

**I**n the 1940s, Jack Northrop generated great excitement with his amazing “Flying Wing,” which flew like an airplane but didn’t look like one, at least not in the traditional sense. It demonstrated that an aircraft did not need a tail or a fuselage to fly. The wing was enough.

In fact, Northrop’s first true flying wing, the small-scale N-1M, took off on its own during a high-speed taxi test on a dry lake bed in the California desert in July 1940. It hit a rough spot, bounced 10 feet into the air, and flew several hundred feet before the pilot landed it.

Northrop was not the first to imagine an “all-wing” airplane, but he took the idea much further than anyone else did. In the middle 1940s, the Air Force regarded his XB-35 as a potential successor to its best bomber of World War II, the B-29.

The XB-35 flew for the first time in June 1946, a giant boomerang-shaped

aircraft with a wingspan of 172 feet, pushed along by four sets of contra-rotating propellers mounted on the trailing edge. The YB-49, a jet-powered version of the XB-35, came in 1947.

Seen head-on, the Flying Wing looked like a flying saucer and was sometimes mistaken for one in UFO sighting reports. Public fascination was nurtured by its regular appearance in newsreels and photo spreads in popular magazines.

However, the Flying Wing had serious technical and operational problems. The contra-rotating propellers never worked well. Instability in flight was a constant struggle for the YB-49.

Controversy surrounds the cancellation of the YB-49 by the Air Force in 1949. Flying wing technology lay dormant and was presumed dead.

In the late 1970s, though, the flying wing was resurrected as a candidate for the Advanced Technology Bomber. “Fly-by-wire” technology had solved

the instability problems and the flying wing offered an advantage that had become of critical importance: It was extremely difficult for radar to detect.

#### **ELIMINATING THE TAIL**

Interest in a flying wing dates from the early days of aviation. It was understood that a fuselage and a tail provided stability and control for an airplane—but that they also created drag, which reduced aerodynamic efficiency.

The first powered all-wing aircraft to fly was the D.4 in Britain in 1908. It was a V-shaped biplane, built by a British army officer, John William Dunne, who acknowledged that it was “more a hopper than a flyer.”

More advanced flying wing aircraft were produced by others, notably Walter and Reimar Horten in Germany, but the concept was taken to

# Jack Northrop and the Flying Wing



its fullest by the innovation of John Knudsen Northrop.

“My grammar school and high school education, outside of the school of hard knocks, was the only education I ever had,” Northrop said. “I didn’t go to college. I didn’t have any correspondence courses, or anything of this sort.” Despite his lack of formal education, he went on to be recognized as one of the leading aircraft designers of the century.

He began as a draftsman for the Loughead brothers—who had not yet changed the spelling of their name to “Lockheed”—in Santa Barbara, Calif., in 1916. In the 1920s, he was the principal designer of the classic Lockheed Vega monoplane and worked with

Ryan Aircraft on *Spirit of St. Louis*, the airplane that Charles Lindbergh flew to Paris.

In 1929, Northrop produced what aviation magazines of the day called a “flying wing.” Indeed, the aircraft was built around a large thickened wing in which the pilot sat, but twin outrigger booms ran backward to a conventional tail assembly.

His first true flying wing was the N-1M—for “Northrop First Mockup”—in 1940, by which time he was the head of his own aircraft company. The N-1M was a small test bed with a wingspan of just 38 feet, constructed mostly of wood to allow easy changes to the

configuration. The control surfaces, including the rudders, were embedded in the wing itself.

The N-1M test results were good enough to elicit a request in 1941 from the Air Corps for an aircraft design study. Northrop, along with Consolidated Aircraft and Boeing, was invited to submit a proposal for a bomber with a range of 6,000 miles and a top speed of 450 mph, improving on the expected performance of the B-29 then in development.

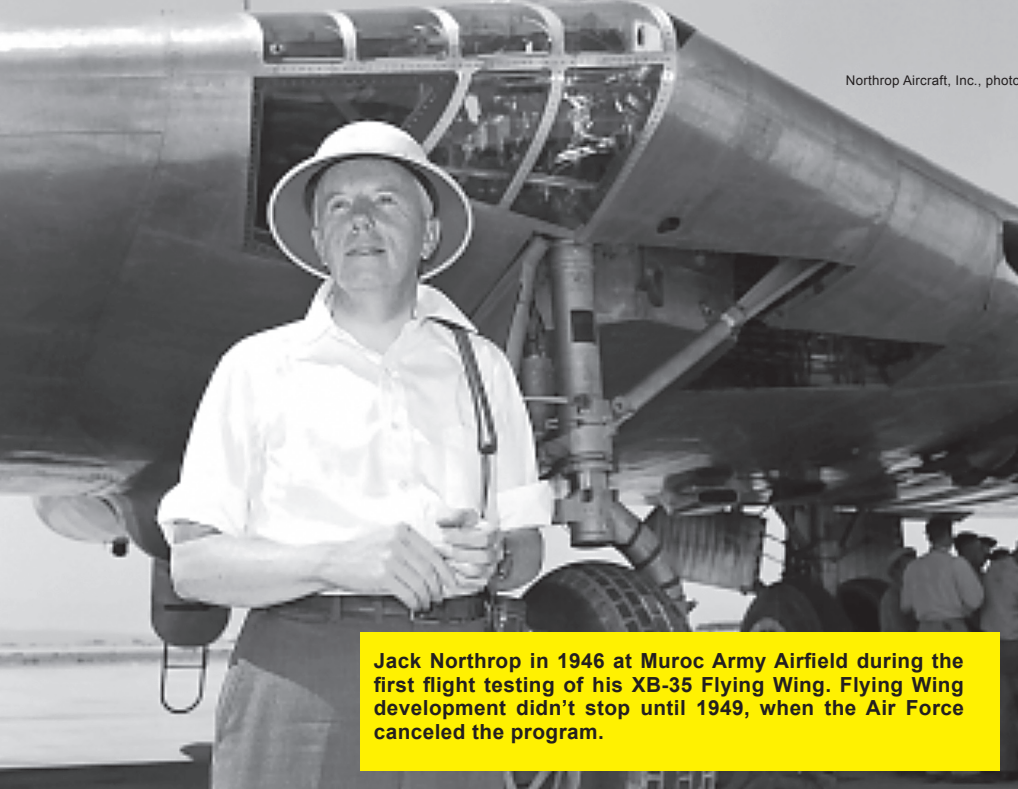
#### THE SPECTACULAR XB-35

Northrop’s design for the prototype bomber, designated the XB-35, was



**It wasn't killed quite as dead as they thought.**

By John T. Correll



Northrop Aircraft, Inc., photo

**Jack Northrop in 1946 at Muroc Army Airfield during the first flight testing of his XB-35 Flying Wing. Flying Wing development didn't stop until 1949, when the Air Force canceled the program.**

Further good fortune came Northrop's way in 1942 when the Air Corps canceled the contract for 402 Martin B-33 bombers and split the revised order evenly between the XB-35 and Consolidated's XB-36. Since Northrop had no space for an assembly line at its plant in Hawthorne, Calif., XB-35 production would be handled by Martin.

Northrop forecast delivery of the first XB-35 in November 1943, but the program was hounded by production problems and disappointing range and speed test results. In May 1944, with the anticipated requirement for wartime bombers diminishing, the Air Corps canceled the XB-35 production contract but kept the Northrop Flying Wing alive for test purposes.

The XB-35 finally made its first flight in June 1946, three years late and 400

elegant and stunningly impressive, a great graceful sweep of polished aluminum. All of the flight controls, "elevons" that functioned as both elevators and ailerons, and flaps that acted as rudders, were mounted on the trailing edges of the wings.

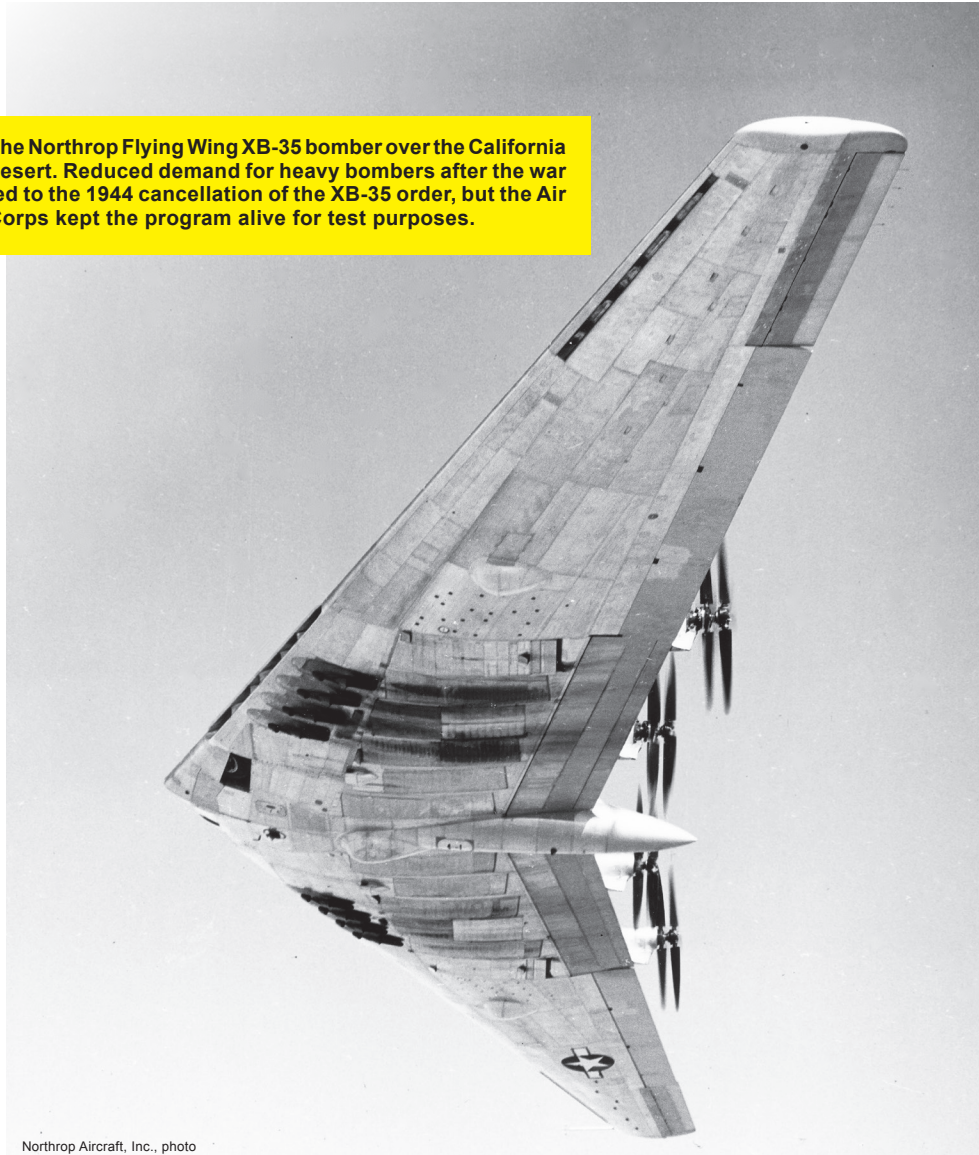
There were a few bumps and blisters on top—notably the plexiglass bubble above the pilot's position and a smaller one for the navigator to take sightings—but the crew nacelle, the fuel tanks, and bomb bays were inside the wing. It was thick enough, 85.5 inches at the root chord, to provide cramped cockpit space for a standard crew of nine.

Among the unusual features were contra-rotating propellers, two of them mounted, one behind the other, on each engine shaft and turning in opposite directions. (This was considerably more complicated than counter-rotating propellers, which also turned in opposite directions but with only one on each shaft.)

This radical propulsion system promised greater efficiency but it never worked as it should and was eventually dropped in favor of conventional single-rotation propellers.

In late 1941, the Air Corps ordered two XB-35s. The news reports were ecstatic. "Perhaps the day is not far distant when flying-wing types will dominate the entire field of military, commercial, and private flying," *The New York Times* gushed in November 1941.

**The Northrop Flying Wing XB-35 bomber over the California desert. Reduced demand for heavy bombers after the war led to the 1944 cancellation of the XB-35 order, but the Air Corps kept the program alive for test purposes.**



Northrop Aircraft, Inc., photo



The YB-49 rolls out from its hangar at Northrop Aircraft, Inc., in Hawthorne, Calif., on Sept. 29, 1947. The rollout is being filmed by two cameras mounted on the roofs of cars.

Northrop Aviation, Inc., photo

percent over budget. By then, it had another problem.

“The atomic bomb had dramatically changed the nature of strategic warfare,” said Air Force historian Richard P. Hallion. “It would be increasingly important in the years ahead to develop bombardment aircraft capable of lugging the then-ponderous 10,000-pound atomic bomb. The XB-36 could do so; Northrop’s XB-35 and later the YB-49 could not.”

Cheerleaders were not substantially deterred. *The New York Times* proclaimed in June 1946 that the XB-35 could “carry more bombs farther and faster than any plane in history” and could “outspeed most of today’s fighter planes.”

Not to be outdone in enthusiasm, *Air Force Magazine* predicted in July 1946, “Compared to a conventional airplane of equal power, weight, and fuel load, the Flying Wing will 1) carry one-fourth more useful load, 2) travel one-fourth farther with an identical fuel load, 3) travel approximately 20 percent faster with the same thrust or applied horsepower.”

## JETS FOR THE YB-49

The XB-35 was not as futuristic as it looked. The design had been advanced for 1941 but, as Hallion said, it was “caught at a transition point in aeronautics: between the era of the propeller and the jet.”

Northrop and the Air Force attempted to bridge the transition by replacing the propellers on several of the XB-35s with eight jet engines in a variant designated as the YB-49. It was easily the most handsome of the Northrop Flying Wings.

Four fixed vertical fins were mounted on the trailing edges for stability and

four shallow “fences” or air dams ran from front to back to help channel the airflow. Northrop disliked the intruding fins but they added, in their way, to the sleek appearance of the aircraft.

The YB-49 first flew in October 1947. It achieved some gain in top speed, but the extra weight of the jet engines reduced the range and the bomb load significantly. It also had “mission-limiting stability problems that rendered it unsuitable for a bombing platform,” Hallion said.

By then—and although its supporters were not ready to concede the point—the Flying Wing had been effectively eliminated as a bomber. The B-36, which performed much better, entered Air Force operational service in 1948 and would continue as the first-line bomber until supplanted by the B-52 in the 1950s.

The prospects for the Flying Wing were restructured in September 1948 with an Air Force contract for 30 YRB-49s in a reconnaissance variant called the RB-49A. Even in that the future was not secure, with the option of a reconnaissance version of the faster and more capable B-52, then moving along in development, looming in the 1950s.

The YB-49 was inspirational in flight but it “could not fulfill the promise given to it by jet propulsion,” Hallion said. “Its aerodynamic planform remained that of a solidly subsonic 350 mph propeller-driven airplane. Structurally it was at best only marginally suited for the 500 mph environment since it constituted basically a ‘lash-up’ of jet engines replacing the B-35’s piston ones.”

On June 5, 1948, a YB-49 broke up in flight over the Mojave Desert near Muroc Dry Lake in California, killing

all five members of the test crew. The cause of the mishap was disputed, but structural failure almost certainly figured into it.

## CANCELLATION

The final blow came from deep cuts ordered by President Harry S. Truman to the Fiscal 1950 defense budget. A board of senior Air Force officers in December 1948 proposed the cancellation of six aircraft programs, 240 airplanes altogether, from four different contractors.

Among these were the 30 reconnaissance YRB-49s. Air Materiel Command sent Northrop a telegram in January 1949 to stop work on the YRB-49 except for testing, but the heyday of the Flying Wing was not quite finished.

The YB-49 was already scheduled to take part in a big air show at Andrews Air Force Base on the outskirts of Washington, D.C., in February. The show, according to *The Washington Post*, grew from a plan for the House Armed Services Committee to see “virtually every plane in the fighting fleet.” That included what the newspaper described erroneously as “the flying wing jet bomber B-49.”

The YB-49, flown in from California, was seen at Andrews by Truman, four members of the Cabinet, and 102 members of Congress. *The Post* reported that “the Northrop B-49, a flying wing, drew the most attention. Apparently, most of the members of Congress did not know that the order for the odd-looking plane had been canceled.”

Truman liked it, too, and reportedly said, “This looks pretty damn good to me. I think we ought to buy some.” At his instruction, the YB-49 was flown down Pennsylvania Avenue and past the Capitol, but the President’s impressions were momentary and the budget cuts held.

The House Armed Services Committee held an inquiry that summer, ostensibly about malfeasance in procurement of the B-36 bomber. In actuality, it was an offshoot of the “Revolt of the Admirals,” seeking to block the B-36, which the Navy regarded as a threat

The front landing gear of an XB-35. Note the copilot's window above the strut, to the right of the centerline.



USAF photo

to aircraft carriers in the long-range power-projection role. The hearings were orchestrated by Rep. James Van Zandt (R-Pa.), who was a member of the Navy reserve.

Several aircraft industry executives were called to testify, including Northrop who said there had been no dishonest influence in award of the bomber contracts or the cancellation of other contracts.

Of the 15 Northrop Flying Wing platforms produced, several crashed and a number of others, some of them stripped “shells,” were destroyed as surplus. Two YB-49s survived the cancellation. One broke in two when a landing gear collapsed in a high speed taxi run test in 1950 and was destroyed.

The other was preserved for testing, flew 13 times, was put into storage, and finally scrapped in 1953. Jack Northrop retired in 1952 at the age of 57 and sold his holdings in the company.

From all appearances, the flying wing was dead, a footnote in history, although it popped up from time to time in popular culture. The 1953 movie “War of the Worlds” used Northrop YB-49 test footage to depict the dropping of an atomic bomb on Martian invaders, oblivious to the irony that the demise of the YB-49 was due in part to its inability to carry the atomic bomb.

“Raiders of the Lost Ark” in 1981 had a fight on the ramp around the fictitious “BV-38” flying wing. Indiana Jones backed his opponent into the spinning

propellers with suitable bloodshed. The BV-38 was supposedly based on a Horten test bed from Germany but it also borrowed features from several Northrop prototypes.

#### NORTHROP'S CHARGE

After a silence of 30 years, Northrop reemerged in public with an accusation that the Air Force had killed the Flying Wing in retribution for his refusal to merge his company with Consolidated Vultee—also known as Convair—which had been formed by the earlier merger of Consolidated with Vultee in 1943.

The charges were made in an interview with Los Angeles public television station KCET in 1979 but the program, “The Flying Wing—What Happened to It?”, was not broadcast until December 1980, by which time Northrop had suffered a series of strokes that left him unable to speak.

According to Northrop, he was summoned in July 1948 to a meeting with Secretary of the Air Force Stuart Symington, who demanded that Northrop agree to the merger with Consolidated Vultee, maker of the B-36 bomber.

He quoted Symington as saying, “You’ll be goddamned sorry if you don’t.”

“I got a telephone call a few days later from Mr. Symington,” Northrop said. “He said, ‘I am canceling all your Flying Wing aircraft.’”

Northrop said he had perjured himself in his congressional testimony in 1949

in which he had joined in absolving the Air Force of impropriety in the bomber contracts. He did so, he said, out of fear that his company would otherwise be blackballed.

KCET reporter Clete Roberts then enlarged on the story, reporting that the YB-49 won a “flyoff” competition against the B-36 and “had been selected by the United States Air Force as the next generation bomber, the replacement for the B-29.”

*The Los Angeles Times*, picking up on the story, said that in 1948, the Air Force had “awarded Northrop a contract to build 35 bombers with the possibility of ultimately producing 200 to 300 planes.”

Variations on these accusations have persisted ever since. The best job of sorting out the facts has been by Francis J. “Bud” Baker, currently on the faculty of Wright State University, a former Air Force officer and manager in the B-2 program who investigated the Flying Wing cancellation for his Ph.D. thesis in 1984.

To begin with, it is fairly clear that the July 1948 meeting was requested by Northrop, not by Symington, to obtain clarification about several aspects of the program. There had never been a “flyoff,” with the B-36, the YB-49 was not selected as “the next generation bomber,” and there was no contract for 35 bombers with more to come. Northrop’s contract was for 30 YRB-49 reconnaissance aircraft.

Symington denied that he had made any threats. “There was a tremendous



President Harry Truman (left, with binoculars), military officers, and members of the press inspect a B-49 in 1949 during an air show at Andrews AFB, Md. Despite Truman's enthusiasm for the Flying Wing, the program was canceled.

overcapacity in the industry following World War II," he told Baker. "It was clear that many of the smaller companies could not survive. Northrop came to see me and said that unless he received his flying wing orders, his company would be in serious trouble. I knew at the time that the Air Force favored the B-36, built by Convair. I may very well have suggested that he merge his company with Convair, who we knew was going to get business."

Symington also pointed out that summary cancellation of the YB-49 was not within his authority. That decision came as a result of the senior officer board review five months later, and Northrop was not singled out for the cut. The biggest losses in the reduction were sustained by North American, not Northrop.

## RETURN OF THE FLYING WING

Northrop died in 1981, but he lived long enough to see the reincarnation of his flying wing concept in a dramatic new application. Competition was underway for the Air Force's Advanced Technology Bomber, and by then, two big things had changed.

It was known in the 1940s that the all-wing configuration had a low radar cross section—registering a minimal

image on the radar screen—but that had not been of much interest at the time. By the 1980s, the ability to evade radar was regarded as vitally important.

The technology of the 1940s could not resolve the Flying Wing's problem of instability in flight. The solution was developed by NASA and the Air Force Flight Dynamics Laboratory in the 1960s and 1970s with "digital fly-by-wire," which translated the pilot's actions into electronic signals and used computers to manipulate the flight controls.

Fly-by-wire, operating instantly and constantly, compensated for instability. It was sometimes said that given the right software and enough engine, it would be possible to fly a John Deere tractor.

The two companies contending in the Advanced Technology Bomber program were those with the most experience with radar low observables, Lockheed because of its development of the F-117 attack aircraft, and Northrop for its history with the Flying Wing.

"Northrop's design team and mine worked in total ignorance of what the other side was doing," said Ben Rich of the Lockheed Skunk Works. "But

following the basic laws of physics, they came up with strikingly similar designs—a flying wing shape," concluding "that this unusual boomerang shape afforded the lowest radar return head-on and provided the favorable lift-over-drag ratio necessary for fuel efficiency in long-range flight."

Just before Northrop's death, he was given special permission by the Air Force to enter the Northrop development facilities and see the ATB design, which eventually became the phenomenal B-2 stealth bomber. It had a wingspan of 172 feet, just like the YB-49.

Northrop's original Flying Wing was "30 years ahead of its time," said E. T. Wooldridge when he was chairman of the Aeronautics Department at the National Air and Space Museum. Retired Brig. Gen. Robert L. Cardenas, who was the principal test pilot for the YB-49 in the 1940s, added that the airplane "had to wait for technology to catch up." ✪

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