Yesterday's Wings The Emigh Trojan



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The Emigh Trojan is an interesting aeronautical oddity on several counts. For one, it was an all-metal two-seater with revolutionary construction techniques, which came on the market in 1948 just as the short-lived postwar boom in two-seaters was collapsing and some producers had actually closed down.

Further, it was the product of a new and very small firm totally inexperienced in commercial aircraft manufacture and marketing. In spite of these handicaps, it amazed everyone by staying in production on virtually a oneat-a-time and hand-built basis until the Korean war curtailed lightplane production.

The designer of this nonconformist phenomenon was Harold E. Emigh, who had experimented in 1937 with an original all-metal sportplane that was ahead of even the famous Ercoupe in anticipating the use of tricycle landing gear for general aviation airplanes. Nothing came of Emigh's 1937 effort, and he spent the succeeding war years as a military transport pilot. This job left him with plenty of time on his hands for thinking and doodling, during which he worked up the design of the postwar model that became the Emigh A-2, or Trojan.

A small factory was established at Norwalk, Calif., and production got under way on the unique new lightplane that defied structural and aerodynamic tradition in several areas. First of all, structural simplicity was a primary goal in the interest of reduced tooling, assembly time and cost. Secondly, the airplane was to be more maneuverable than the contemporary trainers, although not necessarily faster with the same power.

The wing, a good example of the simplification philosophy, was a multiple oddity. For one thing, the right-



THE EMIGH TROJAN

Specifications

Powerplant

Span Length Height Wing area Empty weight Gross weight Continental C-90 90 hp @ 2,475 rpm 31 ft 7 in 20 ft 5 in 6 ft 5 in 156.8 sq ft 874 lb 1,450 lb

Performance

130 mph

115 mph 1,000 fpm 13,000 ft

550 sm

High speed Cruise speed Initial climb Service ceiling Range

This view of the low-slung Emigh Trojan shows off the unique external ribs of the symmetricalsection wings that could be interchanged right and left. Each cabin window opens by sliding up on one side and down the other.



In further pursuit of structural simplicity, the movable tail surfaces of the Trojan were all interchangeable and the stabilizers were interchangeable right and left. The fuselage was symmetrical in side elevation, with similar rolled-aluminum skins used for both the top and bottom halves.

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hand and left-hand panels were interchangeable, which meant that the airfoil had to be as effective upside down as right side up. This required a symmetrical section, unheard of in the lightplane industry but well-known in such commercial designs as the Boeing 247 transport of 1933 and its immortal descendant, the B-17. However, the Boeing wings did not have Emigh's interchangeability feature. This detail alone reduced tooling costs considerably by eliminating the need for separate right-hand and left-hand assembly jigs.

The wing structure was also radically simplified. Instead of the traditional flanged sheet metal ribs between the spars, the Trojan used a few internal stiffeners but added stretch-formed aluminum channels with an inverted U-section to serve as external ribs, even around the flat-wrapped leading edge. A secondary benefit of these, not really anticipated at the time, was their function as longitudinal airflow fences. The same channel sections, bent with the flanges on the outside of the curve, were used for internal fuselage formers and straight sections were used as stiffeners elsewhere.

A final simplification of the wing was to eliminate the traditional aileron cutout and closed inner trailing edge by making the aileron the full length of the panel, which bolted to the center section outboard of the landing gear. An added aerodynamic oddity, at least for lightplanes, was an extra control by which the ailerons could be drooped five degrees to reduce the landing speed by five mph. The Trojan had no flaps.

The philosophy of structural simplification extended to the fuselage and tail surfaces. The top and bottom fuselage skins were rolled in identical quarters from flat stock and the top and bottom halves were assembled in the same jig, while using an absolute minimum of internal parts. The rudder and elevators were all interchangeable and the stabilizers were interchangeable left and right. These and the fin were constant-thickness, flat sections instead of being the traditional curved sections. Hinges were the full-length piano type that doubled as aerodynamic seals.

The center section contained the two 14-gallon fuel tanks and the main landing gear fittings. It was flat, to minimize intersection drag at the fuselage, but had bevelled outer ends to



This view of the Trojan shows the full-span droopable ailerons and the clean angle of intersection between the center section and the fuselage. Note the small 5.00-5 wheels and the short landing-gear legs on this 1948 model.

give the outer-wing panels the proper dihedral. The landing gear used small 5.00-5 wheels all around and had uncommonly short legs. Seating was sideby-side at stick controls, with nosewheel steering tied into the rudder pedals and braking by a single floor pedal on the left, or pilot's, side.

Crew entry was by the step-in method from the walkways on the center section stubs. The single window on each side slid upward in grooves and then down on the opposite side of the cabin, in the manner of the prewar, Culver-designed Dart. With this system, only one window at a time could be fully open for entry. For good weather flying, each side could be open half-way simultaneously.

The engine in the early, or California, Trojans was the 85-hp Continental C-85, turning a Macauley metal propeller. The first test models had welded, steel-tube engine mounts, but these cracked under vibration testing and were replaced by a new magnesium design. The cowling was short on aesthetics but was another example of a "keep-it-simple." Except for the formed, two-piece nose bowl, it was all flat-wrap sheet metal.

The Trojan came along just at the time the government added structural vibration tests to the other requirements for an Approved Type Certificate, or ATC. It passed these and was awarded ATC A-801 on December 21, 1948.

While the lines of the Trojan clearly indicate that it wasn't designed for speed, the table indicates that it did quite well in this department for a fixed-gear tricycle. In flight, it was very maneuverable—in Emigh's own words, "A Baby P-51!" Stick forces were extremely light; it could be looped with one finger on the stick and had terrific snap-roll capability. Spins were something else, however, and the FAA placarded it against intentional spins.

It was not as stable as one would expect a low-powered trainer to be, and had to be flown precisely by the numbers in the manual for best results. It was "fussy" at a time when contemporary trainers were quite tolerant of sloppy handling. It was definitely not a docile and forgiving type; as Emigh said, "One does not get stability and maneuverability in one package."

As an example of the informality of the Trojan's manufacturing operation, some of the stockholders would come into the shop in the evening and help rivet fuselages on the early models. Unfortunately, the goal of reduced production costs was pursued so diligently that Emigh found that he was losing about \$800 on each of the 32 Trojans that had been built so far in California. This discovery forced a reorganization of the firm and relocation to a new plant in Douglas. Ariz., in July 1949.

A few minor changes were made to the airplane before resuming production, still on the proverbial shoestring, with Emigh's 12- and 14-year old daughters riveting tail surfaces for 50¢ an hour and getting school credits for it. The changes included revised cowl lines, substitution of the 90-hp Continental C-90 engine for the C-85, a change to 6.00-6 wheels and a price increase to \$3,295.

Production continued to a total of 58 units until the Korean War ended it and Emigh himself went back into the Air Force. All possibility of resuming production after Korea vanished when the stretch dies for the unique channel sections along with other key tooling were inadvertently scrapped in the fabricators' plants during that war.

The latest FAA figures show 18 Trojans still registered, with 14 listed as active.