



AN F-46 BY ANY OTHER NAME...

By GEORGE E. POLING

Only one Fairchild F-46 was ever built. It has served as a structural guinea pig, been cracked up, repaired, put out to pasture, rescued and rebuilt. It has served several owners, stretched its wings over four countries and puzzled spotters wherever it has travelled. And today, 36 years after the first flight of this remarkable prototype, it is still alive and well and living in California.

Concomitant with the story of this durable airplane is the confusion which has always surrounded its precise identity. Despite its straight Fairchild designation, the F-46 has been referred to over the years as the Clark F-46, Fairchild-Clark F-46, Clark-Duramold F-46 or Duramold F-46 — take your pick. Which of these appellations could be considered more accurate than all the others is debatable, and it is necessary to research the manufactures records at some length to determine just how this confusion came about. The answer lies in a complex corporate maze involving Fairchild and its appended companies, and this should be sorted out before turning to the history of the airplane itself.

During the 1950's, at the time when large, all-metal commercial monoplanes were opening a new era in air transportation in the United States, the Fairchild Aircraft Corp. of Hagerstown, Maryland, became concerned over the upward spiralling cost of new aircraft and set its sights on finding a solution to the problem. Fairchild's studies concluded that the chief villain was the humble rivet, hundreds of thousands of which might have to be hand-driven into any given airframe. If the rivets could be eliminated, so too could the high cost of labor.¹

Fairchild settled on the solution of using wooden construction with a plastic bonding to give the necessary structural strength, retain light weight and keep costs within reasonable limits. The basic idea was hardly original, Lockheed and Fokker having had

some success with it, so Fairchild began looking around for the company with the most expertise in the field, settling on the Haskelite Manufacturing Corp. of Grand Rapids, Michigan.²

Haskelite having been recruited, Fairchild began work on the F-46 airplane. It was designed in 1937 by Col. Virginius E. Clark, an engineer prominent in American aviation as early as World War I. He designed the original Clark Y airfoil and later became preoccupied with aerodynamically smooth surfaces. In 1937 he was Fairchild's corporate Vice President of Engineering and therefore ideally situated to sparkplug the Fairchild- Haskelite program.³

At this juncture the ponderous corporate maze begins. By the fall of 1937 Fairchild decided to remove the F-46 project from the company proper and place it in a subsidiary due to the project's increasing demands on time and money, plus the fact that the F-46 was not in keeping with the more conventional mainstream of company activities. In October 1937, at which time construction of the F-46 was virtually complete, Fairchild set up the Duromold Aircraft Corp. (note the spelling Duromold) as a wholly owned subsidiary of the Fairchild Aircraft Corp. Duromold's offices were maintained with the parent company in Hagerstown, and the F-46 was completed in Fairchild's Hagerstown factory.

The F-46 project itself, along with its construction process, became the responsibility of the ancillary Duromold Aircraft Corp. Expenses continued to mount, however, and the management found it necessary to raise additional capital in order to further pursue the venture. A group of investors came up with \$200,000 in return for a majority interest in the project and in February 1938 formed a new company incorporated in Delaware, known as the Clark Aircraft Corp. By this date the Fairchild F-46

had been flying for two months. The Duromold Aircraft Corp. continued to exist as a holding company only, holding the minority share of Clark Aircraft's stock.

In September 1938, the Duromold Aircraft Corp. changed its name to Fairchild Airplane Investments Corp. in order to clear the trade name "Duromold" for use by Clark Aircraft. In May 1939 the Fairchild Airplane Investments Corp. was liquidated and absorbed by the Fairchild Engine and Airplane Corp. In the meantime, Clark Aircraft set up a manufacturing subsidiary in Maryland in September 1938, called the Duramold Aircraft Corp. (note the change in spelling), and to further confuse matters, Duramold Aircraft changed its name to Molded Aircraft Corp. in November 1938.

Throughout 1938 and 1939 Clark Aircraft attempted, without success, to sell the airplane and licenses for the Duramold process in the U.S. and abroad, the British, French and Soviet governments being among those approached. To the company's chagrin it became obvious that the big F-46 was simply too expensive for the civilian market as it then existed. Military orders likewise failed to materialize; the U.S. Army Air Corps rejected the F-46 in January 1939.

With no sales in prospect, the Clark directors decided to sell out, and received an offer from the Glenn L. Martin Co. of Baltimore. Sherman Fairchild, learning of the negotiations, feared losing the Duramold process to a competitor and succeeded in selling the Duramold license to Howard Hughes (Hughes Tool Co.) for something over \$160,000.⁴ With the fresh capital Fairchild was able to put together enough money to meet the Martin offer and buy out the Clark Aircraft Corp. in the summer of 1939. The Clark name disappeared and the Clark subsidiary, the Molded Aircraft Corp., became subsidiary of the Fairchild Engine and Airplane Corp. under the name Duramold Aircraft Corp., the new spelling being

Opposite, the Fairchild F-46A, for its day an advanced business airplane. Right above, as it was being used for engine tests without propeller spinner. Right, the F-46A back in familiar surroundings at Hagerstown, c. 1953 with P & W 450 hp radial in place of the Ranger V770. (Photos - Fairchild Nos. 44-331, 2088,8591)

retained. Col. Clark sometime later went to work for Hughes on the D-2 and HK-1 (later H-4 Hercules) projects.

As a subsidiary of Fairchild, Duramold Aircraft became very active, particularly in the development of components for the AT-13/AT-14/AT-21 series of trainees, 177 of which were ultimately built for the U.S.A.A.F. In July 1942, the Duramold subsidiary's manufacturing operations were absorbed by Fairchild Engine and Airplane as its Duramold Division. The name Duramold Aircraft Corp. continued to exist until 1945 as the title of a licensing and patent-holding company only. The Duramold Division existed until the postwar rundown forced its liquidation in late 1947.

The process of company mitoses, mergers and name-dropping had now come full circle. It is therefore easy to appreciate how the sole prototype F-46 became involved with so many aliases, and the Duramold name clung more tenaciously than any other. The reason for this is easily explained: by the time the F-46 received its Group 2 approval from the C.A.A., it was being used by (Fairchild's) Duramold Aircraft Corp. and was entered in C.A.A. records as the Duramold F-46, under which name it was presented to the world in the 1940 edition of *Jane's*. The Duramold name stuck although the airplane itself was antecedent to the Duramold (with the "a") company name.

The Fairchild F-46, as we shall now call it, was completed near the end of 1937. The plastic-bonded Duramold (*nee* Duromold) process was employed for the fuselage from mid-cabin aft to the tail cone, a pure monocoque. This was an oven-baked plywood sandwich of extremely thin layers, built in two halves joined by lengthwise seams on the top and bottom; it was covered with fabric as a finishing touch prior to painting. The forward fuselage



consisted of square tubing and metal skin, a then-conventional structure.

The monospar wing, of N.A.C.A. 230 section, was of plywood construction with spruce skin. Landing loads to the fuselage were carried by a small auxiliary spar. Wingtip leading edge slots were incorporated to provide lateral stability at low speeds and high angles of attack. The ailerons were of aluminum alloy with fabric covering, and externally hinged Clark split flaps were fitted. The fixed tail surfaces were wooden with ply-covering while the elevators and rudder were aluminum alloy with fabric covering. The elevators had trim tabs and the horizontal stabilizer incorporated a variable-incidence feature.⁵

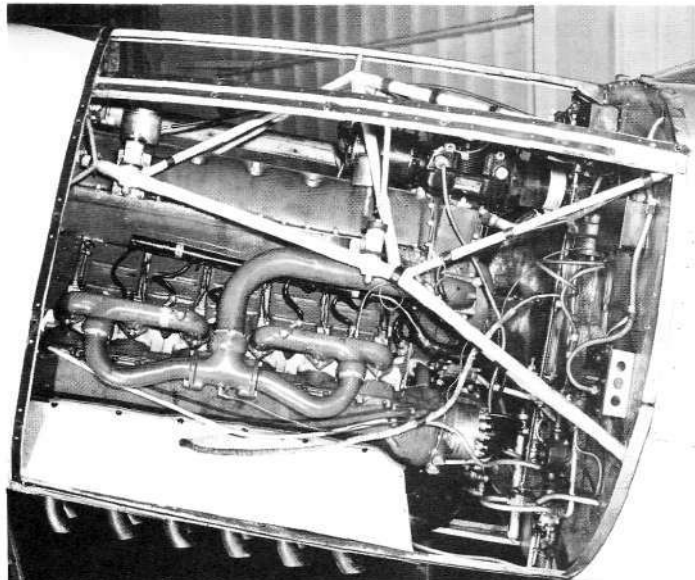
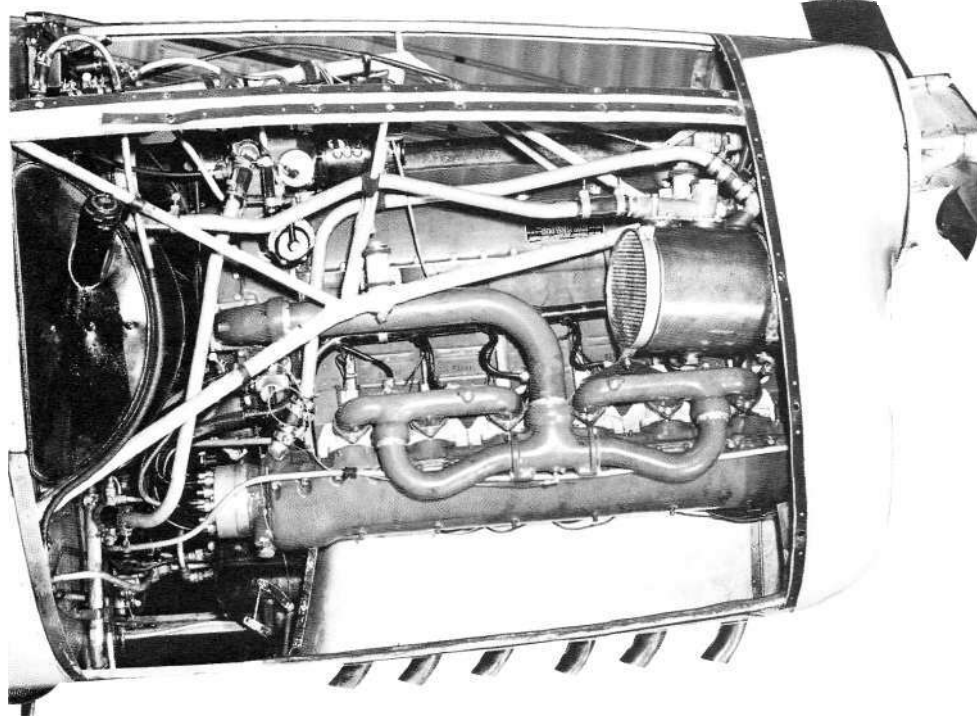
The F-46 was roomy, five-places with full dual controls. Cabin appointments included two buffets and a lightweight folding desk. Baggage capacity was 121 pounds. Fuel was carried in two 50-gallon wing tanks, and a 7-1/2-gallon oil tank was installed.

The F-46 was designed for compatibility with the V-770 series of inverted, aircooled V-12 engines being built by Fairchild's Ranger Engine Division at Farmingdale, Long Island. A supercharged, geared SGV-770B-2 was shipped to Hagerstown in 1937 for the F-46 mockup but is not believed to have been installed in the flying prototype. The F-46, as flown, had a Ranger SGV-770B-5 rated at 420 hp at 2800 rpm and 450 hp at 2900 rpm for takeoff, and drove a Hamilton Standard two-blade constant-speed propeller. A Stromberg carburetor and Scintilla dual ignition were used.

Bearing c/n 5000 and registration NX19131, the F-46 was flown for the first time on 5 December 1937 by Fairchild's Chief Test



Above, the fuselage shell made by the Haskellite Company by a process later to be called "Duromold Process." Below, left and right side views of the Ranger V770 engine installation. Opposite page, the F46A over Hagerstown after gaining the NC registration. (Photos — Fairchild)



Pilot Dick Henson; The flight lasted one hour. With the Ranger B-5 engine the F-46 was later certificated under Group 2 approval 2-545. At an early stage in its development the F-46 was redesignated F-46A and appears as such under Memo 2-545. The reason for the altered designation is unclear, but it may have been due to an engine modification or to the revised, more pointed tail which was incorporated early after flight test. Upon certification the registration was changed to NC19131.

Dimensions of the F-46A were: Span, 38 ft.; length, 33.4 ft.; height, 8.6 ft.; wing area, 238 sq. ft. Empty and loaded weights were 3,173 pounds and 4,800 pounds respectively. Performance at gross weight included a max speed of 225 mph at 9,000 ft., a cruise of 220 mph at 15,500 ft., and a sea level stall speed of 65 mph. Initial rate of climb was 1,700 ft./min. Service and absolute ceilings were 30,300 and 31,700 ft. respectively. Range at 15,500 ft. at 220 mph was 750 miles. Takeoff run was 625 ft.

Apart from proving the viability of the Duramold fuselage and leading the way for later aircraft of similar construction, the F-46A was more involved in stamping out engine bugs. The Ranger V-770 series suffered from over-heating, bearing failure frequently resulting. In September 1943 the F-46A was flown from Hagerstown to Farmingdale for the installation of Alfin cylinders on its engine, which then became the SGV-770B-6. Thus cooling was much improved and plans to install a V-770-11 were abandoned because of the necessity to design a new engine mount to accept it. The B-6 was the final Ranger engine installed in the airplane.

The F-46A came to grief twice during its tenure with Fairchild. On one occasion the landing gear collapsed on landing at Hagerstown while being flown by Dan Henry, a Fairchild production test pilot. The failure was traced to corrosion. The landing gear was wiped out again when a Ranger pilot, Charles Hitchcock, force-landed in a plowed field following fuel starvation.

In addition to its test work, the F-46A was some times used as a company hack, transporting Fairchild personnel between the corporation's many plants. Its cabin equipment and good performance made it ideal for such duty. The big plane's final contribution while with Fairchild was its use as an engineering test mule when it was sent to Fairchild's Jamestown, N.Y. factory of the Duramold Division. At the end of

the war the Duramold factory was reduced to building rowboats and radio cabinets, and the F-46A, its flying days apparently over, was parked in the tall grass near the factory, loaded with sand ballast and all but forgotten.

In October 1947 Fairchild test pilot Dave Lewis rediscovered it at Jamestown. He had flown the F-46A in 1942 and remembered it fondly. The airplane was available, so he bought it — for \$300! — probably just in time; the Duramold Division was in the process of closing down. The lease on the factory was already expired and the elegant airplane might have wound up in a dump as just so much anonymous scrap within a few weeks.

Lewis was presented with the immediacy of putting the airplane into flyable condition. Rumor had it that the fuselage had been cracked during truck shipment, but this proved to be unfounded. The sand was unloaded and the airframe found to be in order, but the B-6 engine was another story. Lewis spent a week working on it, much to the amusement of skeptical factory personnel. An enterprising factory guard, convinced that the big V-12 would in fact still run, began taking bets from the doubters. When Lewis succeeded in firing up the engine, the guard won some \$200! As if to over-demonstrate the fallibility of human nature, the same

guard began taking wagers from those who were rash enough to declare that the old plane would never stagger into the air following its years of neglect. On 22 October, the F-46A and its happy owner took off on a local test flight and the guard collected a second time.

Lewis flew the plane to Hagerstown the same day and landed with an oil-smeared windshield. The leak was traced to the prop seals, which had been installed backwards at some unknown date. The problem was quickly corrected and Lewis flew the airplane to Red Bird Airport in Dallas, Texas in late October. The F-46A was placed in storage at nearby Terrill, where it languished for over a year. In January 1949 it was taken to Texair Aviation at Red Bird for modifications and a complete, from-the-bones-up rebuild by Dave Lewis and John Crow.

The restoration took eight months. The Ranger was carted away to a Texas farm along with its cowlings, and replaced by a 450 hp Pratt & Whitney R-985-AN-3 nine-cylinder radial from a Vultee BT-13, complete with BT-13 cowlings parts all the way back to the windshield. The round engine blended well with the fuselage contours, but added 85 pounds to the empty weight. It also reduced the fuselage length by almost 2.5 feet. The original propeller was retained. Irish linen was stretched over the plywood wing surfaces, the over-head cabin windows were removed and closed in as a concession to comfort in the blistering Texas heat, and several other modifications were introduced.

The restored and modified F-46A, now registered N19131, flew for the first time on 17 September 1949 and was licensed six days later. Performance with the heavier, flat-fronted radial was somewhat less than with the Ranger, but still satisfactory.

Dave Lewis flew the F-46A for the next six years for personal transportation. In early 1950 he based it at Edwards AFB — appropriate for a unique prototype — for commuting between Edwards and Los Angeles. In February 1950 he flew it on the Oregon Air Tour from Portland to Havana, Cuba, returning in March. He later returned to work at Fairchild's Hagerstown plant, bringing the airplane back to its birth place. Lewis ran the engine out and replaced it with a P&W R-985-AN-14B before selling to J.D. Benn in November 1955.

Benn based the F-46A at Washington Airport in Alexandria, Virginia, from where it operated as an air taxi, charter plane and utility transport. He admitted the main reason he bought the F-46A instead of some more prosaic type was because it was a rarity; he already had several other uncommon aircraft. Benn sold the F-46A in August 1959 to H. Russell Taylor, at which time it had amassed some 800 hours total time. Taylor based it at Bakersfield, California since that date.

It retained the B-985-AN-14B engine, and 6-ply 7.00 x 14 automobile tires proved a satisfactory replacement for the original equipment, which all three owners discovered were hard to find in that size.

The three owners of the F-46A since 1947 found little to fault in the airplane; the spacious cabin affords no less than 55 inches of elbow room maintenance is low for its size (virtually nil for the Duramold fuselage). Those who have flown it regard its well harmonized controls as little short of perfect. One enthusiastically called the F-46A "the most beautiful flying airplane ever built," and another reported the ailerons were so effective that he could rock the wings while taxiing!

It is of incidental interest that of all the myriad factory-built

American aircraft types which have been built as sole prototypes, the F-46 has remained active longer than any other. The F-46 was a pioneer, proving the worth of the Duramold concept, and as the times change, so too do the tools and materials used in the aircraft industry, but virtually the entire technology of bonded aircraft structure in use today was developed under the Duramold process. For this alone, the Fairchild F-46 earned a place of honor in aviation history.

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FOOTNOTE:

The Clark Monoplane, as it was then called, was pictured in *the JOURNAL* Vol. 18, No. 2, inside rear cover, in photos submitted by Joseph Kovel,



The question asked was "whatever happened to it?" The present author, George E. Poling, had coincidentally been doing research on the Fairchild-Clark/Duramold airplane for several years, and promptly responded with this article outlining the history of the unique F-46A. Editor.

NOTES:

1. Designer V.E. Clark reported that he counted 300,000 rivets in the Fairchild 91 amphibian airframe, estimating a further 200,000 when he tired of counting.
2. The project was given further impetus by the recent development of resin adhesives made from carbolic acid and formaldehyde, vastly superior to casein glue and resisting far better moisture and mold.
3. Col. Virginius E. Clark (a title given during World War I when he was a member of the Boiling Commission and of the War Production Board) was a graduate in aeronautics from Massachusetts Institute of Technology and the first designer of the American Curtiss-built Bristol Fighter. See *JOURNAL OF AAHS*, Vol. 17, No. 2, (Summer 1972). He was also designer of the Clark GA-43, alias General GA-43, but is best remembered as the engineer of the Clark Y airfoil series. He later became associated with the Hughes D-2 and H-4. Numerous references to his early career are given in Casari, *Encyclopedia of U.S. Military Aircraft*.
4. Hughes bought the rights for "large" aircraft only, defined as single-engined aircraft of at least 1,000 hp, or twin-engine aircraft of at least 1,500 hp each.
5. Clark decided to use Duramold process for the fuselage as an economy measure. The fuselage component could prove the concept without requiring additional tooling for the wings and tail group.