

# The Driggs Dart



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The tiny Driggs Dart of 1924-26 is a good example of an overly specialized design that couldn't find a place in aviation in spite of really good performance for its power, plus a catchy and euphonic name. Because there was no market, it did not exist in significant numbers. It made no great flights and set no records, so it really is a forgotten airplane today.

As with many designs of the 1920's, the prototype Dart was not the product of a recognized aircraft manufacturing firm. The original builder was the Johnson Airplane & Supply Company of Dayton, Ohio, which was representative of a number of small firms around the country that existed primarily to provide parts and material for the civil fleet of war-surplus aircraft. Unlike most, Johnson had adequate shop facilities and did build occasional single airplanes of its own or outside designs.

Since most of the private flying of the time was done in clumsy 90-hp war-surplus trainers, a movement de-

veloped among the purely sport flyers for something a lot livelier but also more economical. The unavailability of small aircraft engines led to the development of a number of ultra-light single-seaters powered with converted motorcycle engines. This activity drew so much attention that several events for planes with engines of 80 cubic inches or less were scheduled into the 1924 National Air Races, held that year in Dayton. The first Dart was built for that race.

The designer was Ivan H. Driggs, an aeronautical engineer who had designed and built his first airplane in 1915. He served with the famous Army Air Service Engineering Division at Dayton's McCook Field, was assistant chief engineer of the Dayton-Wright Aircraft Company and spent a year with Consolidated Aircraft Corporation when that new firm took over Dayton-Wright's army contract and many of its personnel after the Dayton firm shut down. He left Consolidated to be-

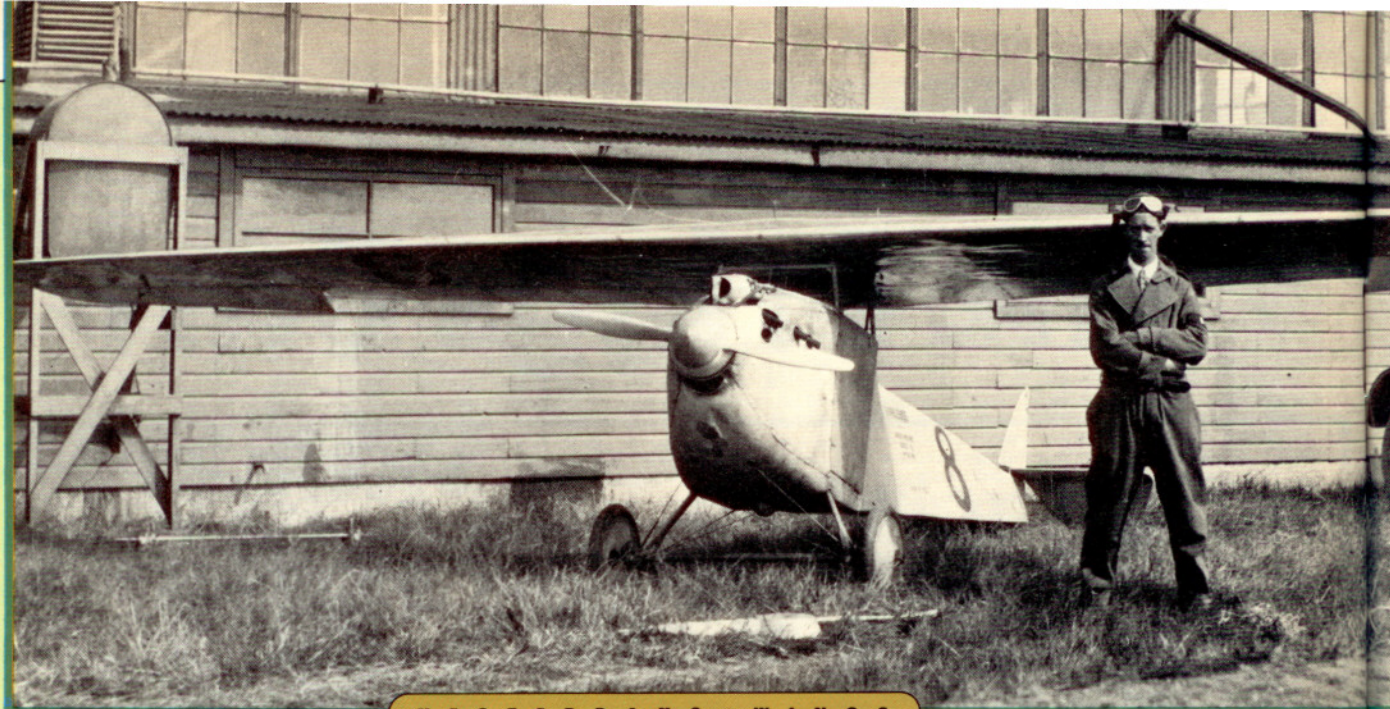
come vice president and chief engineer of Johnson in 1924.

Driggs brought a new and professional touch to the ultra-light field, which to that time consisted mostly of very crude amateur designs built at home. Driggs knew some aeronautical facts of life about low-powered flight that the enthusiastic amateurs did not. Where others were simply scaling traditional designs down to minimum size, he went all-out for a combination of maximum drag reduction and the most efficient wing possible.

The two major innovations on the Dart prototype were use of the monoplane wing in a biplane age and elimination of the traditional open cockpit in favor of an enclosed cabin for better streamlining. One of the major disadvantages of scaling-down was the increase in interference and intersection drag relative to the total drag. Another was that the pilot was not scaled down accordingly. So the open cockpit itself, plus the pilot's

*The original Driggs-Johnson DJ-1 appeared at the National Air Races in Dayton, Ohio, in 1924. The aircraft, prototype of the Driggs Dart, featured an unusual wire-braced, cross-axle landing-gear configuration. The "bubble" cabin configuration was also atypical.*





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head and shoulders, contributed a higher percentage of the total drag than on a comparable, larger design. Further, few designers knew then the loss of aerodynamic efficiency that resulted from the reduced size of the wing itself, a phenomenon later measured by Reynolds Number.

Driggs cut the drag to the minimum by using a clean cantilever monoplane wing raised above the main fuselage structure in what would normally be called the parasol position. (The few contemporary parasols were in effect biplanes without a lower wing that retained their traditional high-drag open cockpits.)

As with all ultra-lights, the pilot was the main load and had to sit right on the center of gravity, which in the Dart meant directly under the wing. There was no room between the underside of the wing and the fuselage for entry to an open cockpit. So Driggs gave the pilot a side door and enclosed the wing/fuselage gap with a removable transparent fairing that made it into a proper cabin and greatly improved the streamlining.

Welded steel-tube construction was just getting a toehold in the industry, and Driggs used it for the fuselage, tail and ailerons. Weight was saved and streamlining further improved by dropping to three longerons aft of the cabin, the single, upper longeron making a clean intersection with the pointed rear of the cabin. This inverted triangle construction came to be called "razorback".

The tapered wooden wing was very efficient, with a very high aspect-ratio (the span squared and divided by the area) for the time. A high ratio reduces induced drag at low speeds and high angles of attack,

such as those attained by racers rounding pylons. The Dart's wing was one-piece, with two laminated spruce spars and plywood-and-stick ribs. Torsional loads were supported by a plywood box ahead of the front spar and by plywood back to the rear spar on the top surface. For upward visibility in steep turns, there was a skylight in the center of the wing.

The powerplant was the best available at the time, the 80-cubic-

to overcome this by using various arrangements of gearing or chain reduction to increase propeller efficiency but without much success.

Built by Johnson as the DJ-1, for Driggs-Johnson, the original Dart did well at the races. It took one first place at 64 mph around a 25-mile course and two second-place positions out of three events entered, winning \$3500 in Liberty Bonds. This success did not bring a rush of customers, however; although the design was advertised, only four additional DJ-1's were built by Johnson.

Driggs soon left to form his own company in Dayton about 1925 and took his design, now officially named "Driggs Dart", with him. He introduced an improved version, the major changes being the use of a new specially designed lightplane engine, the 30-hp Wright-Morehouse, a revised and permanent cabin structure, and a separated tripod landing gear. These improvements raised the empty weight to 400 pounds, which hampered performance. A few Driggs Darts were built in Dayton, some with Wright engines but others (probably because of price) with the Henderson.

In a really audacious move for such a design, a production Driggs Dart was entered in the 2585-mile 1926 Ford Reliability Tour. It dropped out with a broken crankshaft at St. Paul after only 335 miles but received a \$500 award for the effort. A month later the same plane made a round-trip flight from Dayton to the National Air Races at Philadelphia, where it again made a good showing in the 80-cubic-inch events.

A Driggs Dart was involved in aeronautical testing for the Army

#### DRIGGS-JOHNSON DJ-1

##### Specifications

Powerplant	Henderson 80 cu in, 27 hp @ 2700 rpm
Span	27 ft 0 in
Length	19 ft 8 in
Wing Area	70 sq ft
Empty Weight	325 lbs
Gross Weight	511 lbs (150 lb pilot)
Wing Loading	7.3 lbs/sq ft
Power Loading	19 lbs/hp

##### Performance

High Speed	85 mph plus
Initial Climb	300 fpm
Ceiling	12,000 ft

inch, air-cooled Henderson from the popular motorcycle of the same name. This was a four-cylinder, inline engine, later to become a famous conversion in the Heath parasols in 1927-32. In aeronautical conversions, this engine delivered between 25 and 30 horsepower. That sounds like plenty for ultra-light airplanes, but the number is deceiving. Motorcycle engines get their high power from small displacement by turning fast. There is a great loss when this torque is converted to thrust through a small-diameter propeller turning over 3000 rpm. Other designers tried





The production Dart (above), flown from Dayton to Philadelphia to participate in the National Air Races in 1926, had a ground-adjustable metal propeller.

Test pilot Clyde Ernack flew the DJ-1 in the 1925 National Air Races held at Hempstead, N.Y. Ernack finished second in the Scientific American race with a 67.5 mph clocking. Notice the aircraft's cabin enclosure has been removed.



A production model Dart was flown in the 1926 Ford Reliability Tour. The aircraft was powered by a two-cylinder opposed engine rather than the earlier four-cylinder engine.



The U.S. Army Air Corps tested a Dart that used flaps and featured droopable ailerons. Leading-edge slots also were incorporated into the aircraft design prior to Army tests.



Jack McRae's Super Dart was a modern-day, home-built version of the classic DJ-1. The aircraft had a maximum speed of 125 mph and used a 55-hp Lycoming O-145 powerplant.

that used off-the-shelf light planes to test major modifications because of their simplicity and low cost. Driggs received a contract for one Driggs Dart for this work, performed by the Army Air Service (Air Corps from July 1, 1926, to June 20, 1941). The Driggs Dart was fitted with several experimental wings of the same plan form and area, including one of all-metal construction. Another, called "variable camber" at the time, was fitted with trailing-edge flaps and droopable ailerons and leading edge. One wing also was used to evaluate leading-edge slots. The tests were successful in that all the devices worked; but the performance range of airplanes was so limited at the time that there was no immediate benefit.

Driggs soon dropped the Dart design, which there was no attempt to certificate after licensing requirements were introduced in 1927, and moved his plant to his native Lansing, Mich., early in 1927. There he produced more acceptable, open-cockpit biplane designs for the sport-trainer market before closing down during the Depression. The final Driggs design, the Skylark, was sold to Phillips and saw limited production in 1940.

The plans for the little Dart appeared in the *Modern Mechanics Flying and Glider Manual* in 1930, and probably more were built by amateurs than were built professionally.

It is unfortunate that the Dart was designed originally as a racer, with the necessary sacrifice of utility and docile-handling characteristics. With its advanced lines, only a little more wing span and area could have made the Dart more popular than the much-less-refined Heath parasol. □