"Yup, I had an Arrow Sport back in '31. Kinda underpowered for a biplane, but a lot of fun to fly around in."

"Biplane? An Arrow Sport a biplane? You're nuts, man. I had an Arrow Sport, too, but it was a monoplane and I can prove it! I just happen to have a snapshot here in my wallet . . ."

The above argument might never have taken place as described, but it very easily could have. Oddly, both sides are right. The Arrow Aircraft Corporation, later Arrow Aircraft and Motors, did indeed produce two entirely different airplanes with the same name. These appeared nearly nine years apart, and there was little or no confusion between them when both were part of the general aviation scene in the years leading up to World War II. Today, however, both are "rare birds," with only six or seven surviving examples between them. With their heyday over 30 years in the past, the current generation of pilots can be excused for a bit of confusion.

The original Arrow Aircraft Corporation of Lincoln, Neb., was one of many tiny aircraft manufacturers that sprang up all over the country in the year and a half preceding Lindbergh's transatlantic flight in May 1927. The cheap war-surplus types that had stifled the development of competing commercial designs were fading fast and a new market was opening up. Arrow's first offering, in 1926, was a big five-place wooden biplane powered with a 180 h.p. war-surplus Wright-Hispano ("Hisso") engine. This was understandably influenced by the well-known Lincoln-Standard 5, or LS-5, a modified war-surplus Standard Model J trainer that was produced in significant numbers by the Lincoln-Standard Aircraft Corporation, also of Lincoln. The Arrow's designer, Swen S. Swanson, had been chief engineer for Lincoln. His most notable design had been a tiny single-seater known as the Lincoln Sport that was put in limited production but gained its greatest fame as a homebuilt when plans were published in do-it-yourself magazines. The new Arrow, designated the "Five" because of its five seats, was essentially a replacement for the LS-5. Of wood construction, it could hardly be considered an advanced design even in 1926.

The "Five" was not a commercial success, but the five built did give the new firm some valuable design and production experience. Swanson soon developed an entirely new design—the Arrow Sport. This was a two-seat biplane, but was very small by contemporary standards. The short length was made possible by one unique feature: the Sport was a side-by-side two-seater instead of the traditional tandem. At the time, this arrangement was called "sociable seating."

Two other features made the new *Sport* stand out. Firstly, the equal-span wings were sharply tapered; secondly, there were no traditional interplane struts or the associated flying and landing wires. At a time when other de-

signers were still generous in the strutsand-wires department, the *Sport* was a true cantilever biplane. The two parallel box spars in each wing were fully capable of taking all the bending loads, and the panels themselves were stiff enough to withstand the torsion loads without the aid of struts.

In this use of full cantilever wings on a biplane, the *Sport* was not original. However, it ran into the same prejudice barrier that earlier designs had met pilots were used to seeing struts between the wings and simply wouldn't trust a pair that had only air between them. While the prototype never was fitted with struts, the later production models offered them as an option.

Never was an optional feature so widely accepted. Although the production *Sports* were described in contemporary trade publications as not having interplane struts, none, other than the

Yesterday's Wings:

prototype, are known to have gone into service without the optional parts. Once these were in place, the pilots didn't seem to mind the absence of the wires. Actually, the struts were more than just a psychological crutch. The prototype showed some evidence of undesirable vibration resulting from different natural frequencies for the two somewhat flexible wings. The struts eliminated the problem, which had nothing to do with the actual strength of the spars.

The rest of the *Sport* was relatively conventional. The fuselage and tail surfaces were welded steel-tube fabriccovered structures. The landing gear was the divided-axle type then coming into vogue. The sociable seating, however, introduced some specialized problems of its own. Traditional tandem cockpit designs had the passenger's seat right on the center of gravity so the

The Arrow Sports

Two entirely different planes shared same name before WW-II. Company pioneered in converting automobile engine to airborne use

by PETER M. BOWERS / AOPA 54408



An early production Arrow Sport biplane 2A-60L, with 60 h.p. LeBlond radial engine. Note the old-fashioned high-pressure tires on the disc wheels. Traditional bracing wire was used only between the center section struts of this cantilever-wing design.

The sharply tapered wings of the Sport were an outstanding recognition feature. The oversize cutout in the upper wing was needed to allow the crew to get into the cockpit. N3079 illustrated, based in Lynden, Wash., is one of two surviving 2A-60L's.

The Arrow Sport F had a much larger wing than its contemporaries because of the great weight of the water-cooled Ford engine. With the engine geared down two to one, the Sport F sounded like a P-51 when taxing. Two of these Fordpowered monoplanes survive.





balance wouldn't be disturbed by his presence or absence. With two seated side-by-side, both had to be on the C.G., which meant that the wide cockpit had to be in an in-between location. Since the *Sport* was so small, the occupants couldn't be seated under the wing. This necessitated a high degree of stagger (placing one wing ahead of the other) and a very large cutout in the trailing edge of the upper wing that was costly in drag and lost lift.

Since the new Sport was so much smaller and lighter than its contemporaries, most of which used the heavy 90 h.p. war-surplus Curtiss OX-5 engine, it was thought that the light aircooled French Anzani three-cylinder radial of 35 h.p. would be satisfactory. While the prototype did fly with this, it was soon replaced by a six-cylinder Anzani (actually a twin-row design) of 60 h.p.

The 60 h.p. Sport turned out to be a desirable little airplane. The Arrow firm was not in a position to undertake regular production or even finance the costly test program needed to qualify new commercial designs for the Approved Type Certificates (ATC's) that became mandatory at the beginning of 1927. However, after Lindbergh's flight triggered the "Lindbergh boom," designers of airplanes that even looked good on paper had little trouble in finding backers. Financial control of Arrow was taken over by a large real estate and construction firm, and the company was reorganized as Arrow Aircraft and Motors. A new plant was built at Havelock, Neb., a suburb of Lincoln.

By the time new Sports were under construction for the certification program, some new American-made light radial engines had come on the market. The imported French Anzani had many problems that made it unsuitable for a production American airplane, so the new Sport used the five-cylinder 60 h.p. LeBlond. Under the designation of 2A-60L, the Sport was awarded ATC No. 115 in February 1929.

Performance was somewhat marginal with the LeBlond 60. The side-by-side seating on such a small design didn't help, either. Two heads and two sets of shoulders alongside each other in the slipstream caused a lot more drag than the same two in tandem. It is interesting to note that no small opencockpit side-by-side two-seater, in which the cockpit area contributes such a large portion of the total drag, has ever been a notable performer. The inherent high drag of the biplane design was incompatible with low power; all the

## SPECIFICATIONS AND PERFORMANCE

	Sport A2-60L	Sport F
Wing span	25 ft. 10 in.	36 ft. 7 in.
Length	19 ft. 2 in.	21 ft. 4 in.
Height	7 ft. 5 in.	8 ft, 111/2 in.
Wing area	183 sq. ft.	176 sq. ft.
Powerplant	LeBlond 60,	Arrow-Ford V-
	60 h.p. @	82 h.p. @
	1900 r.p.m.	3075 r.p.m.
Empty weight	811 lbs.	1,175 lbs.
Gross weight	1,270 lbs.	1,675 lbs.
High speed	90 m.p.h.	100 m.p.h.
Cruise speed	80 m.p.h.	90 m.p.h.
Landing speed	38 m.p.h.	45 m.p.h.
Rate of climb	600 f.p.m.	500 f.p.m.
Service ceiling	10,000 ft.	14,000 ft.
lange	250 mi.	300 mi.
rice	\$3,845	\$1.500

notable low-powered lightplanes from 1928 on have been monoplanes. It is to the Arrow Sport's credit that it was the lowest-power two-seat biplane to get certificated and into significant production.

The 60 h.p. version was one that needed coaxing, however. Further, it carried the placard INTENTIONAL ACROBATICS PROHIBITED. This could be deleted following demonstration to the Department of Commerce inspector that a particular airplane could stand them. A later 85 h.p. LeBlond was tried in the Sport, but this version was not certificated. A still more powerful version, fitted with the 100 h.p. Kinner K-5 engine, received the lesser Category-2 certification No. 2-110 in August 1929. This was both a heavier and a livelier model and was not restricted against aerobatics.

The stock market crash of October 1929 and the subsequent depression shut down *Sport* production after approximately 71 LeBlond models and 24 Kinner models had been built. Arrow managed to survive when other companies were closing their doors, thanks to the income from an airport and an. aeronautical trade school that it operated. Thus it was in a position to again undertake the design and manufacture of airplanes when the industry began to revive in 1934-35.

The incentive came in the form of a government-sponsored design competition for a low-cost, mass-produced light airplane for "the common man." This came to be known as the "\$700 design contest" because that price was suggested as a practical target. One way officially suggested for achieving this was to adapt current automobile engines to aircraft use. Arrow took this route and quickly developed a flight version of the well-known Ford V-8, then built a new airplane to put it in.

With a displacement of 221 cubic inches, the Arrow-Ford V-8 conversion delivered 82 h.p. at 3,075 r.p.m. Naturally, it was heavy, weighing 402 pounds including starter and generator, or almost five pounds per horsepower, compared to 295 pounds, or barely over three pounds per horsepower, for the contemporary 90 h.p. seven-cylinder LeBlond with 350 cubic inches. To this weight must be added a 33-pound radiator, associated plumbing, and seven gallons of water. To improve propeller efficiency, the high automotive crankshaft speed was cut in half by gearing.

While airplane engines of the time used magneto ignition, the Arrow-Ford retained the original Ford battery ignition system and used only one spark plug per cylinder since single ignition had not yet been prohibited for new designs. Despite the built-in handicaps resulting from the original Detroit design, low cost was the prime consideration. The converted V-8 did the job and was awarded engine ATC No. 151 in August 1935, the first automotive conversion approved for aircraft use.

The airplane designed specifically for the V-8 conversion was the Arrow F and was also named *Sport*. Except for a similarity in rudder shape, it bore no family resemblance to either the biplane Arrow Sport or the Arrow "Five". (Swanson had left Arrow soon after the original Sport was certificated.) Another side-by-side two-seater, the new Sport F was somewhat larger than its contemporaries, a fact necessitated by the weight of the engine. A lot of wing was needed to lift all that iron.

Construction was conventional, with welded steel tubing for fuselage and tail, wood wings using solid spruce spars, and fabric covering over all. The Sport F received ATC No. 613 in April 1936. The Aeronautics Branch of the Department of Commerce, predecessor of today's FAA, bought the second airplane for evaluation in the contest. Although it didn't win, losing out to the Hammond Y with a 150 h.p. Menasco airplane engine, the Sport F was good enough to win commercial orders in spite of some notable shortcomings. With the Hammond selling for \$7,000, the Sport F's price tag of only \$1,500 made such things as slow climb and sluggish controls seem unimportant.

While the cockpit was considerably more roomy than that of the biplane *Sport*, it was also much deeper, and forward visibility was seriously hampered even for tall pilots by the high instrument panel. In the few flights he made in a *Sport* F, the author was never able to read the instruments on takeoff or landing—he was too busy leaning out the side of the cockpit in order to keep the runway in sight.

One problem arose from the optional winter canopy that could be fitted to the open cockpit. This altered the air flow over the tail and required a change of fixed stabilizer setting and a flight test prior to approval of each individual installation. Another and more serious problem resulted from the original wing-root design. This tended to put the horizontal tail into dead air at high angles of attack. The government decreed a mandatory change that consisted of reshaping the trailing edge of the wing at the root to form what was called a "Gull" wing. Arrow sent conversion kits to the owners of the 53 Sport F's delivered to that time, June 1937.

The company began having internal problems at this time. Various managers and stockholders were fighting for control, the planes were being sold at less than cost, and financing was inadequate to support production. The last of just over 100 Sport F's built was completed at the end of 1937. A bid for a higherpriced market was made early the next year by replacing the V-8 engine in the last Sport F with a 125 h.p. Menasco airplane engine. While this reduced the weight by some 250 pounds and greatly improved the performance, the price more than doubled and the new Sport M did not sell. Arrow therefore closed its doors and sold the design rights for the Sport F to the State Securities Company of Lincoln in November 1940, to end the unique double existence of the Arrow Sports.