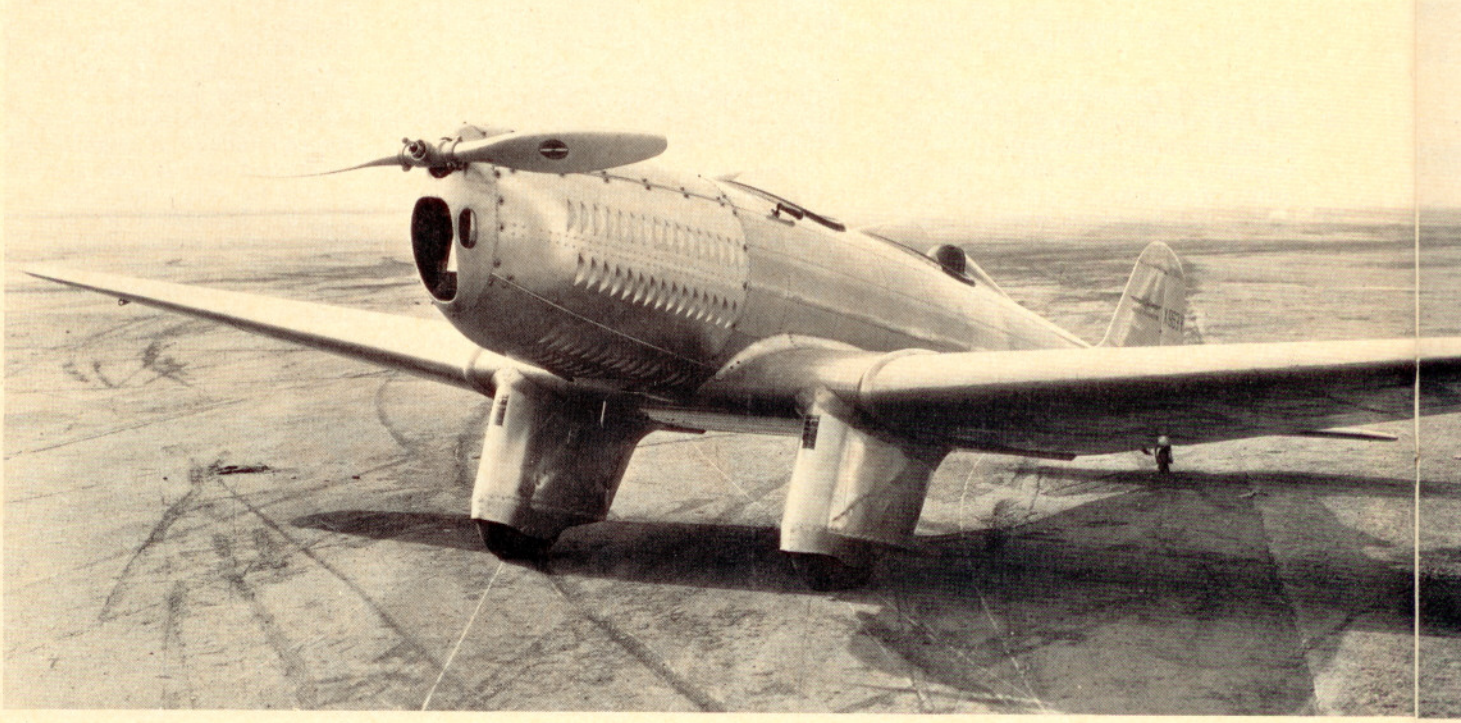
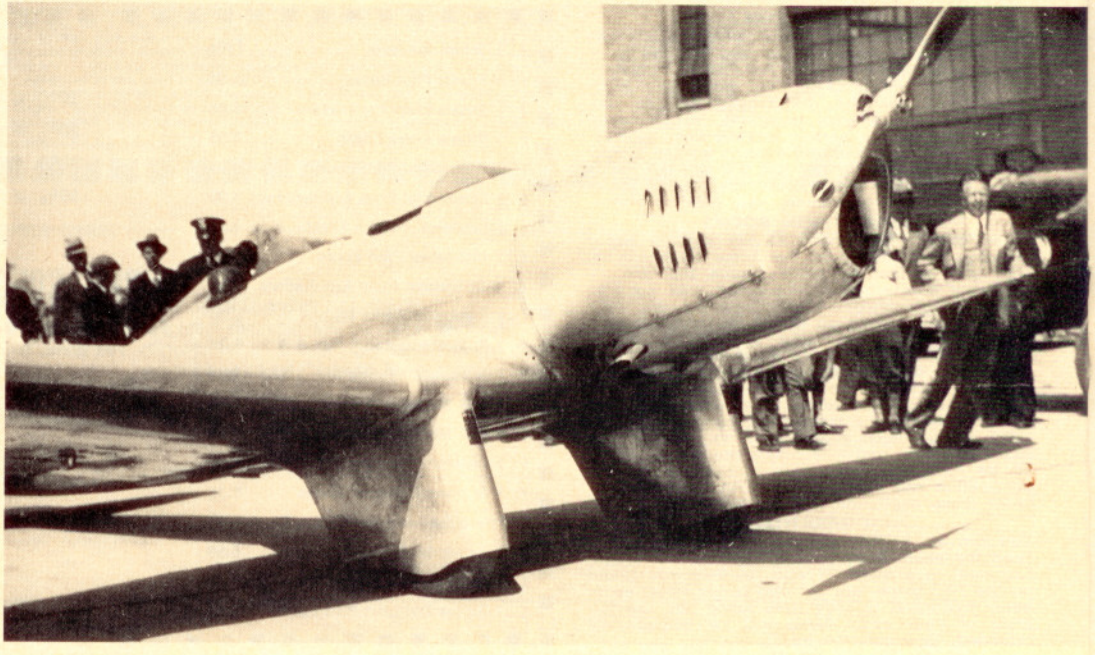
Yesterday's Wings

The Northrop Beta



The first Northrop Beta, showing the high thrust line of the Menasco Buccaneer engine, the new spatted landing gear and the widely spaced cockpits.



Close-up of the Beta during a demonstration. That's Jack Northrop at the far wingtip.

by PETER M. BOWERS / AOPA 54408

NORTHROP BETA

Specifications

Powerplant	Menasco C-6S Buccaneer, 160 hp @ 1,975 rpm
Span	32 ft
Length	21 ft 8 in
Wing area	137 sq ft
Wing loading	8.5 lb/sq ft
Power loading	11.1 lb/hp
Empty weight	1,135 lb
Gross weight	1,770 lb

Performance

High speed	175 mph
Cruise speed	145 mph
Landing speed	48 mph
Initial climb	1,150 fpm
Service ceiling	22,200 ft
Range	4 hr

One of the raciest looking airplanes ever developed for general aviation was the little two-seat Northrop Beta. Pilots who saw it in the early 1930's marveled at its performance on relatively low power, the result of careful streamlining. It looked as though it was going 100 mph just sitting there.

A point not fully appreciated at the time was the innovative structure. General aviation wasn't quite ready for it yet, but the construction of the Beta and contemporary Northrop models was to have a far-reaching effect on the industry even though those particular airplanes quickly vanished from the scene.

The Beta was the product of a very small firm, Northrop Aircraft Corp. of Burbank, Calif. This was founded in 1928 by John K. Northrop, a noted aeronautical engineer whose most recent success had been the design of the revolutionary Lockheed Vega in 1927. Northrop was ahead of his time in many ways, principally in advocating all-sheet-aluminum structures when steel-tube fuselages and wood-frame wings were the industry standard.

The first product of the new firm was a purely experimental model that combined Northrop's structural concepts with some of his other ideas relative to drag reduction. This model was popularly called The Flying Wing because it did not have a conventional fuselage. The weight and drag of that traditional unit were largely eliminated by carrying the conventional tail surfaces on two thin metal booms. Northrop went on, in a later company, to produce a notable line of true Flying Wings—tailless aircraft that culminated in the XB-35 and YB-49 bombers for the Air Force at the end of World War II.

While not a notable success, the 1929 Model 1 proved Northrop's new ideas for multiple-web-type, spar-wing construction and led to the design of the Alpha line of single-engine transports. With an eye toward the private market, Northrop then developed the little Model 3 Beta.

This was a small two-seater powered with the new 160-hp, inverted, air-cooled Menasco Buccaneer engine. In the interest of improved streamlining, the fuselage was circular in cross-section and was set on top of the flat center section of the three-piece wing.

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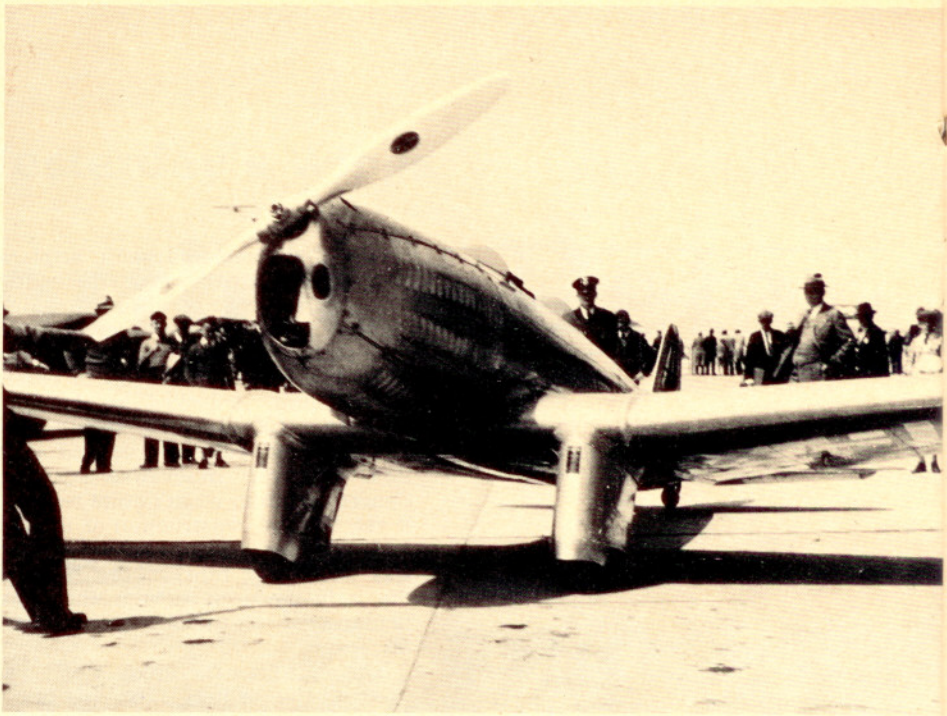
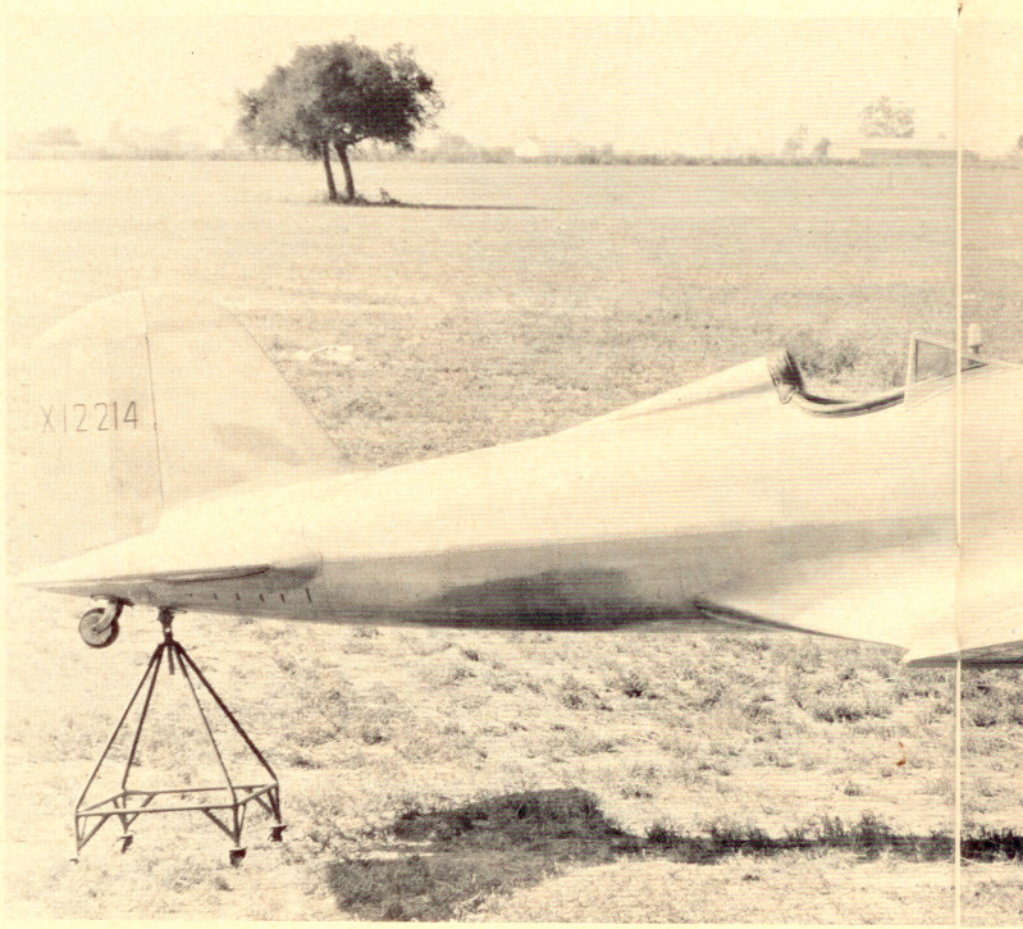


The center section of the Beta was flat, with a dihedral being formed at the outer wing panel attach points. This same layout and construction was used on the Douglas DC-1, -2, and -3 airliners and on the famous North American Texan line.



Yesterday's Wings

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This called for rather elaborate filleting between the wing and the fuselage to reduce intersection drag and airstream turbulence.

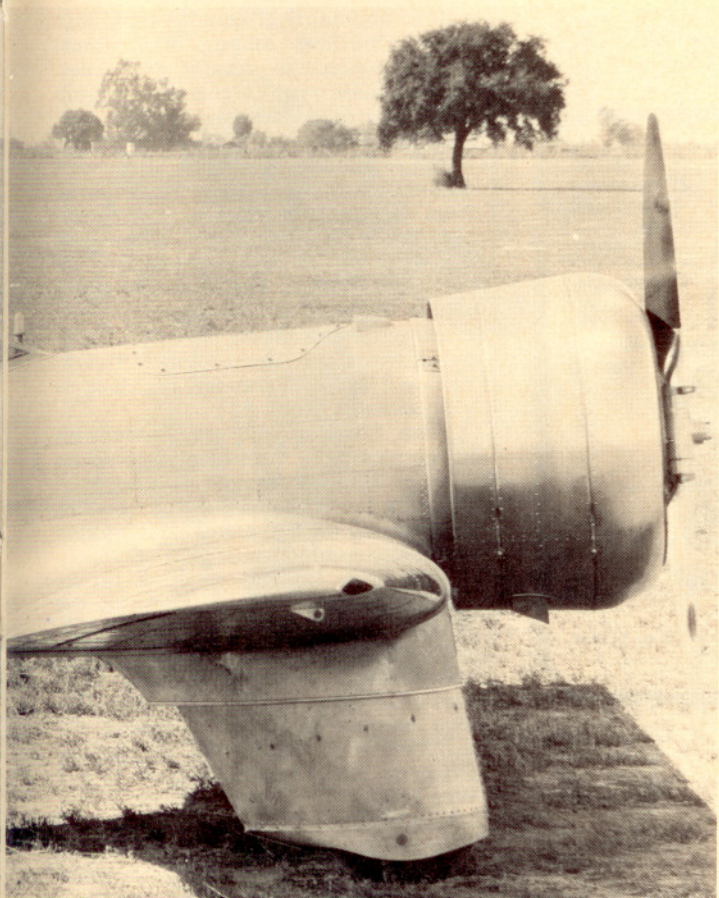
The circular fuselage carried on a mechanical problem from the similarly sectioned Lockheeds. Stabilizer trim was achieved by moving the leading edge of the stabilizer up and down through a control in the cockpit. The stabilizer-fuselage intersection was covered by a big fillet that had to move up and down with the stabilizer. To avoid a variable gap as the setting changed, the fuselage end of the fillet was fitted into vertical tracks on the fuselage so that it was always snug against the skin on that end and was free-sliding over the relatively flat stabilizer. This was a real installation and maintenance headache.

The two open cockpits were fitted with dual controls, which raises an interesting question at this late date—why were they located so far apart? Communication was and is very important in trainers, but those seats were much too far apart for any communication except by interphone. A canopy over both would have improved matters; while Northrop was to pioneer such a feature on his later models, the device was not in use at the time the Beta was designed.

The high thrust line of the Menasco engine permitted a short landing gear, which in turn resulted in a flat ground angle. The gear itself was an innovation, with a single unit under each wing and attached directly to it instead of having angled struts reaching to the fuselage as was then being done on most other low-wing monoplanes. Single-leg units that took all bending loads as well as serving as shock absorbers were still in the future, so each wheel on the Beta was supported on both sides. To reduce the drag of this assembly the entire structure was enclosed in a streamlined fairing that came to be called a spat.

This new landing gear design was so successful that the earlier Alpha models, which featured the old traditional three-strut arrangement, were recalled from airline service and modified to incorporate the new feature.

Desirable as it was at that particular point in time, however, the Northrop spat landing gear was short-lived. Northrop's next company started by using the spat on its first production models but soon discovered the disadvantages for high-speed aircraft. For



The second and final Beta was fitted with a 300-hp P&W Wasp Jr. engine. Note the closed-off front cockpit and the vertical tracks for the movable fairing between the horizontal stabilizer and the fuselage. The lower thrust line and larger propeller of the radial engine required a slightly longer landing gear than was used on the Menasco-powered model.

one, all that sheet metal added to the "wetted area" of the airplane, a significant drag feature. For another, the long line of 90° intersection between the top of the spat and the underside of the wing added a lot of heretofore unappreciated "intersection drag" to the airplane. This did not begin to become significant until speeds began to approach 200 mph. As landing gear design improved under the impetus of higher speed requirements, the single-leg structure soon appeared. It was found that this single leg, faired with a relatively small amount of sheet metal, plus a full or partial pant fairing around the wheel, had much less total drag than the spat type. Northrop's spat, which had virtually been a personal trademark for four years, was out of production by 1935. It did a good job for awhile, though, in a transition period where it produced far less drag than three struts and an unfaired wheel.

While the little Beta got terrific performance on low power, it was not to become a commercial success. Only one other example was built, the 3D model that was fitted with a 300-hp Pratt & Whitney Wasp Jr. radial engine. This was originally a two-seat aircraft but was eventually certificated as a single-seater.

By the time the Betas were flying, the general economic depression was well under way and the bottom dropped out of the aircraft market. United Aircraft and Transport Corp., a huge aeronautical conglomerate that owned Northrop among other firms, had to undertake drastic economies. One of these was to merge Northrop with Stearman, another United subsidiary. Stearman was in Wichita, Kan., so all the Northrop assets and on-hand airplanes were transferred from Burbank to Wichita in September 1931. The Northrop name was dropped and the airplanes officially became Stearmans. Certification testing of the second Beta, the first airplane to exceed 200 mph on only 300 horsepower, received Memo Approval Certificate 2-401 on February 10, 1932, as a Stearman.

John Northrop did not move with his company. He formed a new one on the Los Angeles Municipal Airport as a wholly owned subsidiary of Douglas, and carried on his metal construction and aerodynamic concepts. This association with Douglas resulted in the use of Northrop construction in the famous Douglas DC-1,-2,-3 line.

In 1936, the second Northrop firm was absorbed as the El Segundo Division of Douglas and the Northrop BT-1 dive bomber then in production for the Navy soon evolved into the famous Douglas SBD Dauntless of World War II.

Again, Jack Northrop did not stay with his renamed company. He formed still another and continued to make design history under his own name. □