A dedicated team returns Jack Northrop's dream to the skies

The Wing will Fly

BY LANE E. WALLACE

Former Northrop engineer Bion Provost had never even heard of The Air Museum "Planes of Fame" at the Chino, California, airport before the summer of 1980. But after hearing it mentioned on a television show one night, he decided to go take a look. While at the museum, Provost mentioned his Northrop experience to Howard Wilson, who ran the museum's front office. Wilson smiled and said, "I have something to show you." ■ Wilson took Provost to the museum's "backyard," an area filled with old engines, parts, and derelict aircraft waiting to be restored. He walked over to a corner and pulled

PHOTOGRAPHY BY MIKE FIZER

back a tarpaulin. To many, the decaying wood structure beneath the tarp would have been unrecognizable. But Provost would have known the aircraft anywhere. It was a flying wing—the legacy and dream of Jack Northrop, and a piece of history Northrop employees thought had been destroyed forever.

Dumbfounded, Provost stared at the tattered aircraft, and then his enthusiasm began to soar. The museum had a tradition of restoring aircraft to flying status. Maybe this one could be brought back to life, as well. Provost had worked on all the Northrop flying wing projects, and he knew of both their historical significance and the controversial saga of their rise and fall. To have one of the lost aircraft fly again would not only preserve an important piece of history; it might also help to undo what many felt was a great wrong inflicted on the Northrop employees at the end of the flying wing program.

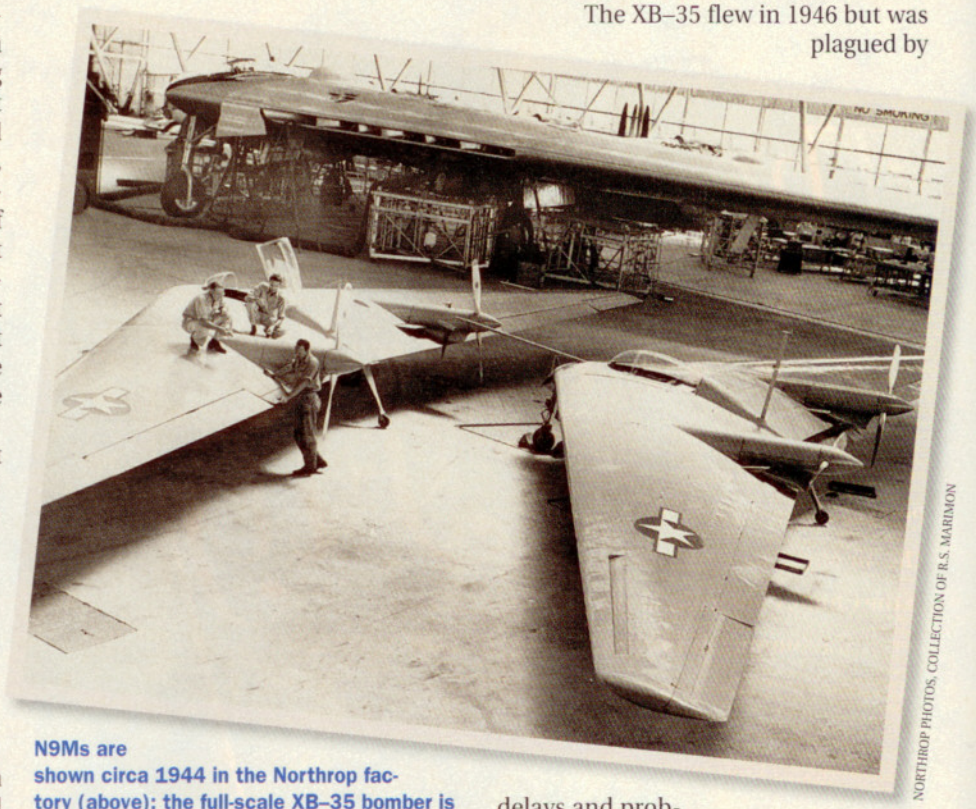
Jack Northrop, founder and president of Northrop Aircraft, began working on a flying wing design in the late 1920s. In 1940, the Northrop company finally built and flight tested a proof-of-concept wing with its own funds. That aircraft, designated the N–1M, now sits in the Smithsonian Air & Space Museum's Garber restoration facility next door to the Silver Hill Fire Department in Suitland, Maryland.

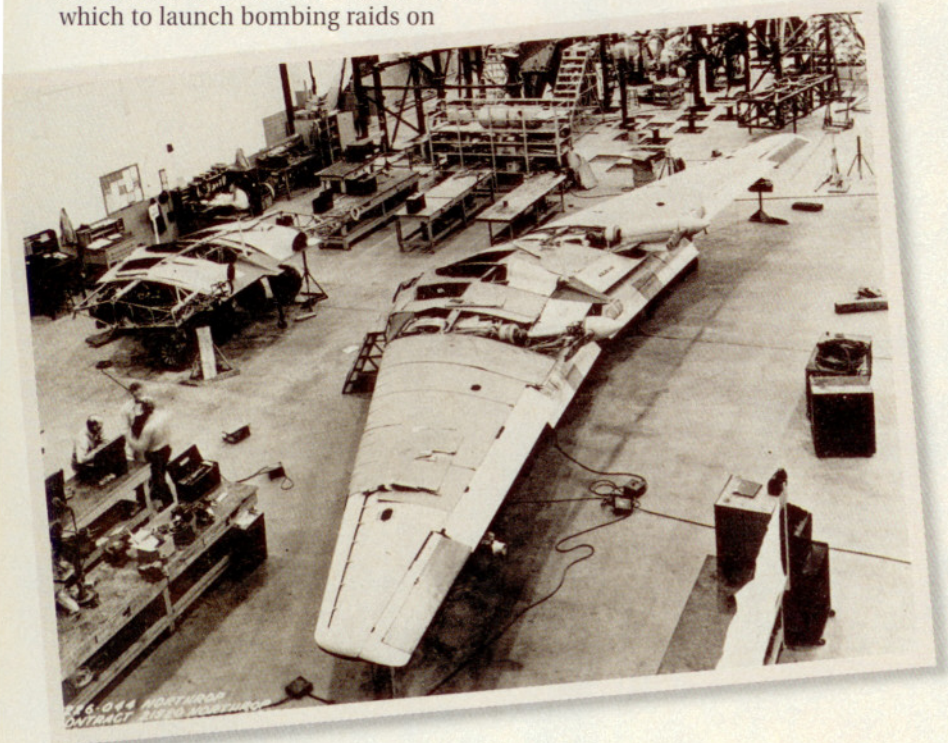
At the same time, the Battle of Britain was raging and military leaders realized that if England were lost, the United States would have no air bases from which to launch bombing raids on German territory. So they asked U.S. aircraft manufacturers to submit bids for a long-range bomber capable of carrying 10,000 pounds of bombs 10,000 miles, unrefueled.

Based on its N–1M results, Northrop proposed a large flying wing design and was awarded the contract for what became known as the XB–35. Because the four-engine bomber involved such large jumps forward in many design areas, the contract also included the building of four one-third scale models to develop and flight test different critical technologies. The last of the four models, designated the N9M-B, incorporated the final design characteristics for the full-scale XB–35.

The XB–35 flew in 1946 but was plagued by delays and problems with its contrarotating propellers. Consequently, two of the prototypes were outfitted with eight jet engines and redesignated the YB–49. The jets solved a lot of the wing's performance problems, although they reduced its range and put it in more direct competition with the massive Convair B–36 bomber. Ultimately, the Air Force awarded Northrop a contract for 300 B–49s, although 270 of those were to be built under license by Convair.

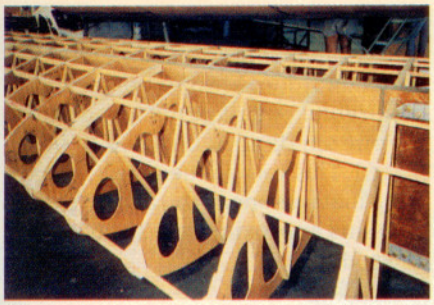
Exactly what happened next is the subject of much controversy. The military said that the YB–49 was not stable enough to be a good bombing platform and, despite its 500-mph speed, was not fast enough to compete in the dawning supersonic age. According to Northrop, the issues were more political and involved Jack Northrop's refusal to comply with Air Force pressure to become a subcontractor to or merge with the larger Convair company. There were also rumors of possible sabotage with the B–49 prototypes, one of which crashed and killed Air Force Capt. Glen





N9Ms are shown circa 1944 in the Northrop factory (above); the full-scale XB–35 bomber is in the background. That's The Air Museum's N9M-B being built in April 1944 (below).

NORTHROP PHOTOS, COLLECTION OF R.S. MARIMON



Edwards, for whom Edwards Air Force Base is named.

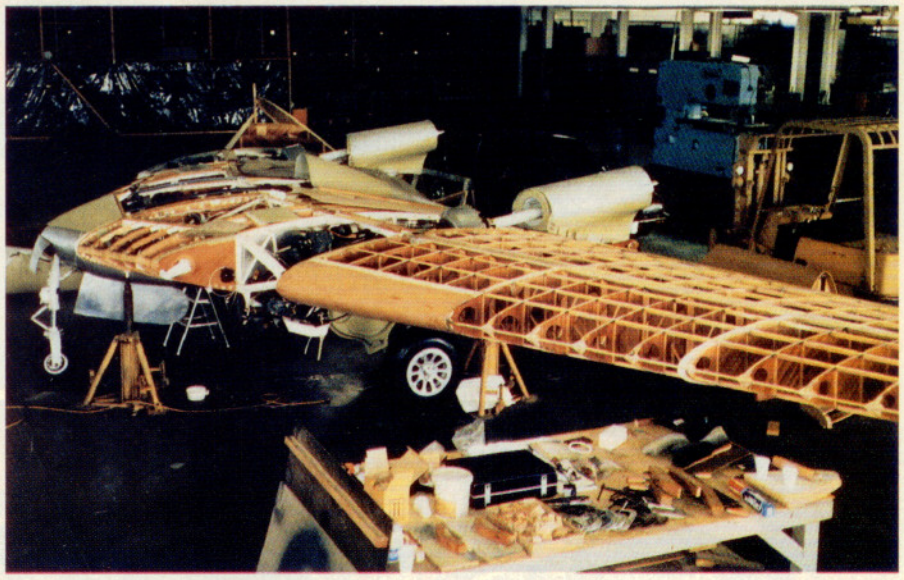
In any event, the Air Force abruptly canceled the program in November 1949. The Northrop employees, who believed in the wing concept as much as did Jack Northrop himself, offered to complete the aircraft in the factory on their own time. But it was not to be. In an unusual step that seemed almost punitive in nature, the Air Force ordered the Northrop employees to roll all the flying wings—finished or not—out onto the company ramp and cut them up for scrap metal. The manuals, drawings, and other design material for the aircraft were all destroyed, as well. It was a demoralizing blow to the entire company, and it devastated Jack Northrop.

The creators of the flying wings had been forced to destroy every single one of their creations...every one, that is, except the final scale model N9M-B, which escaped demolition because it apparently was being used as a reconnaissance photo target in the desert ranges around Edwards Air Force Base. And it was that sole surviving N9M-B that Provost saw under the tarp that day in Chino.

In the early 1950s Ed Maloney, founder of the air museum, had bought the derelict N9M-B from the Air Force to keep it from being scrapped, and it had sat outside in the museum yard ever since. By the time Provost saw it nearly 30 years later, the aircraft was in extremely dilapidated condition, but he was undaunted. He became a museum volunteer and started lobbying to rebuild the airplane.

The museum directors asked volunteer Ron Hackworth to determine whether it was even possible to restore the decaying airplane. Hackworth was a Douglas Aircraft employee who had a lot of experience with wooden aircraft, having restored his own Fairchild 24 and an early M–2 mail plane for Douglas. Hackworth recalled later that "I told them I thought it was possible, but in retrospect, I was wrong."

Among the flying wing's rebuilders in this 1992 photo are (kneeling, from left) Doug Bradley, Greg Shackel, Larry Paul, Hans Rupf, Dick Horst, Bob Marimon, (standing) Dave Murray, Don Miller, Don Schmidt, John Benjamin, Ron Hackworth, Daryl Bond, Ken Lehmer, Keith Parker, Gail Parker, and Bion Provost. Marimon photographed the restoration (above left and below).



To many, the decaying wood structure under the tarp would have been unrecognizable. Provost saw the flying wing.

Indeed, had the initial volunteers known the number and scope of the obstacles they would encounter over the next 13 years, they might never have begun. Difficulties ranged from lack of funds and work space to a complete lack of documentation to show how the aircraft should be built. Balanced against this was simply the determination of a group of people who believed in the project enough to find a way somehow to make it happen. "The wing will fly!" became the rallying cry that drew more and more people into the project and kept the core group of volunteers going. Achieving that dream, however, would take the support of more than 100 vendors, the efforts of almost 60 volunteers, and 13 long years.

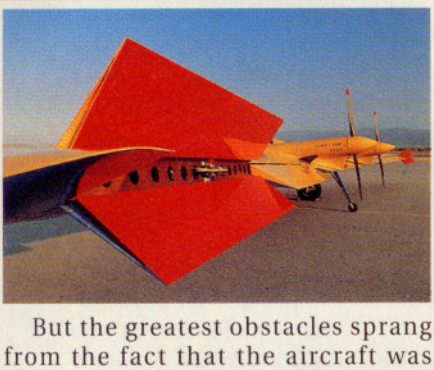
The first challenge was finding space to work on the project. The air museum didn't have a suitable work area, and renting a large enough hangar or warehouse in Southern California would have been prohibitively expensive. The crew found some hangar space at the Hawthorne, California, airport but had to move after only a few months, when the owner needed the area. The project was moved to a warehouse in Long Beach; but three years later, the city

decided to tear down the building.

The volunteers searched for a new home with little success until one of them mentioned the group's difficulties to a manager at the Wiggins Connectors company. The museum volunteers had approached Wiggins to try to get some hardware for the project. But when the company heard of the group's work space crisis, it offered the volunteers free use of a large warehouse area, complete with machine shop and tools. Some of the company's machinists even started coming out on Saturdays to help the group with welding and machine work. The shop setup was completed by Daryl Bond, a museum volunteer and part owner of All-Coast Forest Products, Inc., who donated the use of all the woodworking tools that the crew needed.

Wiggins Connectors gave the N9M a home until the aircraft was moved to Chino Airport for final assembly in 1993. Of course, finding a place to work on the airplane was only the first of many obstacles that the volunteers had to overcome, and the difficulties involved in rebuilding the unique aircraft were even more challenging. For one thing, the airplane was in extremely poor condition. Most of the metal was repairable, but all of the wood except for one small air scoop had to be replaced. This was no mean feat, considering that just one of the aircraft's wings contains approximately 20,000 pieces of wood.

Elevons on each wing act as both ailerons and elevators (right); the outboard split flaps serve as rudders and, when deployed together, function as speed brakes (below right).



But the greatest obstacles sprang from the fact that the aircraft was a one-of-a-kind prototype. The 315-horsepower Franklin engines, for example, were manufactured exclusively for the N9M-B, and only 11 were ever built. Furthermore, the current Northrop company was unwilling to provide drawings or other support, apparently because the company was concerned about its potential liability with an aircraft the museum planned to fly once it was restored.

Even if Northrop had been willing to cooperate, the N9M-B had been considered only "tooling" for the XB–35, which meant that reliable engineering drawings for the airplane did not even exist. Since the airplane had been stored in three separate pieces for 30 years and was badly deteriorated, this posed a real problem. Undeterred, Provost recruited several other former Northrop employees who had worked on the original flying wings to help with the project. The volunteers also traced down numerous other workers and vendors who had been involved with the wings in the 1940s, including a couple of the original test pilots, who were able to provide useful information.

One of the most valuable "finds" was a former Northrop employee named Gerry Balzar. Ten years after the YB–49 program was canceled, Northrop had thrown out the archival photographs that documented the construction of both the original N9Ms and the larger bombers. Balzar had heard that the photographs had been put in the trash and literally chased down the garbage truck and dug the photos out of the back. As a result, Balzar was able to provide the museum volunteers with at least some record of what various components or sections of the aircraft were supposed to look like.

With the help of these leads, the growing restoration crew began the painstaking process of rebuilding the aircraft by reverse engineering. They would look at Balzar's photos and determine what a part was supposed to look like and do, compare that with what remained of the N9M, and then figure out how the part had to be built. To rebuild the wood structure of the wing, for example, volunteers carefully pieced together what sections they could find from the original ribs and, from that, extrapolated drawings of what each rib's completed shape must look like. Those drawings, in turn, were used to design tooling to build new ribs. It was an imperfect system, but it worked. "We just learned to make everything a little big so we could shape and shave it to size," says volunteer Bob Marimon.

Even after the wing ribs were finished, there still remained the question of how to arrange them so that the wing would have the proper degree of twist, or "washout." There were no official written records, but on some of the original ribs the volunteers found pencil lines that marked their location with regard to both the wing reference and wing chord lines. From those markings, the volunteers were able to plot the points for the remaining ribs and determine the proper washout for the wing.

The aircraft's hydraulic system posed another challenge. The N9M-B was the first aircraft to use a fully hydraulic control system with artificial feedback, which varied the responsiveness of the pilot's controls, depending on the aircraft's speed. It was a complex system, and there was zero documentation for it. Fortunately, Provost managed to recruit Warde Parker and Otto Wolff to help on the project. Parker was a former Northrop employee who had co-patented the original hydraulic system with Jack Northrop, and Wolff had worked

Tailless wonder

Making sense of an unconventional design

The Northrop N9M-B flying wing was a radical departure from the conventional aircraft designs of its time. With no tail, the airplane depends on surfaces along the trailing edge of the wing to control its pitch, yaw, and roll. Split flaps near the wing tips open above and below the wing, acting as both rudder and speed brakes. Deployed separately, they create drag on one side, which yaws the airplane around. Deployed together, they become speed brakes.

Pitch and roll are controlled by "elevons" that are located inboard of the rudder/speed brakes. They move up and down together in response to the pilot's pitch commands, or individually like conventional ailerons to roll the airplane left or right. For climbing or descending turns, the elevons move together to control the pitch change and then adjust individually to roll the airplane. Inboard of the elevons are flaps, which operate in a conventional manner. The gear is also conventional, with the exception of a small fourth wheel that is designed to keep the pusher propellers from striking the runway during landings and takeoffs.

From the pilot's perspective, the unconventional operation of the aircraft's control surfaces is almost transparent. The aircraft flies very much like any other airplane, according to project volunteer and pilot Ron Hackworth. It is not overly sensitive in pitch except on takeoff and landing, although it does "yaw around," especially at slower speeds. The N9M-B's cruise speed is about 165 mph, and it touches down at about 80 mph.

One peculiar aspect of the airplane is that because the cockpit is in the wing and the "ball" indicator is exactly on the center axis of the airplane, the ball does not move much, regardless of whether a turn is coordinated. In the 1940s, slip information was obtained from a special probe that extended above the airplane. In the museum's N9M-B, volunteers simply attached to the nose of the aircraft the same kind of "yaw string" used by glider pilots. The only nonstandard aspect of the cockpit controls is that the rudder pedals are uncoupled so that they can be used individually to control the rudders or together to deploy the speed brakes.

The flying wings were a design ahead of their time. In fact, the Northrop B–2, built and flown more than 40 years later, relies on the same basic control principles as the N9M-B. The only difference is that the system is controlled through a highly capable flight computer, instead of simply through a pilot's hands. ***—LEW***

on components of the system for a Northrop subcontractor.

Parker and Wolff carefully photographed and studied each piece of hydraulic tubing from the N9M as it was disassembled. Then, between the two men and the rest of Parker's family, who had joined in the effort, they managed to reconstruct the airplane's complex control system. Parker's daughter-in-law Gail jokes that the family became "Hydraulics-R-Us," but the Saturday work sessions became a kind of weekly family reunion for them. In the end, there were three generations of Parkers working on the wing.

The flying wing project also benefited from the unique skills of volunteer John Benjamin. One of the first people to sign up for the project, Benjamin had no experience in rebuilding aircraft. But he was a natural supply sergeant and gifted salesman. "John would cold-call companies to ask for help or supplies, and by the time he got off the phone, they'd be offering to have their own guys look at stuff to help us," remembers Gail Parker. Benjamin managed to get almost 80 percent of the aircraft's supplies donated, including approximately $25,000 in special paint and primer. Yet Benjamin insists that his job wasn't very hard. "I didn't have to sell anything," he says. "The airplane sold itself."

The N9M-B restoration was still a long and arduous process. The unique learn-as-you-go approach the volunteers had to take to rebuilding every component meant that a lot of things had to be done more than once. Finding materials, parts, and hardware was a never-ending struggle, and the crew was constantly uncovering new problems that had to be solved. "There were a lot of times when morale would get low or we'd get to a saturation point," acknowledges Gail Parker, "but then someone would come up with an idea, Keith's mom would bring in chocolate chip cookies, and we'd be back at it the next week."

As the N9M lifted into the air, a sense of elation swept through the volunteers who had made the feat possible. The wing had flown.

The crew also found that many times, just when they hit a barrier, some help would appear to get them going again. "At one point, we realized that we needed an aircraft electrician and we didn't have one," remembers Marimon. "And just about then a guy showed up on a motorcycle, said he worked as an aircraft electrician for Grumman, and asked if there was anything he could do to help."

Over the course of 13 years, a number of volunteers came and went. But there was a core of 12 to 15 who stuck with the project from beginning to end. What kept them going was both a determination to see the dream through and the friendships they formed

To provide the nose gear with room to retract into the aircraft's structure, the N9M's control yoke was mounted to the side of the cockpit. It was the first aircraft with fully hydraulic controls and artificial feedback.

with each other over the years. "We went through the ups and downs of everyone's family," Gail Parker explains; these included weddings, graduations, and even funerals. Hackworth met his wife, Mary Ann, through his work on the project, and Keith and Gail Parker's children grew up during the course of the restoration. Their daughter Robin, inspired by the many hours she had spent working on the wing, even went on to become a pilot.

Sadly, not all of the volunteers would live to see the dream realized. Both Warde Parker and Otto Wolff died before the airplane was completed. But Keith Parker says that by the time his dad died, he had developed a closer family at the air museum than the one into which he was born.

By the fall of 1993, the crew thought it could see the light at the end of the tunnel. The airplane was trucked to Chino for final assembly, and it seemed that the first flight would be only a few weeks away. But one more major obstacle lurked ahead. During the engine test runs, the crew discovered that the overhauled Franklin engines were leaking oil. After several frustrating attempts to correct the problem, the volunteers finally located someone who had run a Franklin overhaul shop in the 1940s and still had archival photos of the N9M-B's engines. The photos showed that the engine cylinders were all missing a critical gasket. Correcting that problem, however, was a long and arduous task. It required disassembling each cylinder, heating the components to 600 degrees, inserting the gasket, and then quickly reassembling the cylinder with a 6-foot-long wrench that the volunteers gerry-rigged for the job. But finally, in November 1994, the wing was ready to fly.

Among the many people gathered to witness the N9M-B's first flight were Jack Northrop, Jr., the son of Northrop Aircraft's founder, and Bruce Hinds, test pilot of the Northrop B–2 bomber that is a direct descendant of the company's original flying wing program. As the N9M lifted into the air, a sense of incredible elation swept through the cheering crowd of volunteers who had made the feat possible.

The wing had flown. But the family that had brought it back to life would face one more loss before the story was over. One of the primary woodworkers on the project was a volunteer named Dave Murray. He had been troubled for some time with a heart problem and Parkinson's disease, but he had kept his illness from the crew and continued working because he wanted so badly to see the project finished. In fact, his family believes that his desire to see the wing fly was a large part of what kept him going. Perhaps it was—because as Murray watched the wing lift off on its second flight, he suffered a massive heart attack and died as the airplane flew overhead.

It was a hard blow for the crew. But Murray's wife, Jessie, says she takes comfort from knowing that he was enjoying his passion up until the last and had a chance to leave something for his children and grandchildren. "I looked at his face as he saw the airplane take off that day," she says, "and it was like that of a little boy who was watching his very first model airplane fly for the first time."

It had started with a derelict old airplane behind a hangar. It ended with a living, breathing airplane and a family of people joined by 13 years of shared experience. It was a long road, but the dream of Bion Provost and the N9M–B crew had come true. Children had grown up, relationships had flourished, and members of the family had been lost along the way. But the dream had endured. The wing had flown. As for Dave Murray, his wife says that his private dream was to fly with the wing one day. Perhaps in the end he did.

Lane E. Wallace, AOPA 896621, *is an aviation writer and owns a 1946 Cessna 120.*