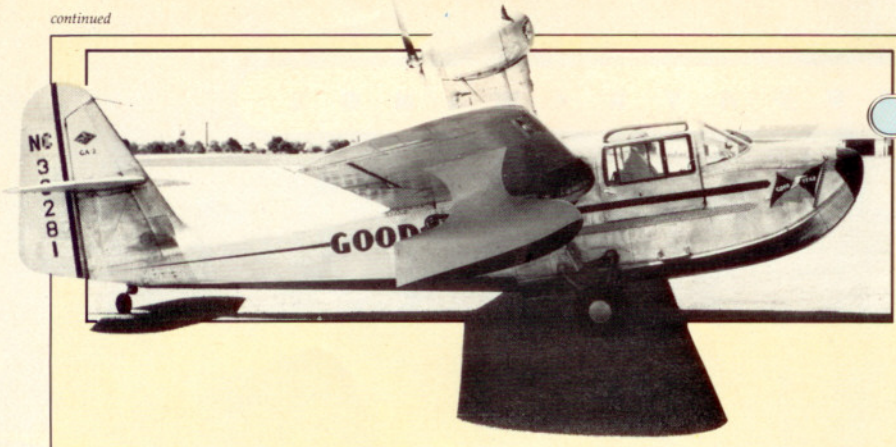
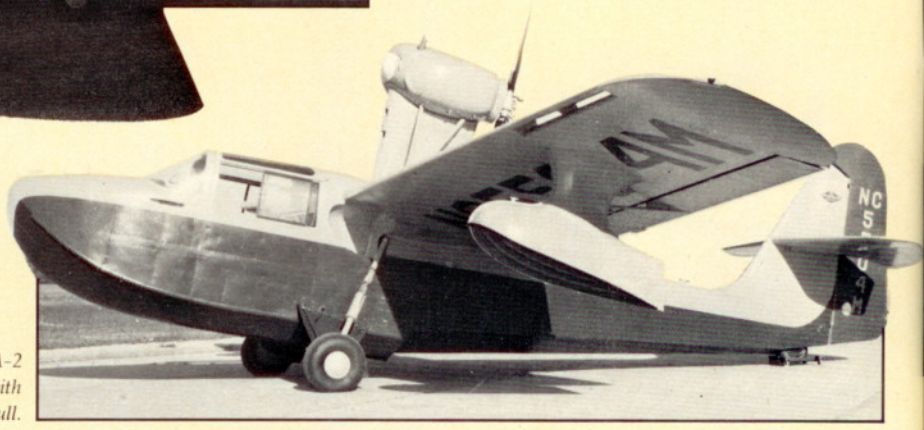
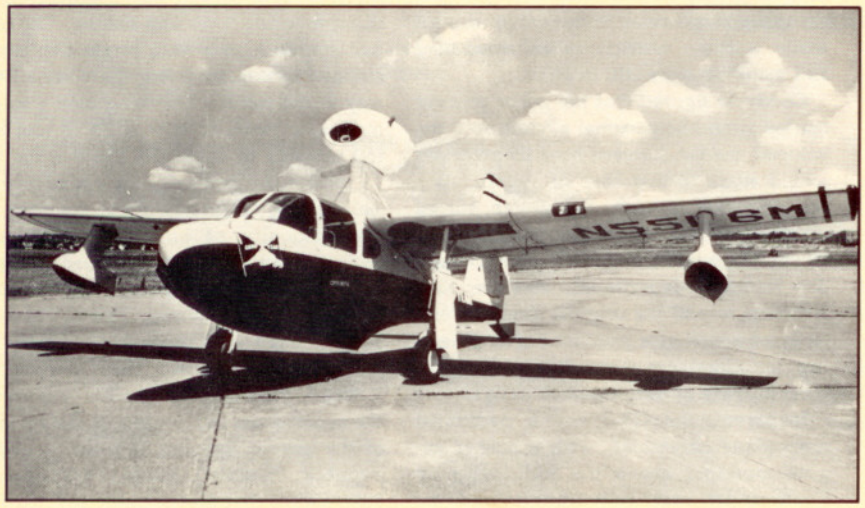


Many significant improvements were made to the original Duck design, justifying a new model number—GA-2.



To improve ground handling, the GA-2 was given a wide-track gear, with two struts that pivoted on the hull.

For water landings, the lower struts, which were connected to the fuselage by a solid fairing, lay flat against the hull. The struts were drawn into the hull by an automobile starter motor.



In 1950 another Duck, the GA-22, was built. It had a new hull and wider landing gear that could be contained in the wing. The tailwheel fairing could serve as a tailcone or as a water rudder.

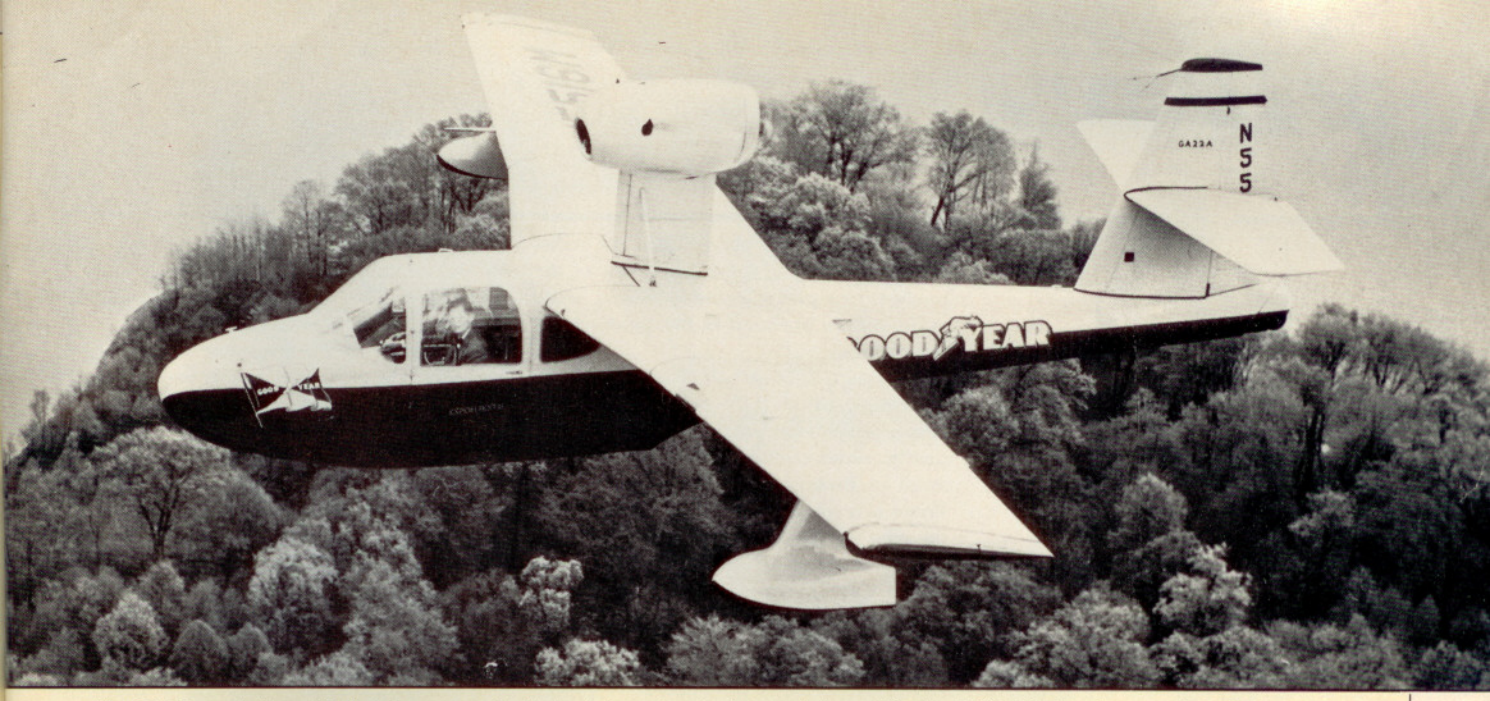
bous fairings when in the Up position. Steering on the water was by means of a retractable water rudder that could be retracted into the bottom of the air rudder.

A 113-hp, geared Franklin 4ACG-199-H3 drove a Koppers Aeromatic propeller. To overcome the chronic overheating problems of pusher seaplanes when operating on the water, the engine was fitted with a fan ahead of the propeller to suck cooling air through the tightly cowled nacelle, supported by a monocoque, sheet-metal pylon. Fuel capacity was 30 gallons, carried in a Goodyear Pliocel tank in the hull.

The GA-1 flew in September 1944. Although it proved to be a very satisfactory little amphibian, there was room for improvement; so Goodyear built a second Duck prototype that had enough changes to justify a new model number—GA-2.

As with so many modified designs, the GA-2 improvements were hooked on the old "with a little more power we can" line. A more powerful engine was used—a direct-drive Franklin 6A4-145-A3 with 145 hp. The airplane had three seats; the extra one was on the centerline behind the pilots. The added seat made it impossible to use the original retractable canopy; so that structure was made rigid, a door was added on the right side, and the right side of the sloping windshield was hinged on the center post to provide the essential mooring hatch.

Major changes were made in the interest of improved ground handling. The original narrow landing gear, combined with the inherent top-heaviness of designs with high-mounted engines, made the GA-1 very tricky to handle on the ground. The GA-2 had new wide-track gear, with two struts that pivoted on the hull just above the chine and with shock struts that ran up to the wing root. The lower struts were



The GA-22 was built specifically to incorporate the National Committee for Aeronautics' new "Planing Tail" hull. The advantage of the double-taper wing on the GA-22A above was an aerodynamically thinner root airfoil without a decrease in spar depth. Note how in flight the tailwheel acted as a tailcone.

connected by a solid fairing and laid flat against the side of the hull when the gear was retracted. The inner ends of the shock struts were drawn into the hull by an automobile starter motor, and the inner halves of the wheels then rested in niches in the top of the hull.

The prototype GA-2 incorporated a number of structural changes, such as the replacement of some of the fabric areas with metal and the deletion of the cantilever construction of the instrument panel that had been necessary with the retractable canopy. For this one airplane, first flown early in 1946, the wood and plastic wingtip float construction was retained; the later GA-2s used pressed metal. To reduce drag, the fat sheet-metal pylon for the engine was replaced by a narrow faired truss stabilized with side struts.

After obtaining ATC A-784 for the GA-2 Duck on February 28, 1947, Goodyear started a "Service Test" batch of 15. It was made clear that these were not for sale. Painted in Goodyear's well-known fleet colors of yellow and blue, they were to be loaned to various fixed-base operators around the country who would, in return for their use in normal operations, report to Goodyear in detail as to how they performed and how the structures, systems and components faired in use.

Goodyear's purpose was not to debug the GA-2 and make it a better amphibian; the company was not interested in that at the time. Rather, it wanted service experience on its construction processes, which could be licensed to other manufacturers who also were potential customers for such Goodyear-built components as wheels, brakes and Pliocel fuel tanks. Goodyear did not want to put itself in the position of competing with its customers in their own field. Before the GA-2 run was complete, the more-power bug bit again, and the last six were completed as GA-2Bs with 165-hp Franklin 6A4-165-B3 engines. These were added to the GA-2's ATC on August 12, 1949.

The GA-2Bs were not the end of the line for Goodyear Duck development, however. One was rebuilt to incorporate the new "Planing Tail" hull just developed by the National Advisory Committee for Aeronautics (NACA, now the National Aeronautics and Space Administration) for flying boats. The new hull was so encouraging—because of the better performance it allowed—that Goodyear built another Duck in 1950, the GA-22, specifically to incorporate it. The GA-22 (later GA-22A) was a little larger than the GA-2, with a higher gross weight, flaps, four seats in the cabin with doors on each side, a single throw-over control column and a 225-hp Continental E-225 engine. The fuel capacity was 60 gallons; but as in so many cases, full fuel meant reduced payload.

Other than the hull lines and interior, the major change in the GA-22 was a new and wider main landing gear that was contained entirely in the wing. The tailwheel was enclosed in a fairing that doubled as a tailcone for the hull when retracted and as a water rudder when lowered.

Goodyear tried to sell the GA-22 to the military as a utility aircraft rather than to the civil market, even though the revamped Duck had been issued a new ATC, 1A-12. The sales campaign was not successful, and the GA-22A became the sole survivor of the 18-airplane Goodyear Duck fleet. The others, Goodyear believes, were scrapped upon completion of the testing. The GA-22A was donated to the Paul Poberezny Air Age Education Museum of the Experimental Aircraft Association in Hales Corners, Wisconsin. □

GOODYEAR DUCK

GA-2		GA-22A
	Specifications	
Franklin 6A4-145-A3	Powerplant	Continental E-225-8
145 hp @ 2,600 rpm		225 hp @ 2,600 rpm
36 ft	Wingspan	38 ft
26 ft	Length	29 ft 9 in
178.2 sq ft	Wing area	209 sq ft
12.3 lb/sq ft	Wing loading	14.3 lb/sq ft
15.2 lb/hp	Power loading	13.3 lb/hp
1,450 lb	Empty weight	1,964 lb
2,200 lb	Gross weight	3,000 lb
30 gal	Fuel capacity	60 gal
	Performance	
120 mph	High speed	146 mph
108 mph @ 85% power	Cruising speed	135 mph @ 78% power
54 mph (w/o flaps)	Stall speed	63 mph (w/o flaps)
		53 mph (w/ flaps)
600 fpm	Initial climb	900 fpm
14,000 ft	Service ceiling	15,500 ft
310 sm	Range (no rsv)	575 sm