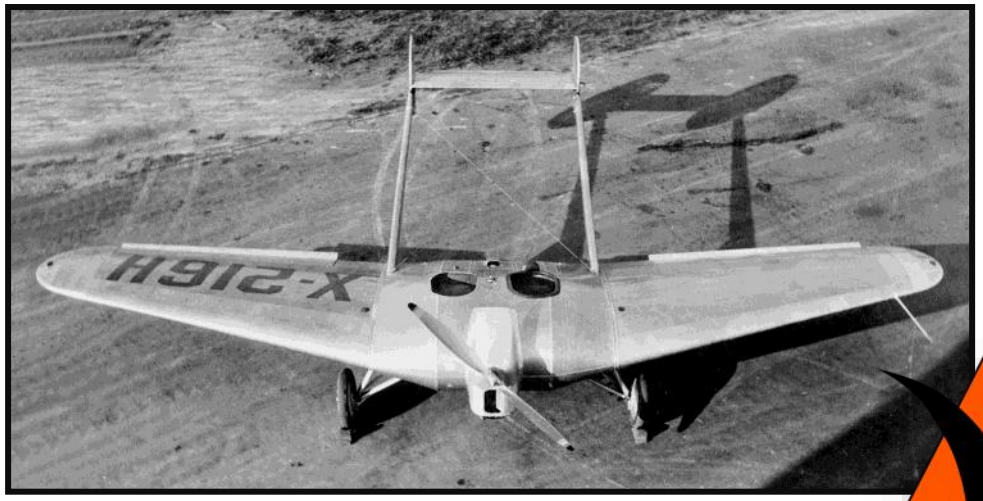
A Look Back...

NORTHROP FLYING WINGS-PART 1

AVION MODEL 1, N-1M & N-9M



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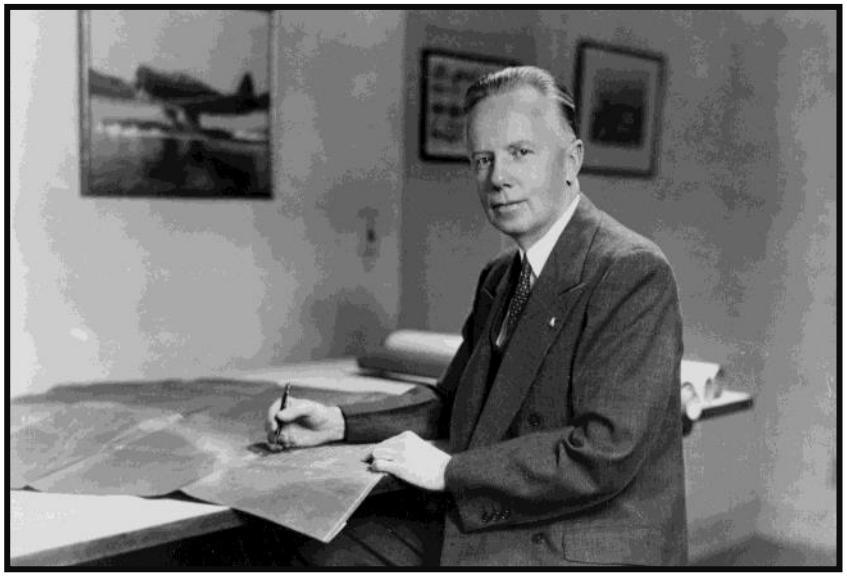
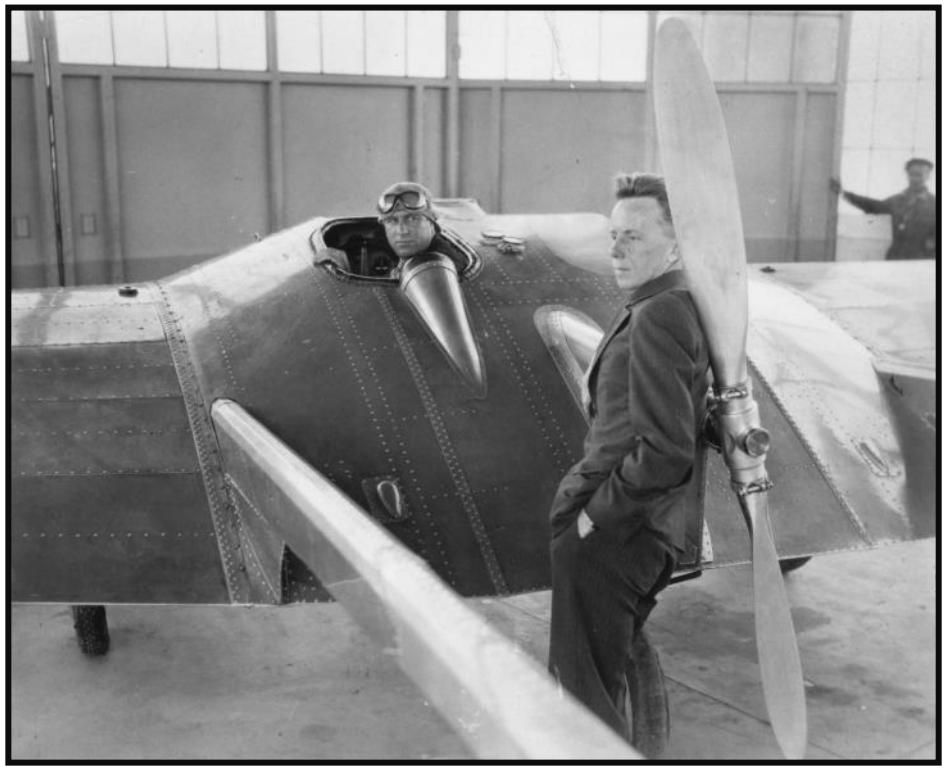
Northrop's latest aircraft, the B-21A Raider is the culmination of John K. Northrop's dream of all wing design whose evolution stretches back to 1929. This is the first in a series of articles that will take a look back to the early days of aviation to show the birth of John Northrop's dream.



The Avion (Northrop) Model 1, commonly known as the 1929 Flying Wing, was the first rudimentary attempt at an all-wing vehicle, though it retained a simple boom-mounted tail assembly for added stability. Breaking away from the standard protocol of using wood for the structural assembly, Northrop chose 24S Alclad aluminum for the Model-1. Powered by a 90 HP 4 cylinder, inline, inverted Cirrus engine center-mounted inside the fuselage in a pusher (rear mounted) arrangement, the Avion Model 1 made its first flight at Mines Field, California on July 30, 1929 when test pilot Eddie Bellande performed two short hops during high speed taxi runs. Shortly thereafter the aircraft was trucked to Muroc Dry Lake in California's Mojave Desert. The vast expanse of the dry lake gave the small test team plenty of room to test their new design.

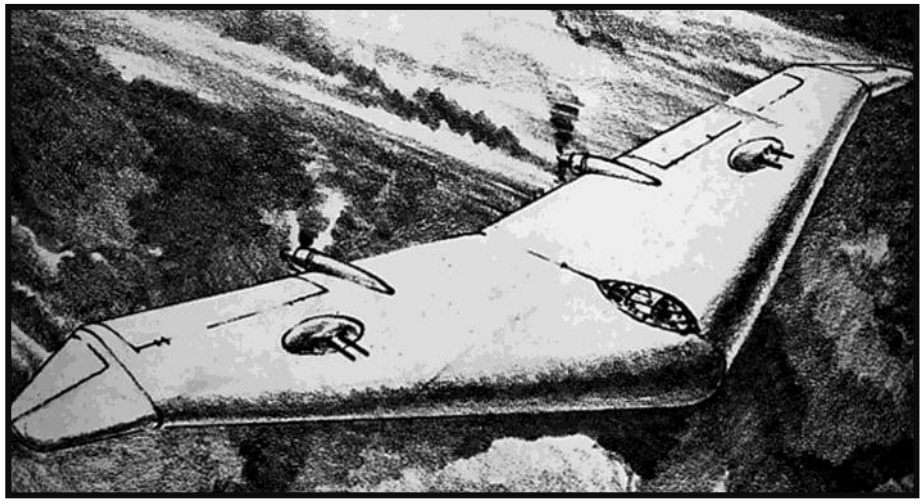


The first 'official' flight of the Model-1 came on September 26th at Muroc. Bellande performed two brief flights totaling 5 minutes on the 26th and three days later made its final Muroc flight during a 5 minute test hop around the lakebed before operations moved to United Air Terminal in Burbank where flight operations continued on November 18th.

Though the Model 1 only flew for just over a year, it underwent significant design changes to improve performance. The retractable landing gear replaced by fixed gear, tail dragger to tricycle gear arrangement, rudder extensions added for better directional stability and the pusher Cirrus engine swapped for a Menasco A-4 tractor (front mounted) arrangement. Northrop found the Model 1 to have remarkable maneuverability and performance with speeds 25% greater than contemporary designs of similar power and capacity.

The following year, the Great Depression took its toll on Jack Northrop and his new company an as a result, he notified the Civil Aeronautics Authority (the predecessor of today's FAA) that flight testing of the Model 1 would cease on September 22, 1930. Northrop dismantled the small craft and it would be another 10 years before he could pursue his dream of all-wing design.

In 1939, after years of working for others and attempting to restart his company, John Northrop finally acquired the funding and talent to open up the new Northrop Aircraft Inc.

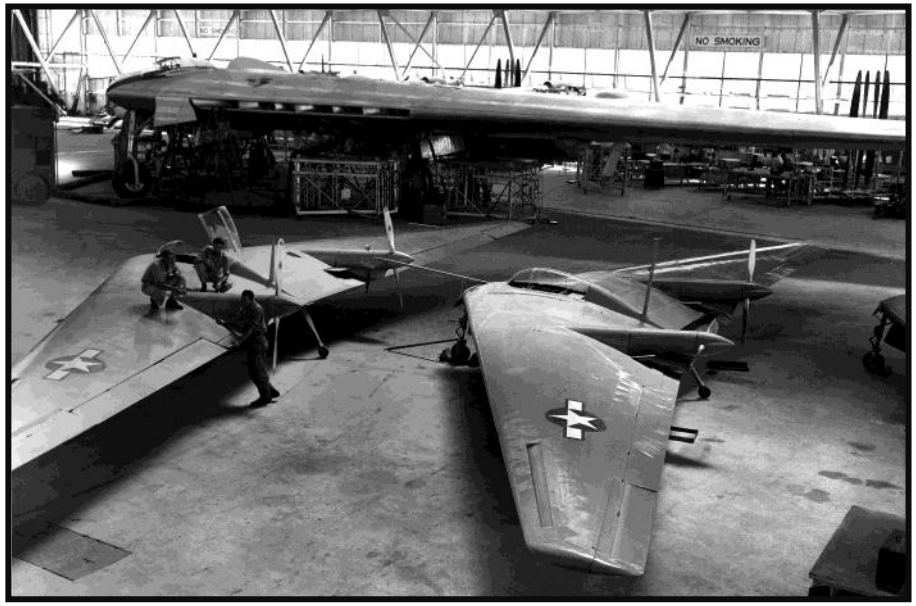


Their first project, the N-1, was a twin-engine all-wing medium bomber with drooped wingtips in place of conventional vertical stabilizers with a wingspan around 81 ft. Northrop completed various design studies but none seemed to interest the US Government enough to gain a contract. Northrop instead chose to make the N-1 a subscale proof-of-concept demonstrator referred to as a flying mockup.

Northrop designated the new vehicle as the N-1M (M for Mockup), an internally funded project that contained many unique features, built specifically for flight testing. The drooped wingtips could be manually adjusted on the ground to different angles in order to test stability of the airframe. The outer wing sections could also be manually adjusted on the ground to different degrees of sweep. Initially powered by two Lycoming 0-145, four-cylinder engines with 65 HP each driving two-bladed propellers, the small craft of 17 feet in length and 38 feet in span, was significantly underpowered and the engines were replaced with two Franklin 6AC264F2 six-cylinder, air-cooled engines producing 117 HP and driving three-bladed propellers.

In the summer of 1940, with construction and ground testing completed, Northrop trucked the N-1M to Baker Dry Lake in the Mojave Desert for initial flight testing. Once again, the first flight occurred during a high-speed taxi test on July 3rd when the airplane hit a bump in the lakebed and became airborne for several hundred feet. Pilot Vance Breeze found the N-1M to be fully controllable before settling back down on the lakebed. The underpowered Lycomings could get the 4,000 pound aircraft into the air, but couldn't get the vehicle above 5 feet in altitude. Even with modifications to the airframe, the craft could only reach 10 feet above the lakebed. With the new Franklin engines installed, the N-1M flight and altitude performance greatly improved.

Breeze made the initial flights on the N-1M before handing the craft over to Moye Stephens for continued testing. John Myers later joined Stephens on the flight test program and along with numerous single flights by guest pilots, the N-1M continued to fly into early 1943. It is estimated that the N-1M made approximately 100 flights before being retired. The restored N-1M now has a rightful place in the collection of the Smithsonian National Air & Space Museum.



Northrop engineers used the knowledge and experience from the N-1M project on their next all-wing design, the N-9.

In April 1941, the U.S. military sent out a bid request to industry for a bomber with a 10,000-pound payload capacity and 10,000-mile range. Northrop submitted several variants of their N-9 design with the N-9E being accepted for further study. Northrop received a contract for one full-sized mockup and one test aircraft on October 30, 1941. Allocated the project number of MX-140, the new bomber designation became XB-35. A second test aircraft was added to the contract the following month. (The XB-35 and YB-49 are covered in a future segment)

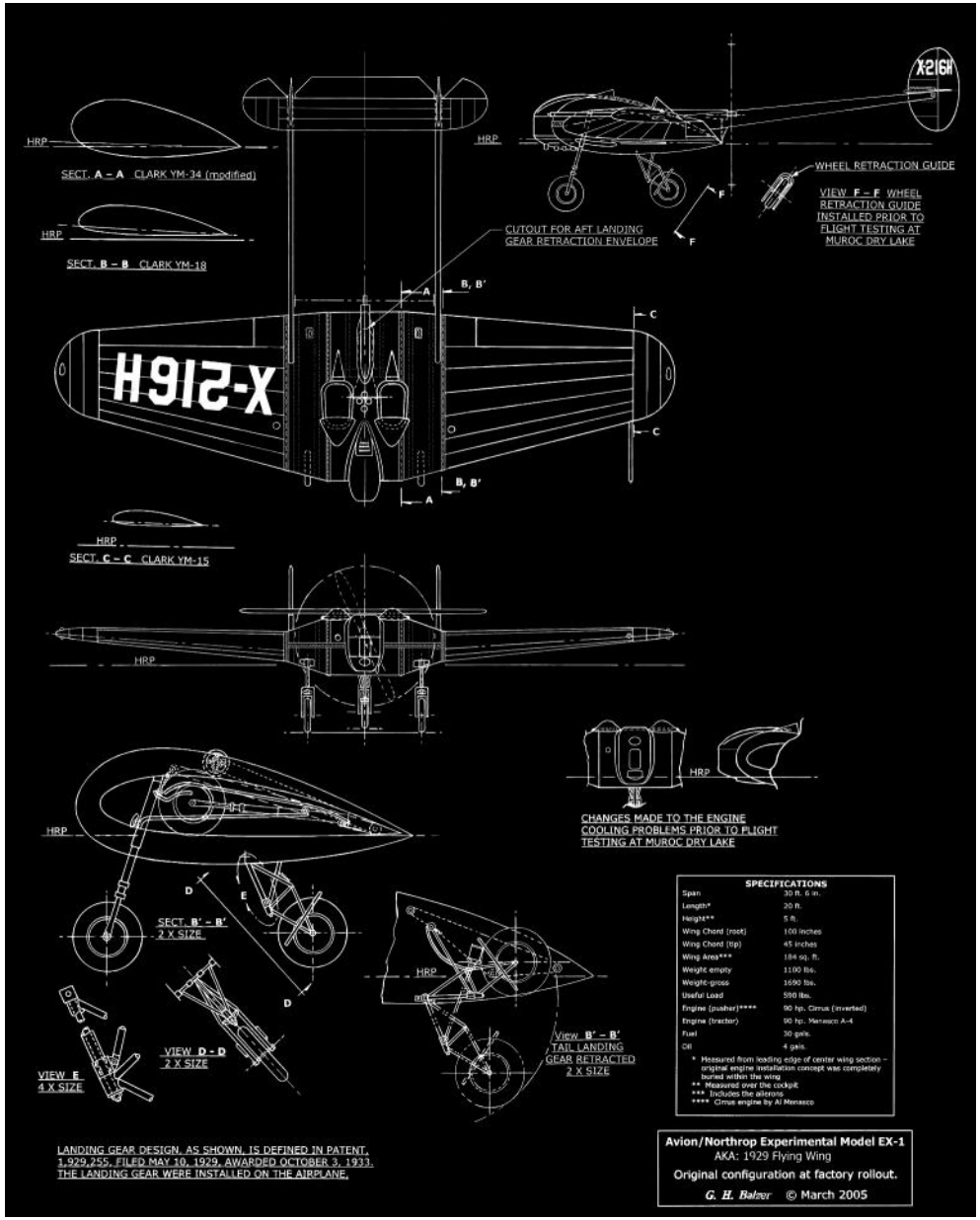
Northrop engineers quickly decided a one-third scale flying mockup could assist with finalizing details for the new bomber. With a 60-foot wingspan, the two Menasco C6S-4 air-cooled engines each producing 269 HP gave the N-9M a top speed of 257 mph at 7,000 feet with a service ceiling of 19,500 feet. Prior to construction of the first prototype, two additional N-9M's were added to the contract and given the designations of N-9M-1, N-9M-2 and N-9MA.

Flight testing of the new prototypes began when Northrop test pilot John Myers took the N-9M-1 up on its first flight on December 27, 1942. Engine reliability issues limited flight times on the new vehicle. Northrop pilot Max Constant replaced Myers early in the test program when Myers was needed for other test programs. Barely six months into the test program, the N-9M-1 crashed, taking the life of Constant when control reversal pinned the control column to his chest preventing bailout.

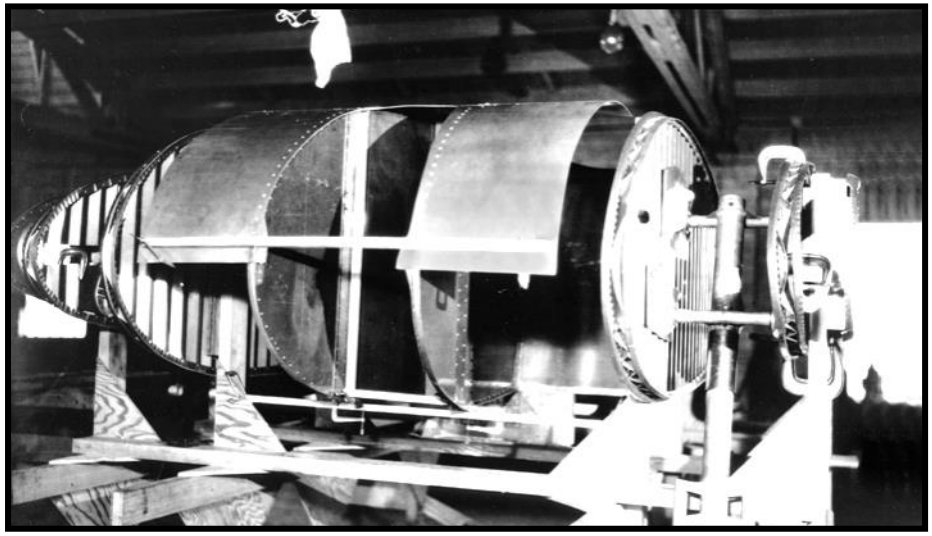
The test program called for a replacement airframe and Northrop built the N-9MB with uprated and more reliable Franklin XO-540-7 engines of 300 HP each. The new aircraft made its first flight on January 26, 1945. Clamshell, split flap drag rudders had been installed on the wingtips of N9M-1 and N9M-2, whereas the N-9MA and N-9MB utilized split drag rudders on the trailing edge and a pitch trimmer for improved performance.

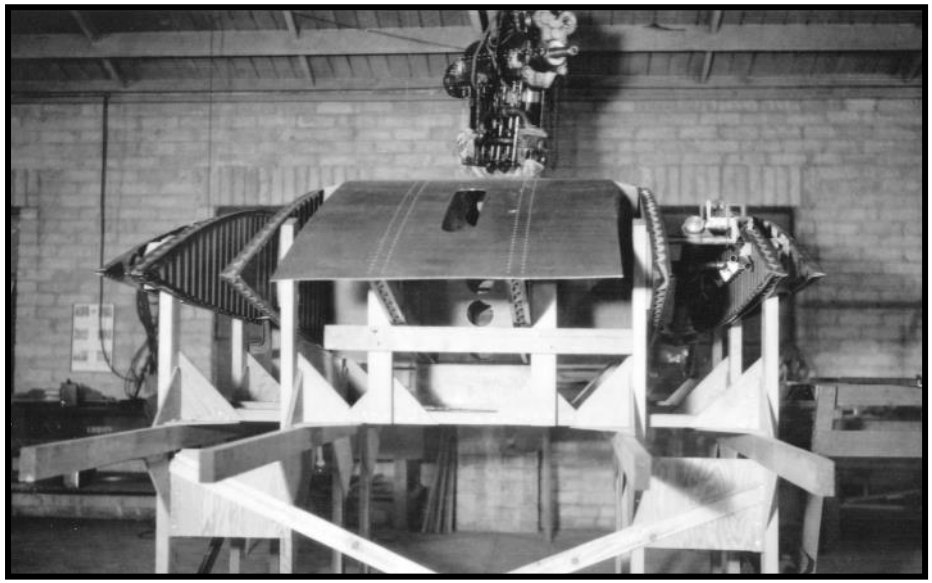
The three N-9M's tested various control systems planned for use on the upcoming XB-35, but were slowly retired after the Aircraft Projects Section at Wright Field determined the aircraft had satisfied all test requirements. Prior to being placed in storage, guest pilots were allowed the opportunity to fly the N-9M's. Lt. Van Shepard and Captain Glen Edwards were among those invited to check out in the flying wing prototype. Edwards stated "the airplane flew surprisingly well, was more stable and handled far better than most would expect". Records are slim on the N-9M at this point and it is believed the last flight of an N-9M took place in late 1946 or early 1947. All three airframes became the property of the Northrop Aeronautical Institute and little is known as to the actual disposition of the N-9M-2 and N-9MA. The N-9MB survived, and after an extensive restoration by volunteers at the Chino Air Museum, the little plane took to the skies once again on November 8, 1994. After many years of flying on the airshow circuit, the sole surviving N-9MB crashed during a test flight on April 22, 2019 in Norco, CA taking the life of pilot Dave Vopat. The N-9M program proved John Northrop's belief in an all-wing aircraft design leading to future aircraft with similar characteristics.

AVION MODEL 1



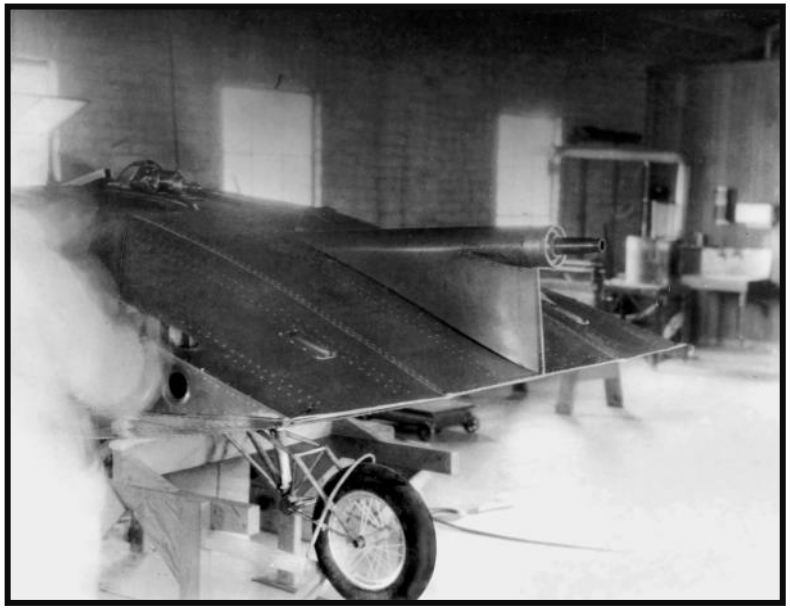
Detailed three view artwork showing the original layout of the Model 1 with pusher propeller and retractable landing gear.





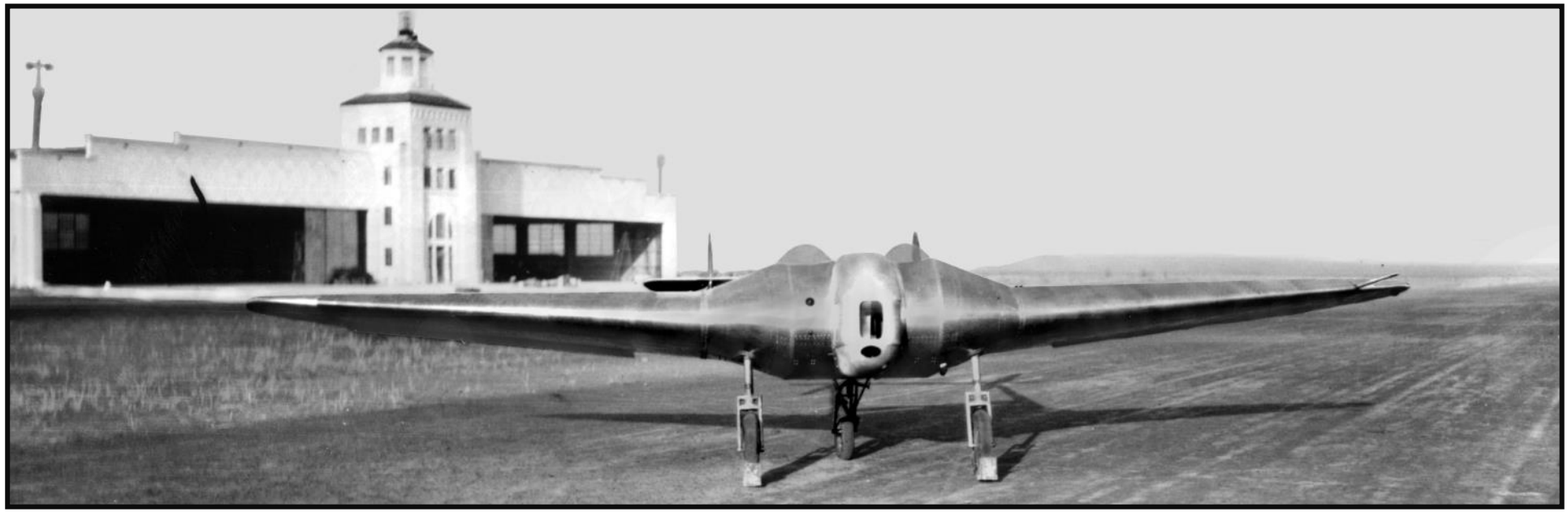
The partially completed Model 1 during assembly at Avion. The 90 HP 4-cylindar Cirrus engine was housed in the center of the structure while the retractable main landing gear occupied the outboard spaces. The lower photo shows the cutout required for the pusher propeller drive shaft.

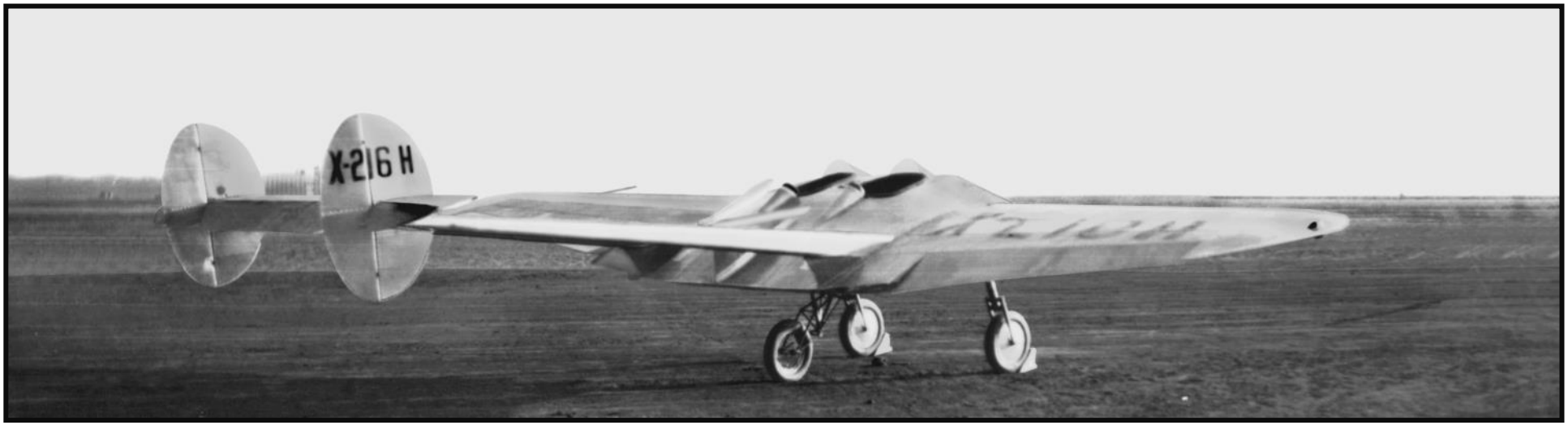
John Northrop put in many long hours during construction of the Model 1. He is shown here performing load tests on the horizontal stabilizer.



The swiveling, retractable aft landing gear and pusher propeller shaft installation show up well in this aft view of the Model 1's center fuselage.

The Model 1 being suspended from the ceiling for weight and balance calibrations.

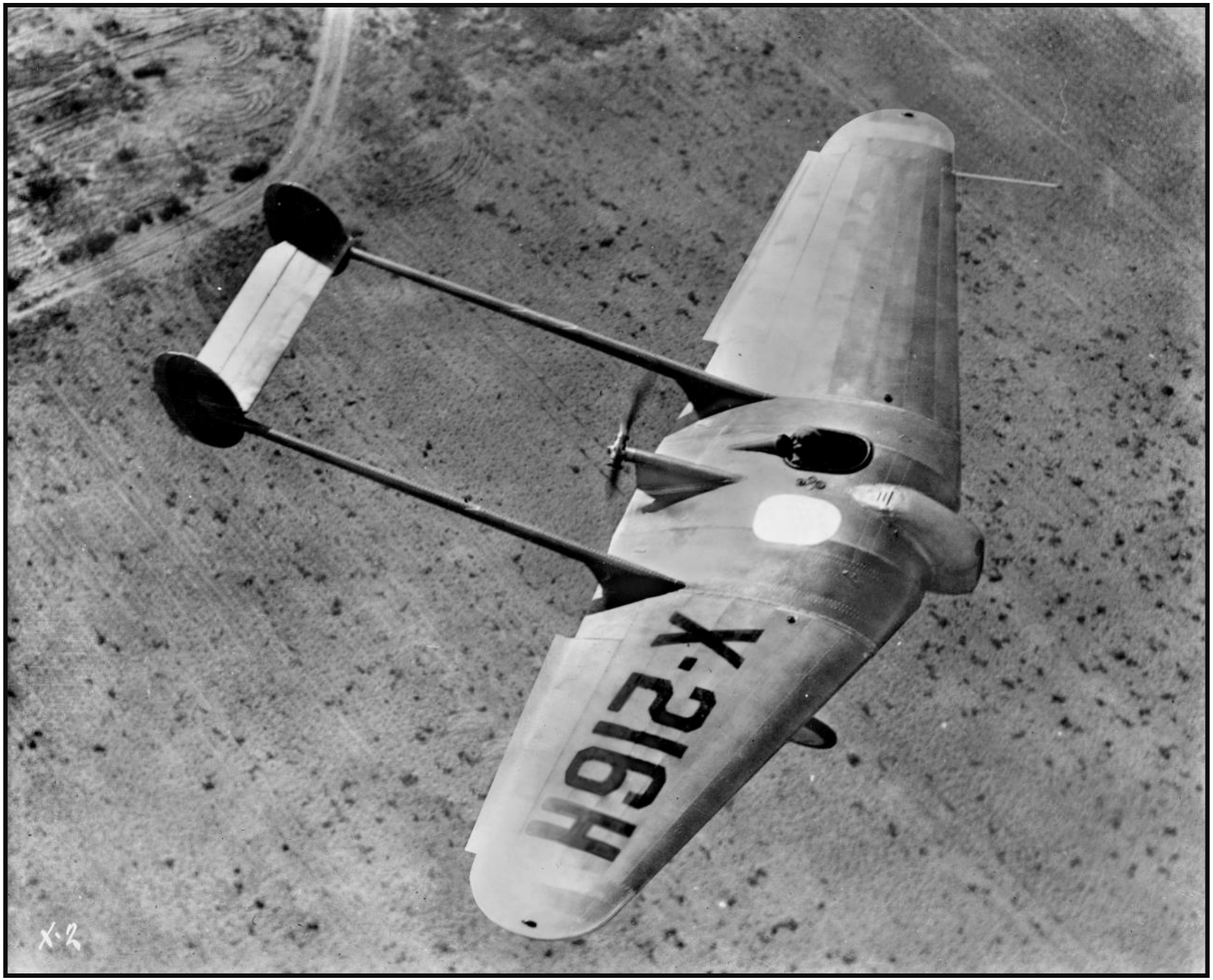




The Model 1 at Mines Field, Los Angeles, California shortly after final assembly at Avion Corporation. The two cockpits of the Model 1 show up well in these views. Both had windshields installed to protect the crew from the effects of wind, but later removed due to drag. Northrop pilot Edward 'Eddie' Bellande performed two short hops at Mines Field on July 30, 1929 prior to shipping the aircraft to Muroc Dry Lake for future flight testing.

Prior to shipping the Model 1 to California's high desert for flight testing, static testing, engine runs and taxi test's were performed at Mines Field.

The Model 1 shown during a test flight near the Muroc Dry Lake test location. The retractable landing gear has been replaced by fixed gear.



When flown with only one crew member, the right side cockpit had a cover installed to reduce drag. Note that the windscreens in front of the cockpits have been removed by this time.

Eddie Bellande (in cockpit) and Ken Jay pose with the Model 1 in the grass area at United Airport in Burbank, California.

With the Great Lakes biplane, used for photo and safety chase, in the background, the Model 1 taxi's out for a test flight from United Airport.

John Northrop (leaning on propeller) and Eddie Bellande (in cockpit) with the Avion Model 1 inside the new facility at United Airport in Burbank, California.

Modifications to the trailing edges of the wings and rudders for improved performance and handing show up well in this view of the Model 1 in flight over the empty Burbank countryside.

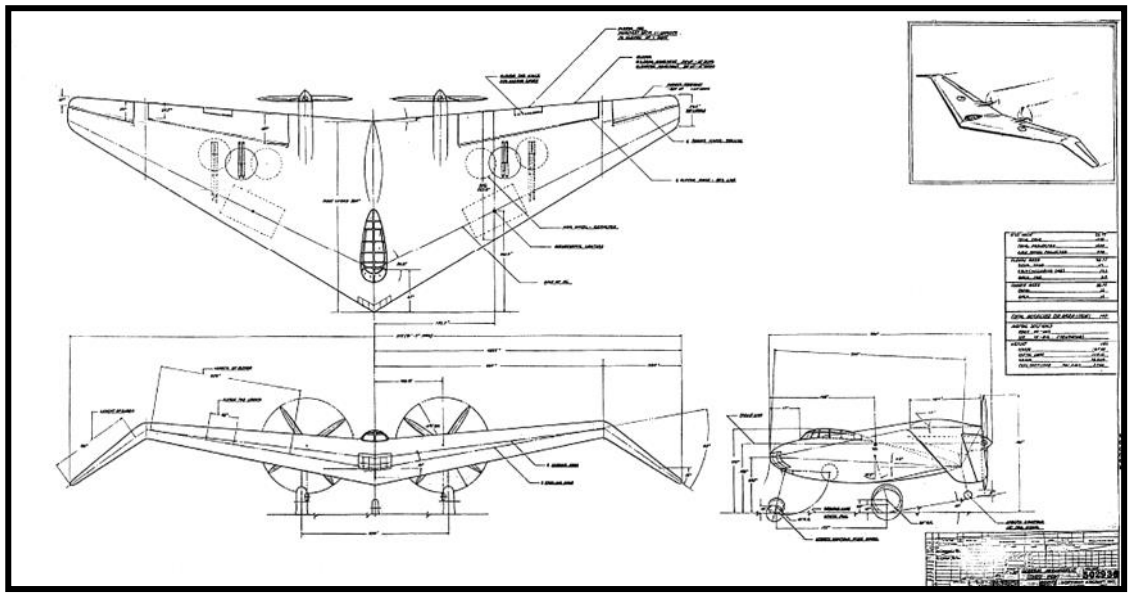
The second and last major modification to the Model 1 is in work — the change from pusher engine to a tractor Menasco A-4 engine installation. This change was anticipated, but not as expected. The change was motivated when the pusher drive shaft sheared shortly after takeoff in a southerly direction, over the Valhalla Memorial Park, ending in a straight-in forced landing in a plowed field.

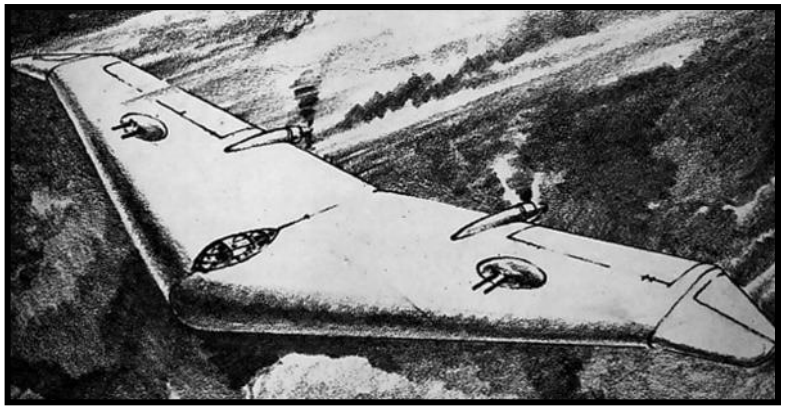
The Avion Model 1 comes in for a landing at United Airport.

The final configuration of the Model 1 showing the uncovered right cockpit. Control wheels installed in both cockpits allowed the aircraft to be flown from either side.

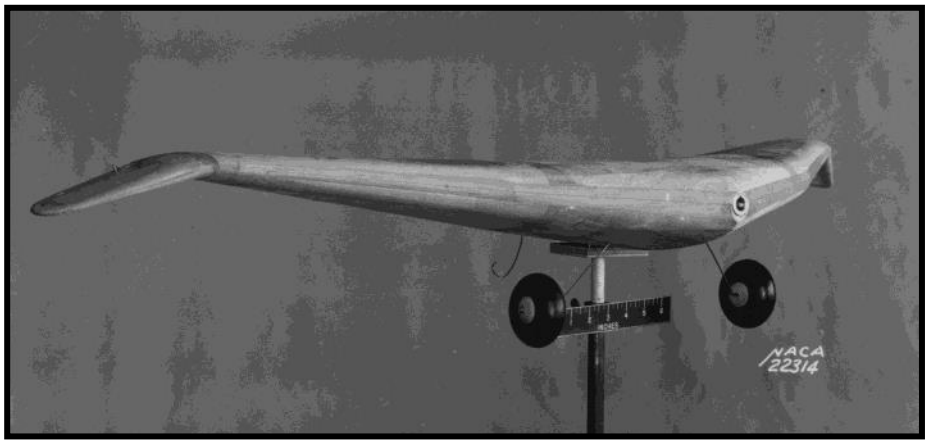
Parked next to the prototype 'Alpha' (R/N X-2W) is the Avion Model 1 on static display during the dedication ceremonies for United Airport in Burbank, California. Currently known as Bob Hope Airport (Hollywood Burbank Airport), the facility has changed names several times since its opening in 1930. The airport has been named United Airport (1930-1934), Union Air Terminal (1934-1940), Lockheed Air Terminal (1940-1967), Hollywood-Burbank Airport (1967-1978), Burbank-Glendale-Pasadena Airport (1978-2003) and Bob Hope Airport (2003-present). Though legally still known as Bob Hope Airport, in 2017 it was rebranded as the Hollywood Burbank Airport.

NORTHROP N-1M 'JEEP'

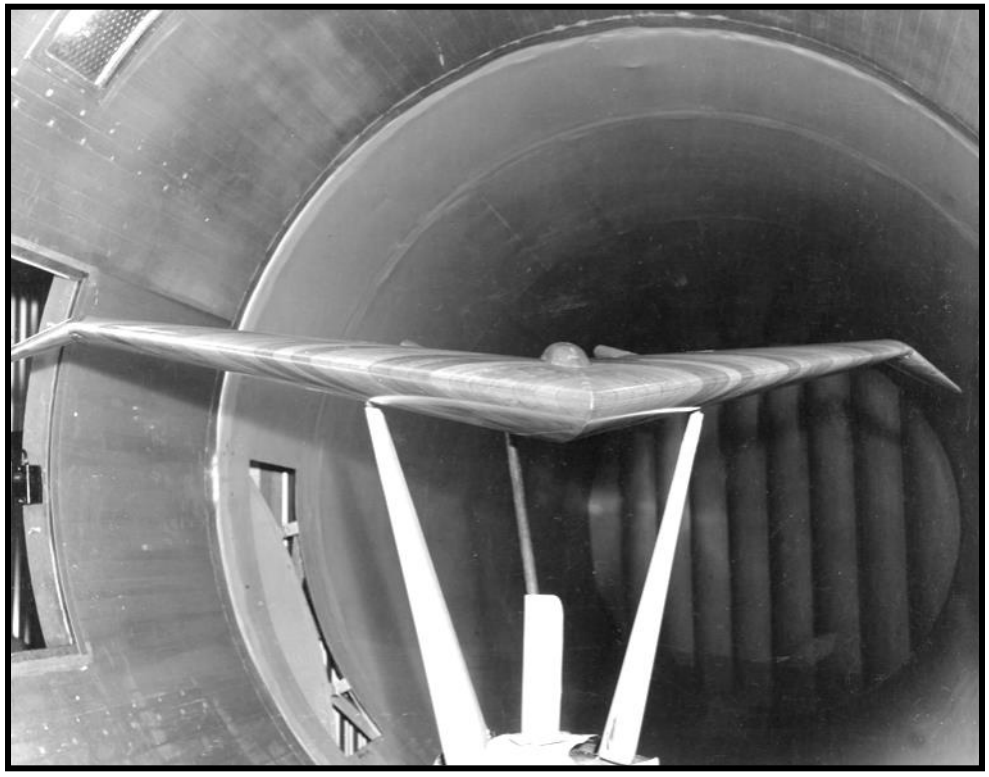


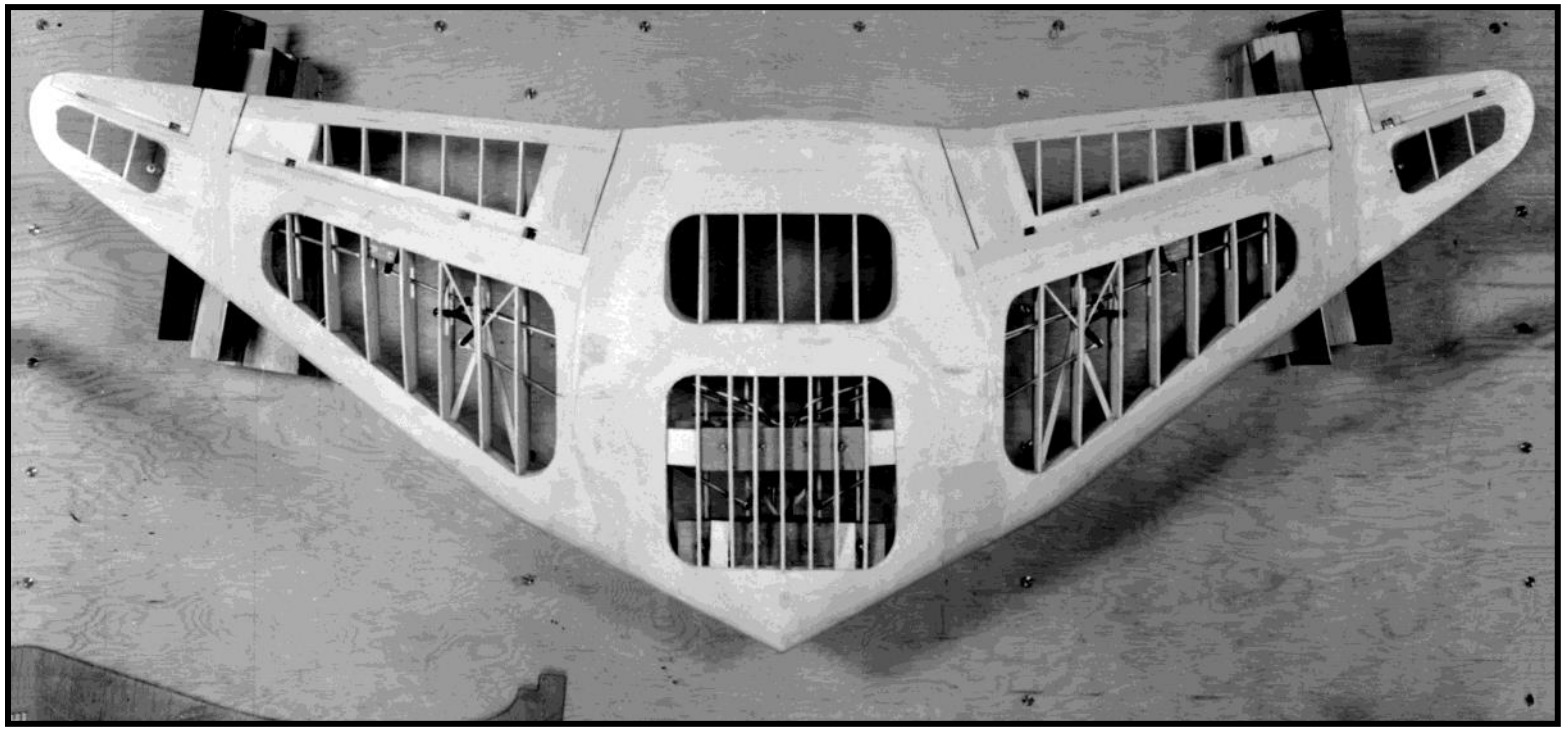


Three view and artist concept of a late variation of the Northrop N-1 medium bomber proposal shows the drooped wingtips and remotely operated gun turrets on the upper wing surface.

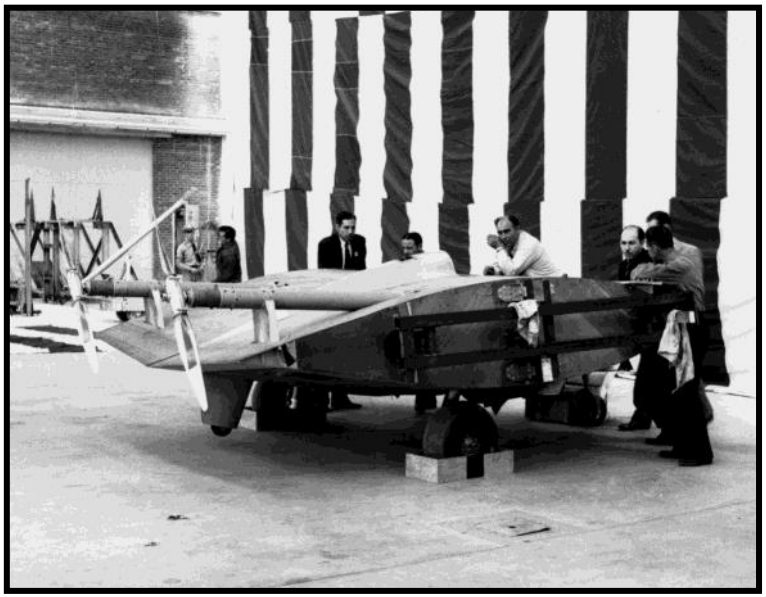


Wooden wind tunnel models of the N-1 design. The early design (above) shows large, fixed main wheels and tail skid, while the later design (right) is more refined with cockpit and engine shaft housings being added.

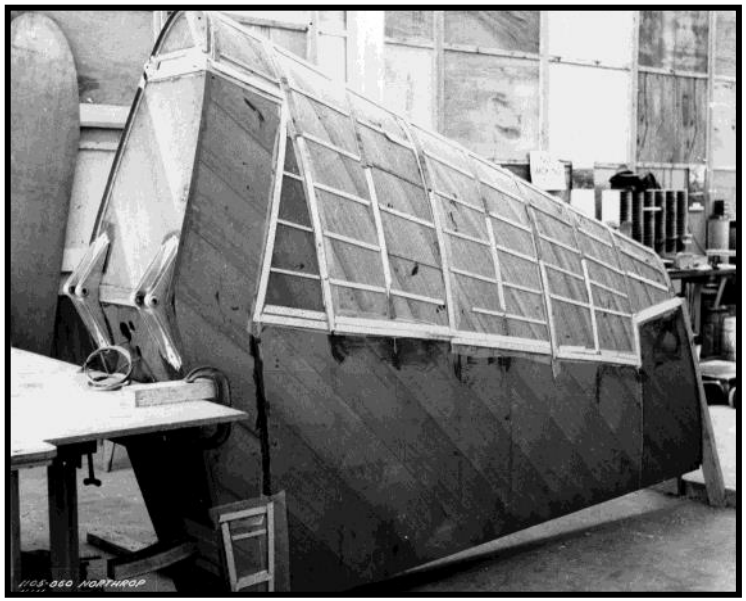


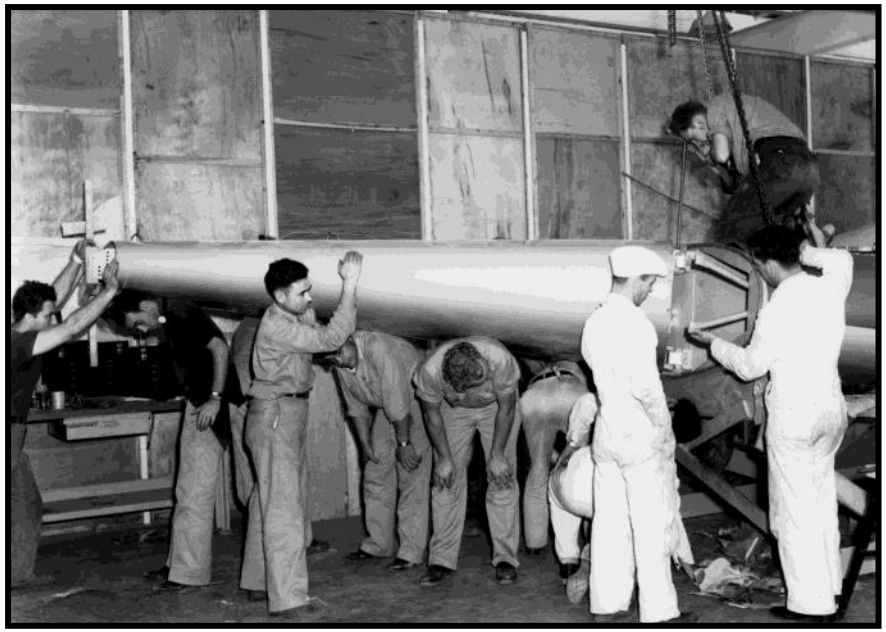


Northrop's talented craftsman built a variety of flying wing models including this one showing the basic internal construction of an N-1 design.



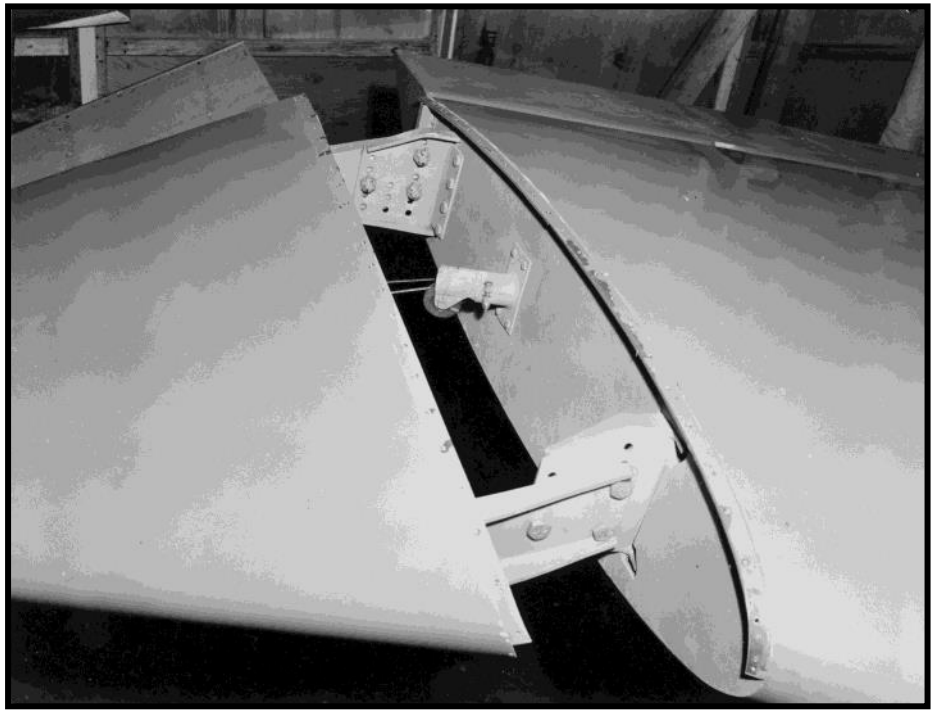
The sole N-1M under construction at Northrop. The center fuselage section (left) with engines and propellers in place, is prepared to have the main wing components (right) installed.

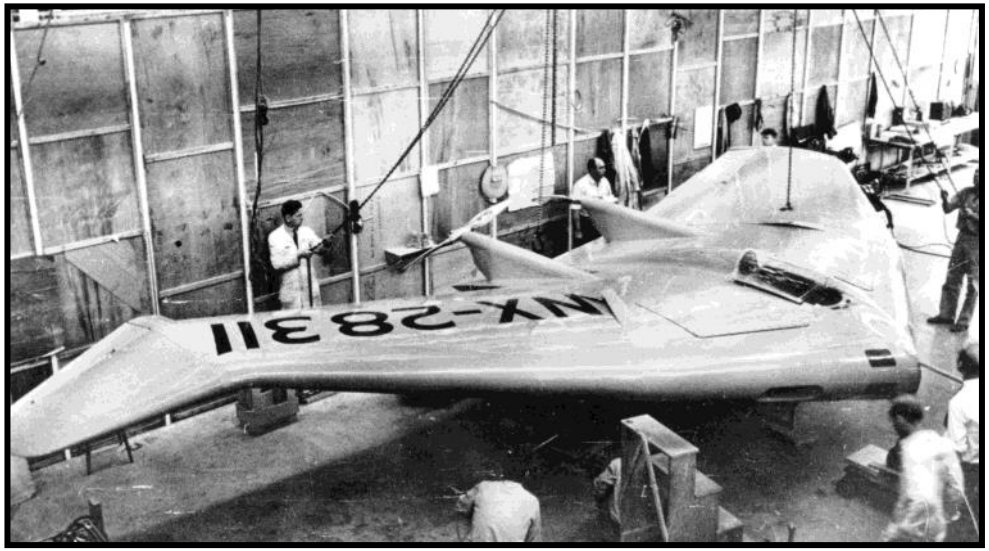




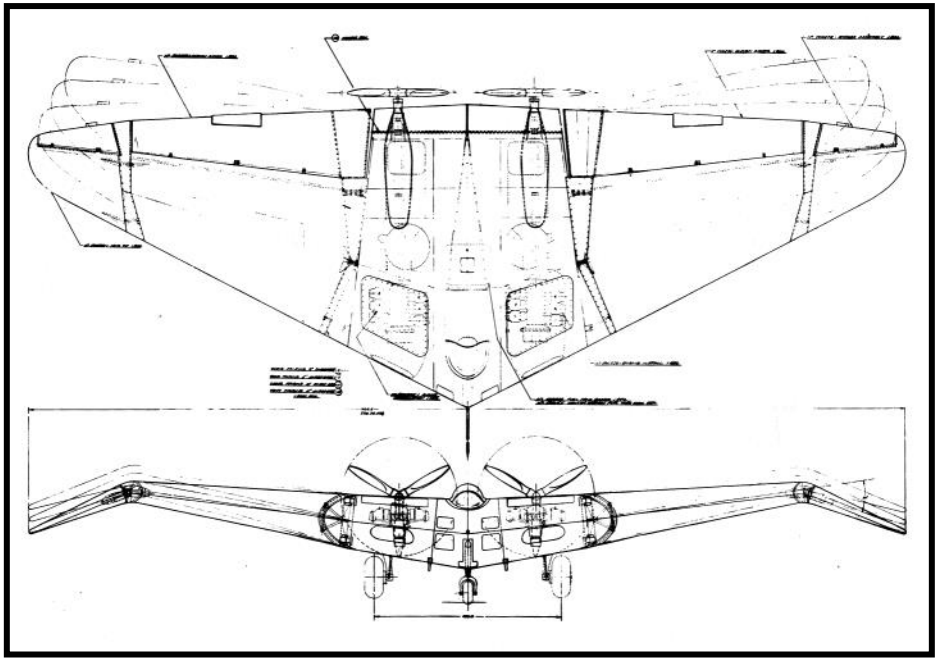
Sometimes brute strength and a strong back are required to get things done. Northrop technicians install the left main wing section of the N-1M.

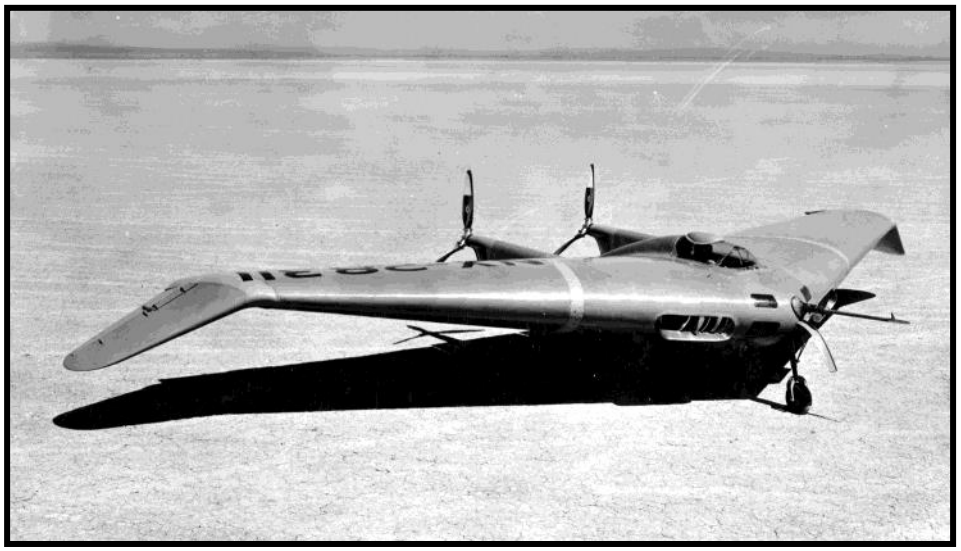
Weight and balance checks on the N-1M prior to taxi testing. Note the curved window panels in the nose . These would be covered over later in the test program.





Northrop N-1M three view at right shows the wing sweep and wing droop variations built into the design of the flying mockup.

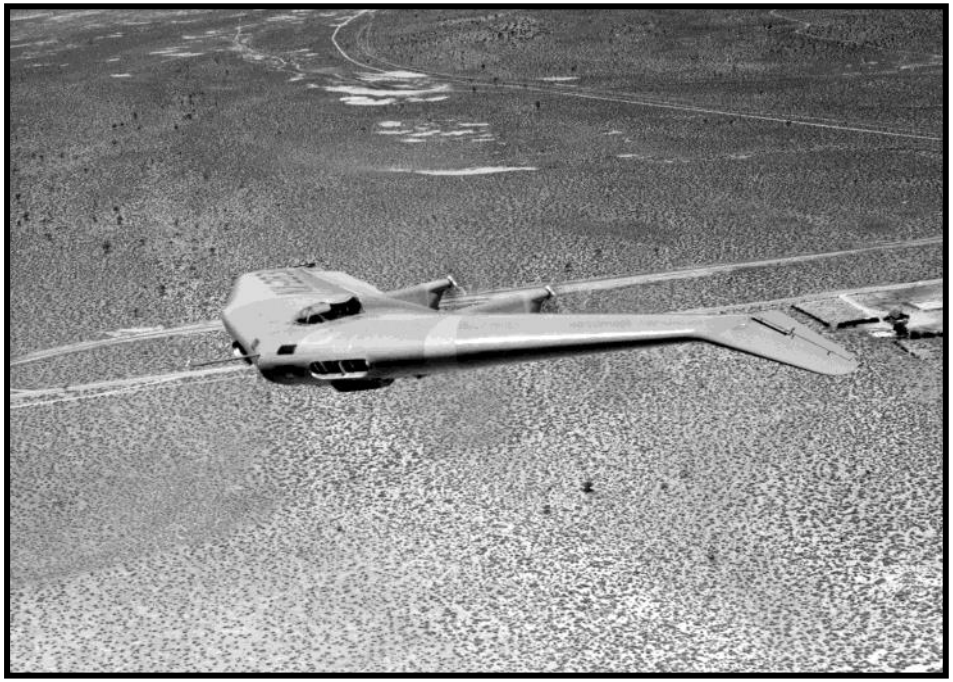


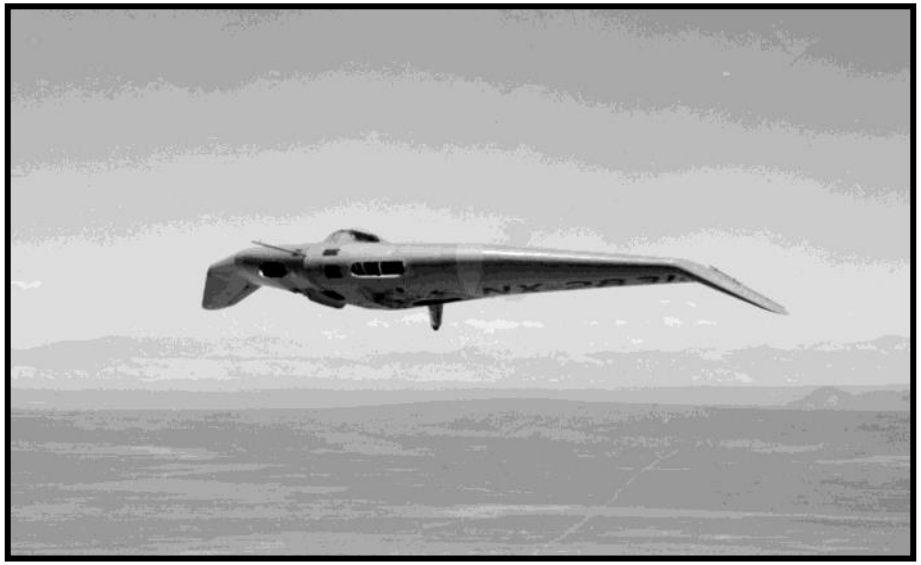


The majority of flight testing on the N-1M was conducted on the dry lakebeds of the high desert of California. Muroc dry lake was the preferred location with Roach dry lake being used as a backup location as needed.

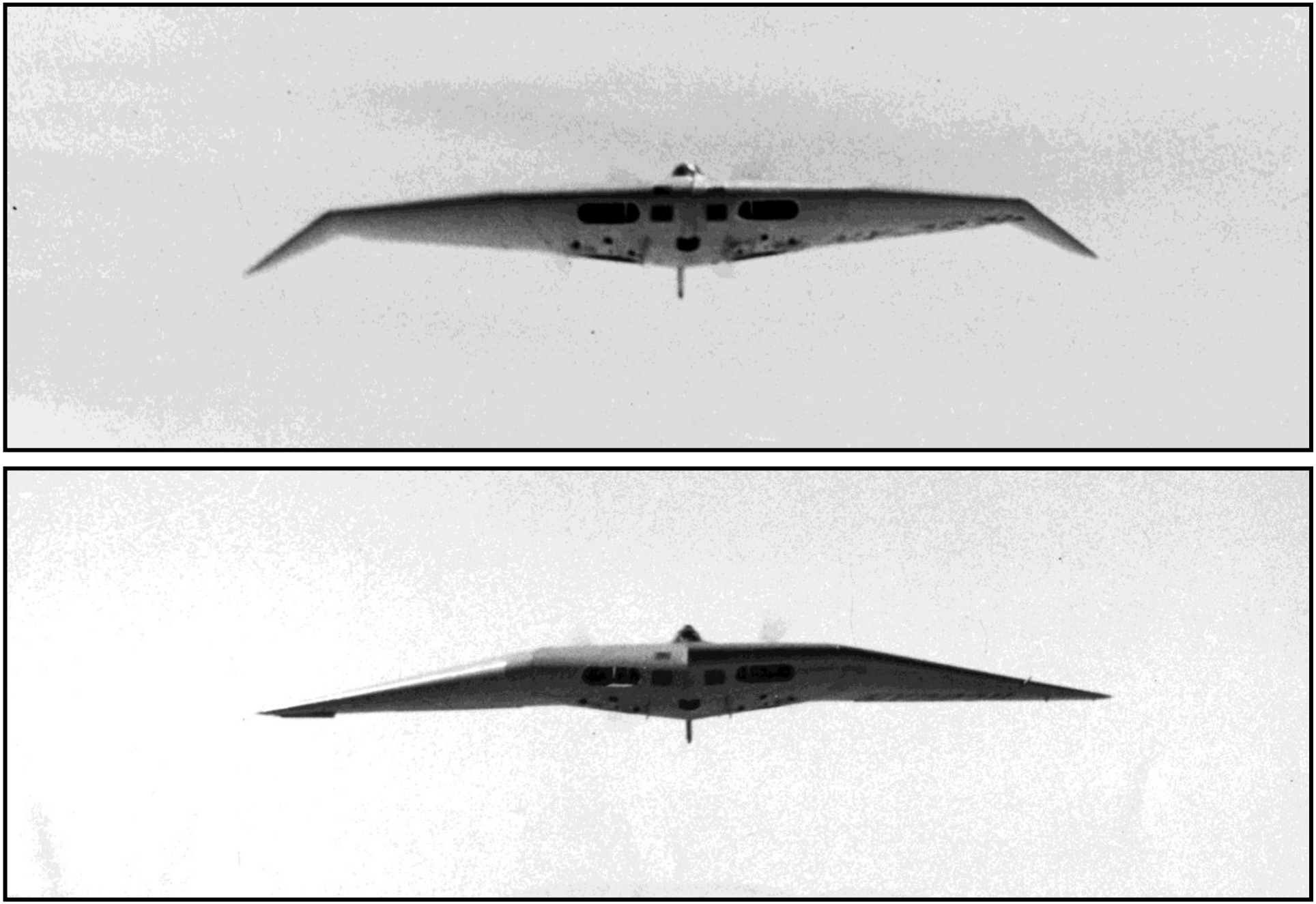
The first flight of the N-1M occurred on July 3, 1940 with Northrop pilot Vance Breese at the controls. Due to the underpowered Lycoming engines, early test flights were less than spectacular with the aircraft getting only a few feet off the ground.

Although the N-1M had limited performance, it did prove Northrop's theory that an all-wing design was fully controllable. Data acquired from N-1M flight testing assisted in the design of the N-9M and XB-35 flying wing aircraft. Note the outer wing sections are adjusted aft a few degrees.



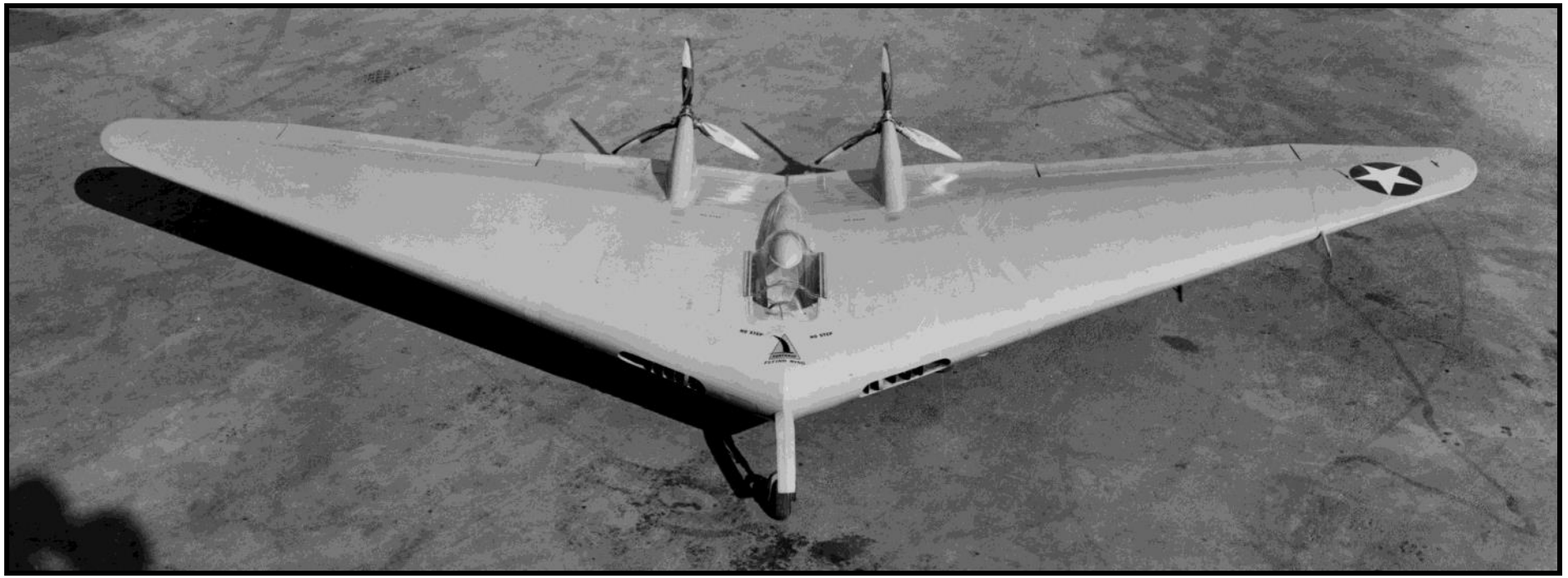


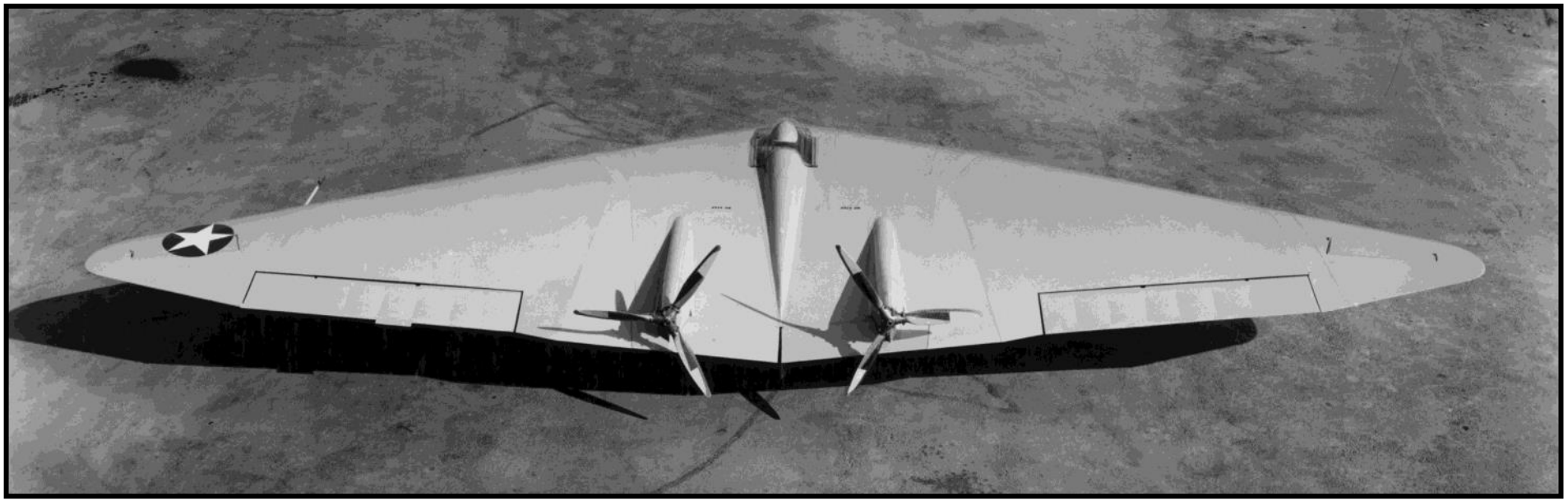
Once the 65 HP Lycoming engines were replaced with 117 HP Franklin engines, flight testing of the N-1M really increased. With the uprated engines, the small test aircraft could reach altitudes up to 4,000 feet. A small lip has been added in to each air intake to improve airflow.



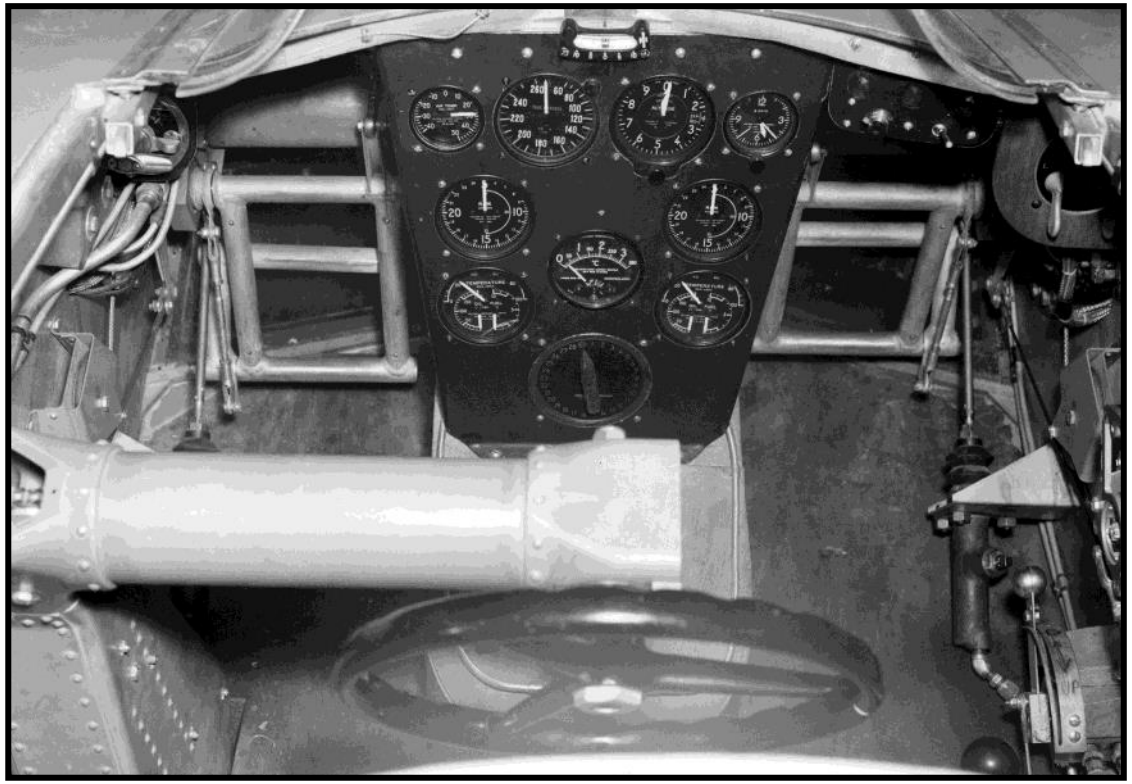
Two views of the N-1M in different configurations. The upper image shows the wing tips drooped and only a slight change in wing sweep while the bottom photo depicts the aircraft with wing tips straight and outer wings swept aft to their full sweep angle.

Once word spread about Northrop's new design, the press encouraged him to view the new aircraft. The Army gave permission and a press day was held in the Mojave Desert on December 4, 1941. Northrop pilot Moye Stephens (shown at right) put on an impressive flying display for the media.



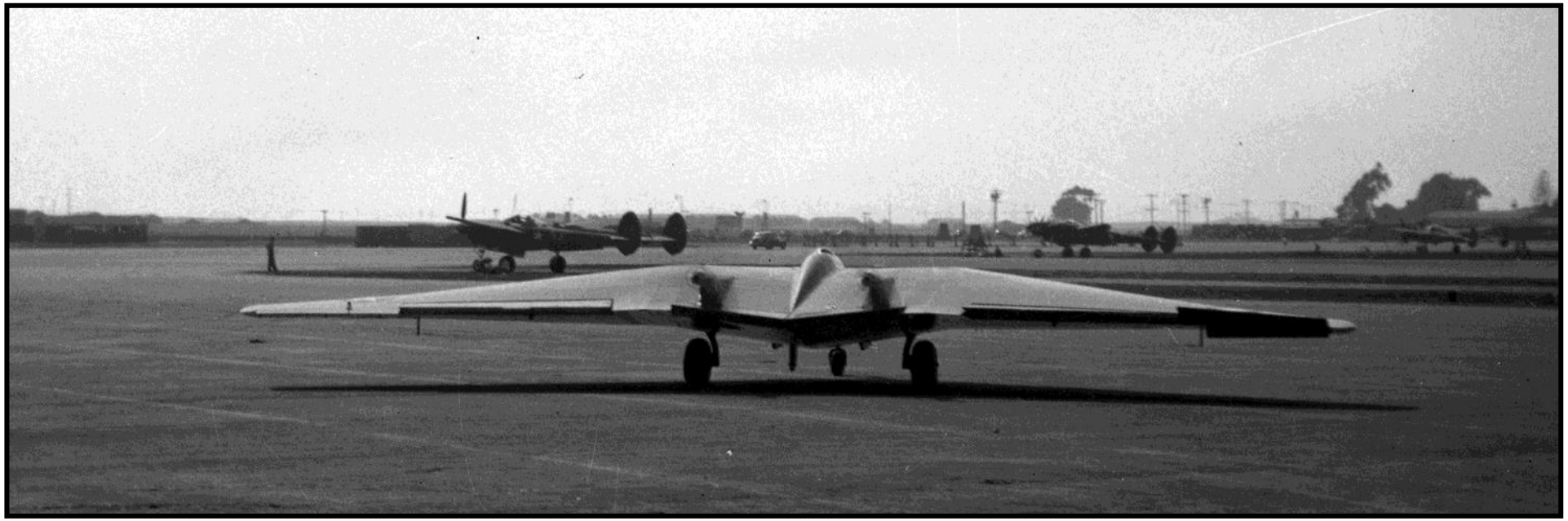


The clean lines of the flying wing design are clearly visible in these views of the N-1M. With wing tips straight and outer wings manually positioned in their fully forward position, the N-1M now sports military insignia in place of the civil registration. The Army requested the new insignia be applied to the aircraft after the breakout of hostilities with Japan.

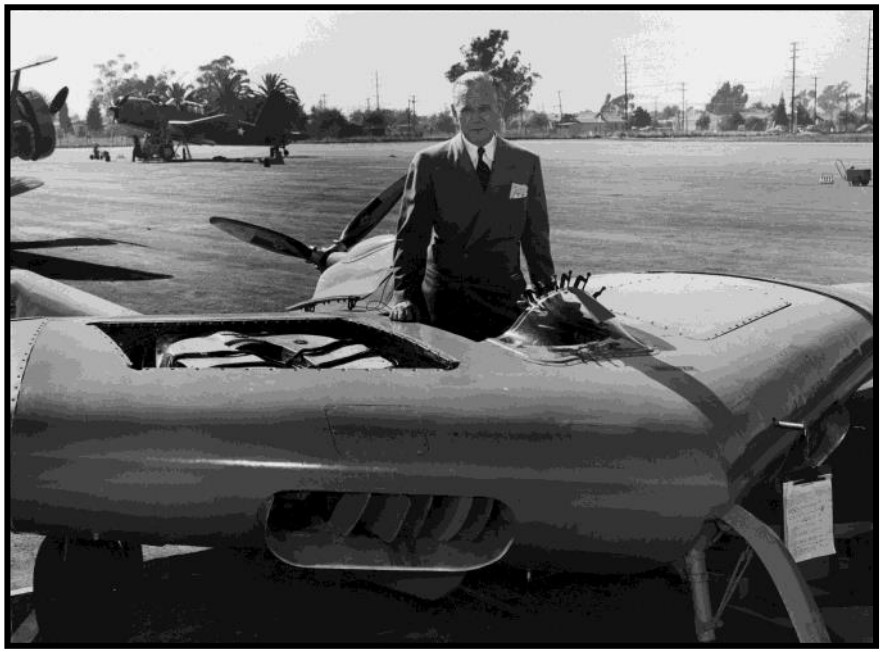


The cockpit of the N-1M was simple and straightforward using a control wheel in place of a yoke or stick.

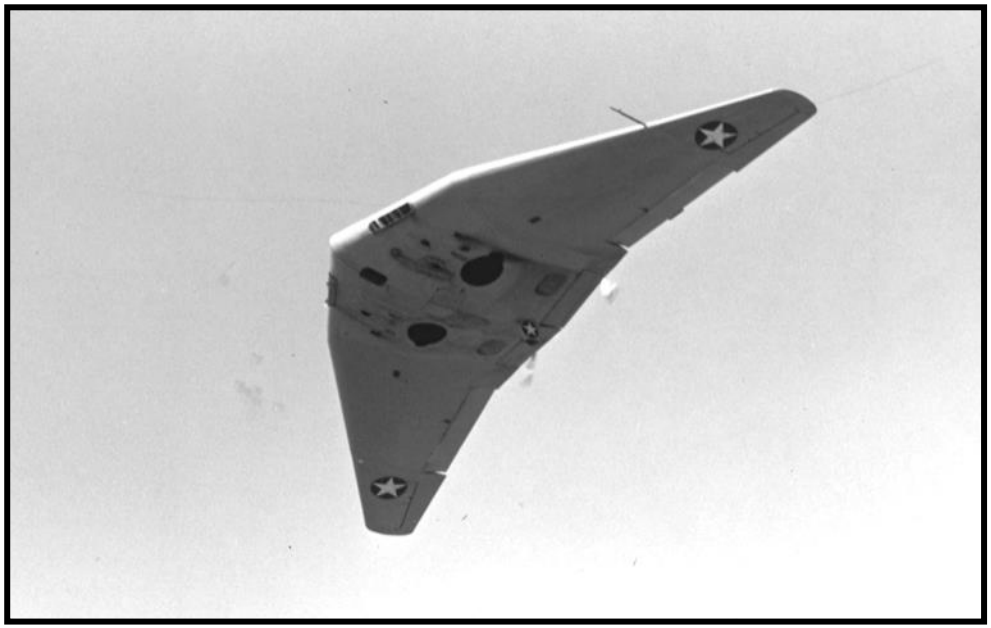
With numerous Lockheed P-38 Lightning's parked about, the small N-1M taxi's for another test flight out of Burbank Airport.



The two photos above show differences in early and late flight testing of the N-1M. The four, small forward-facing windows have now been covered and a metal lip added around the bottom of the intake lip. Also of note is the use of a civil-registered chase plane (above left) while later testing made use of military aircraft.

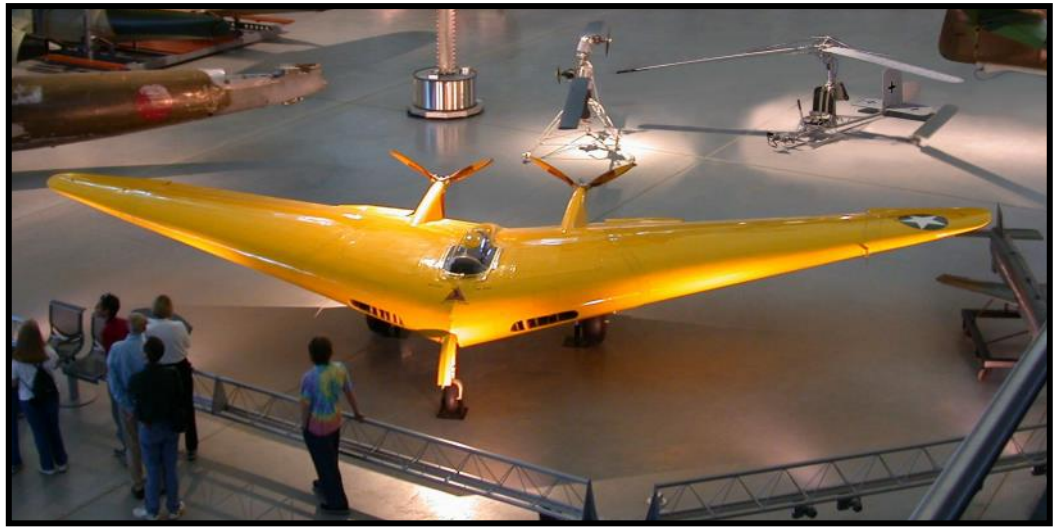


Dignitaries were a familiar site around the Northrop facility during flying wing testing. Here, U.S. Senator Monrad Wallgren poses in the cockpit of the N-1M.



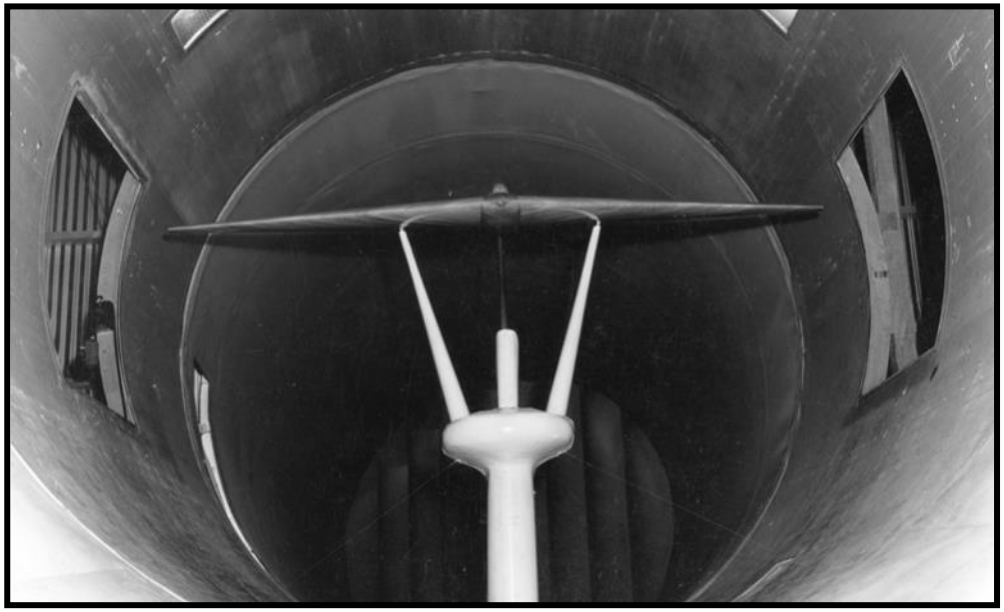
The dark patches on the bottom of the N-1M are the open landing gear wells. For simplicity and weight, the N-1M had no cover for the aft portion of the nose gear or main landing gear.

Just a few of the many Northrop personnel involved in the development and testing of the first flying wing prototype from Northrop. John Northrop kneels just off of nose of the N-1M.

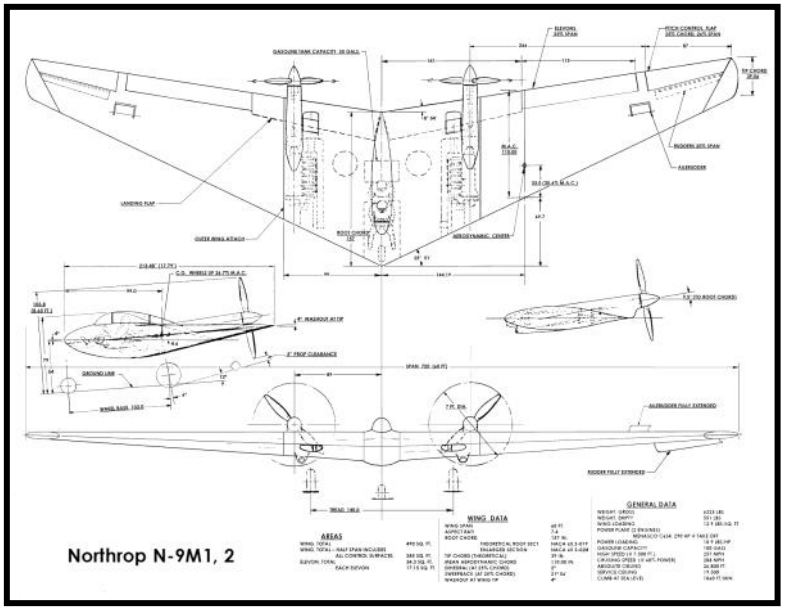


After sitting in storage for a few decades, the N-1M went through an extensive restoration in the early 1980's and is now in the collection of the Smithsonian Air & Space Museum.

NORTHROP N-9M

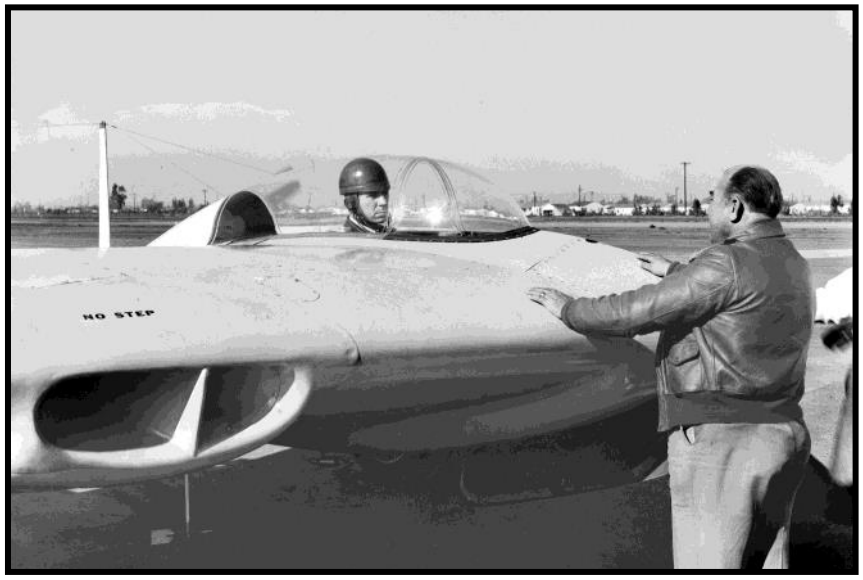


The N-9M was a 1/3rd scale flying mockup for the XB-35. Pictured here is an early wood model of the N-9M undergoing aerodynamic testing inside the wind tunnel.



Detailed dimensional drawing of the N-9M-1 & N-9M-2 flying wing.

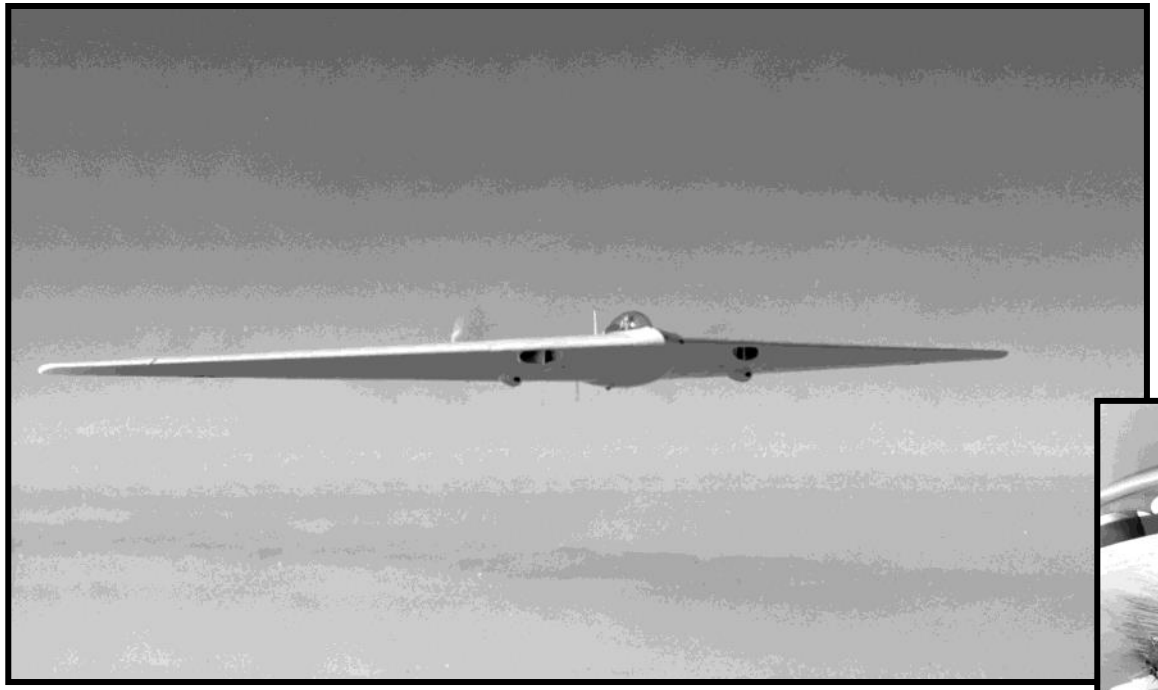
Two of the first three N-9M aircraft under construction at Northrop. A fourth airframe was added to the contract after the loss of the first airplane. Each airframe received its own designation; N-9M-1, N-9M-2, N-9MA and N-9MB.



Ground testing of the N-9M-1 began on December 20, 1942 with Northrop's chief test pilot John Myers at the controls.

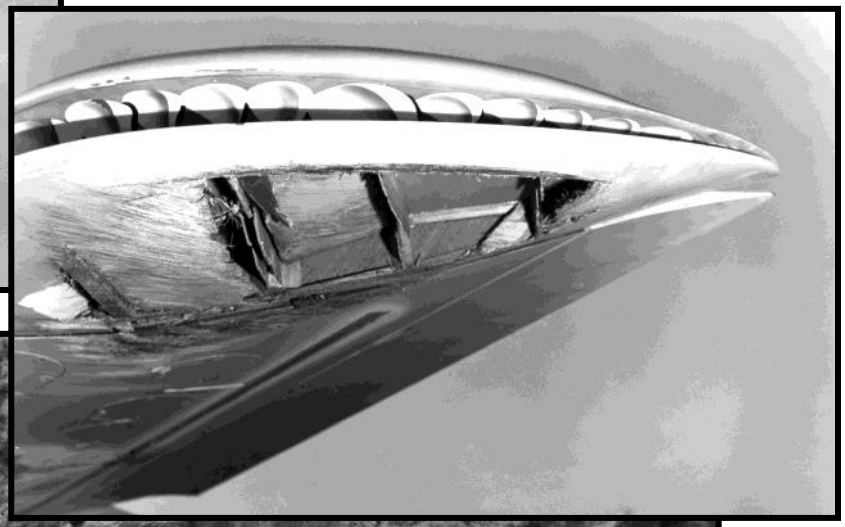
Northrop test pilot John Myers took John Northrop for a ride in the N-9M in January 1943.

First flight of the N-9M-1 took place on December 27th, 1942 when John Myers took the aircraft on a 55 minute flight. Most N-9M testing occurred at Muroc or Roach dry lakes in the California high desert, but a handful were made over the Los Angeles area from Northrop's facility in Hawthorne, California. John Myers did most of the early flights on the N-9M, but turned the task over to Max Constant when Myers was needed on other programs.

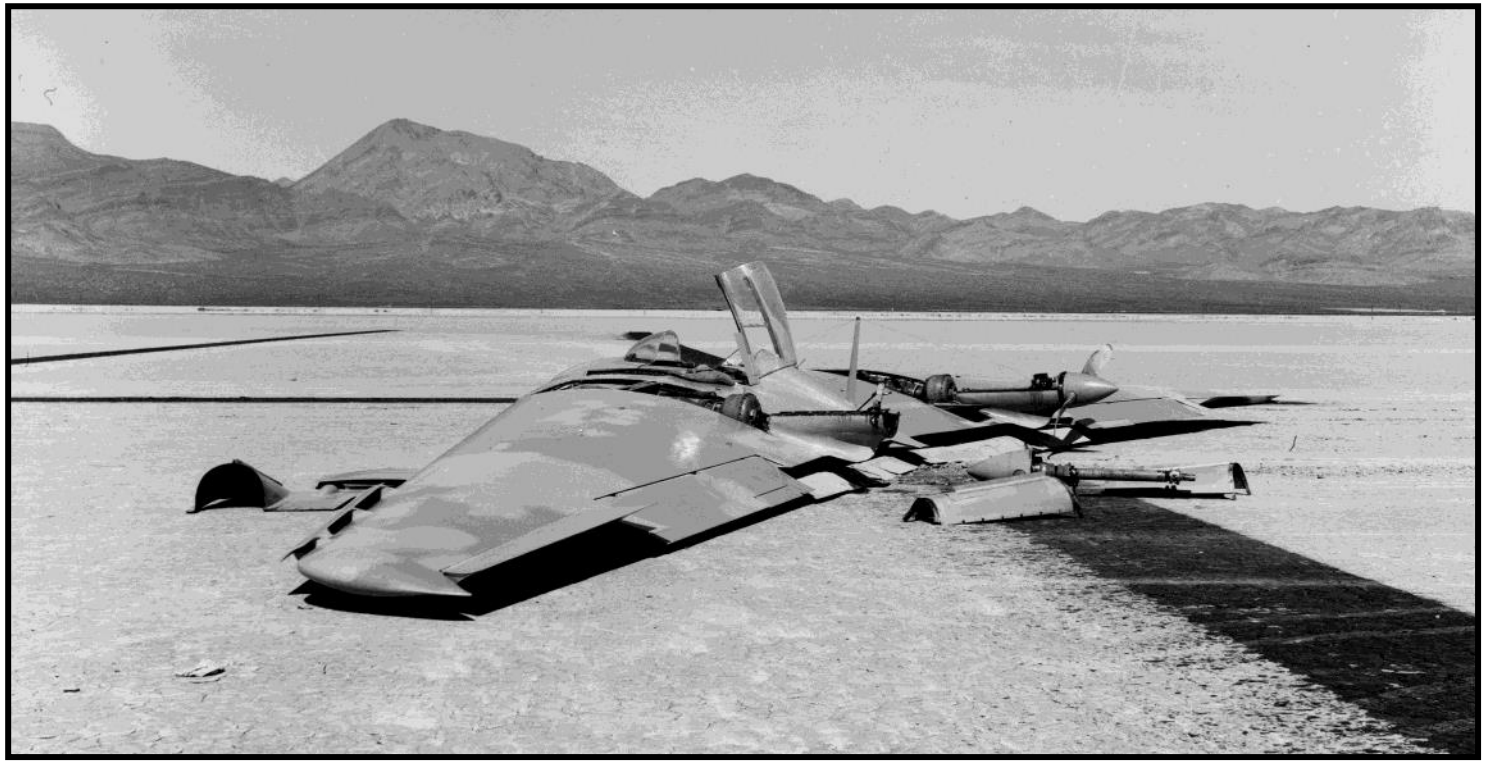


The Menasco C6S-4, 260 HP engines installed in the N-9M-1 and N-9M-2 were a constant source of trouble. In five months of testing only 20 hours of flight time had been acquired during the first 44 flights, with only a small number being full term, the rest being terminated due to mechanical failure of the engines.

Damage to the left wing occurred when the left main gear failed to deploy on landing. Pilot John Myers was able to minimize damage on landing and the plane flew again the following day. Note the teeth painted inside the wing tip split speed brake.



During the 45th flight on May 19, 1943, Max Constant took N-9M-1 up for a flight from Muroc dry lake. While conducting aft center of gravity stability and control tests, the aircraft entered a right-hand spin at 6,500ft and the little craft impacted the ground before Constant could bail out.

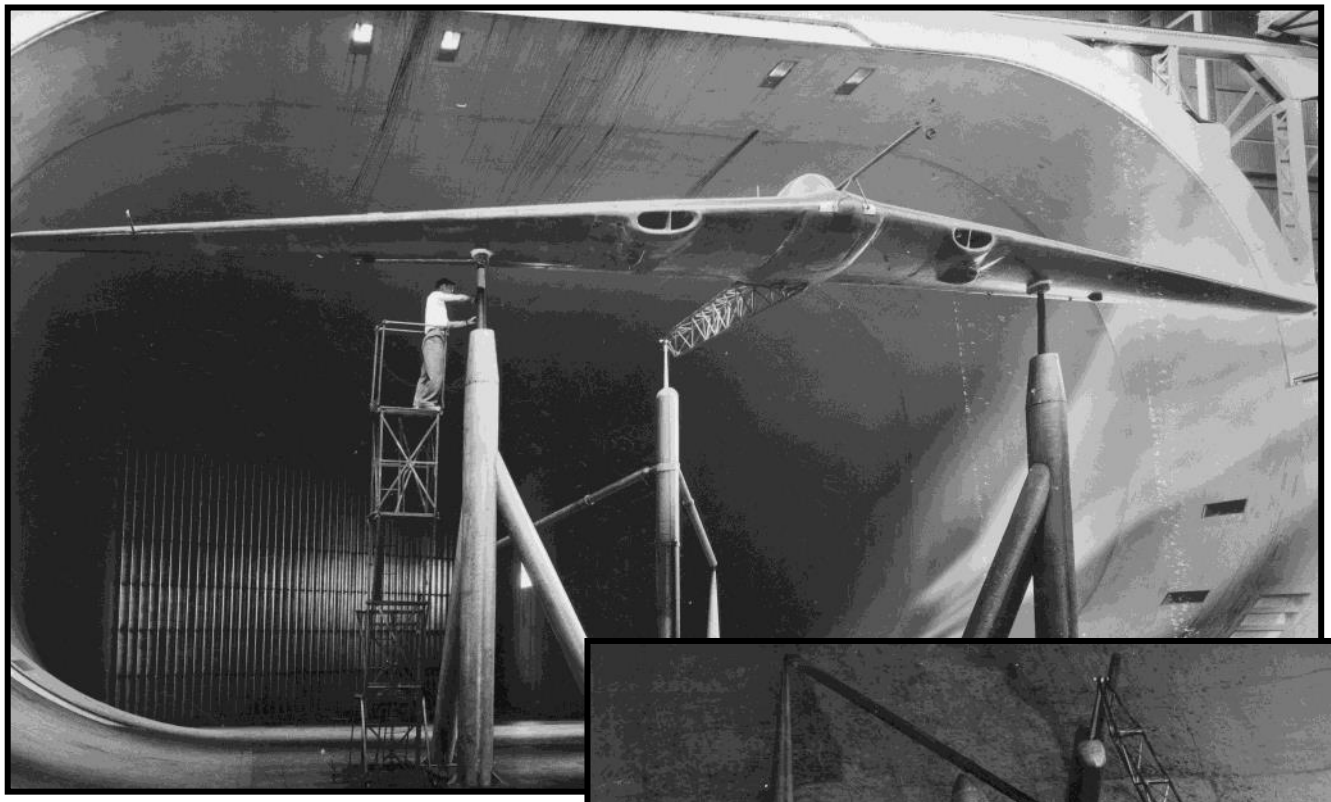


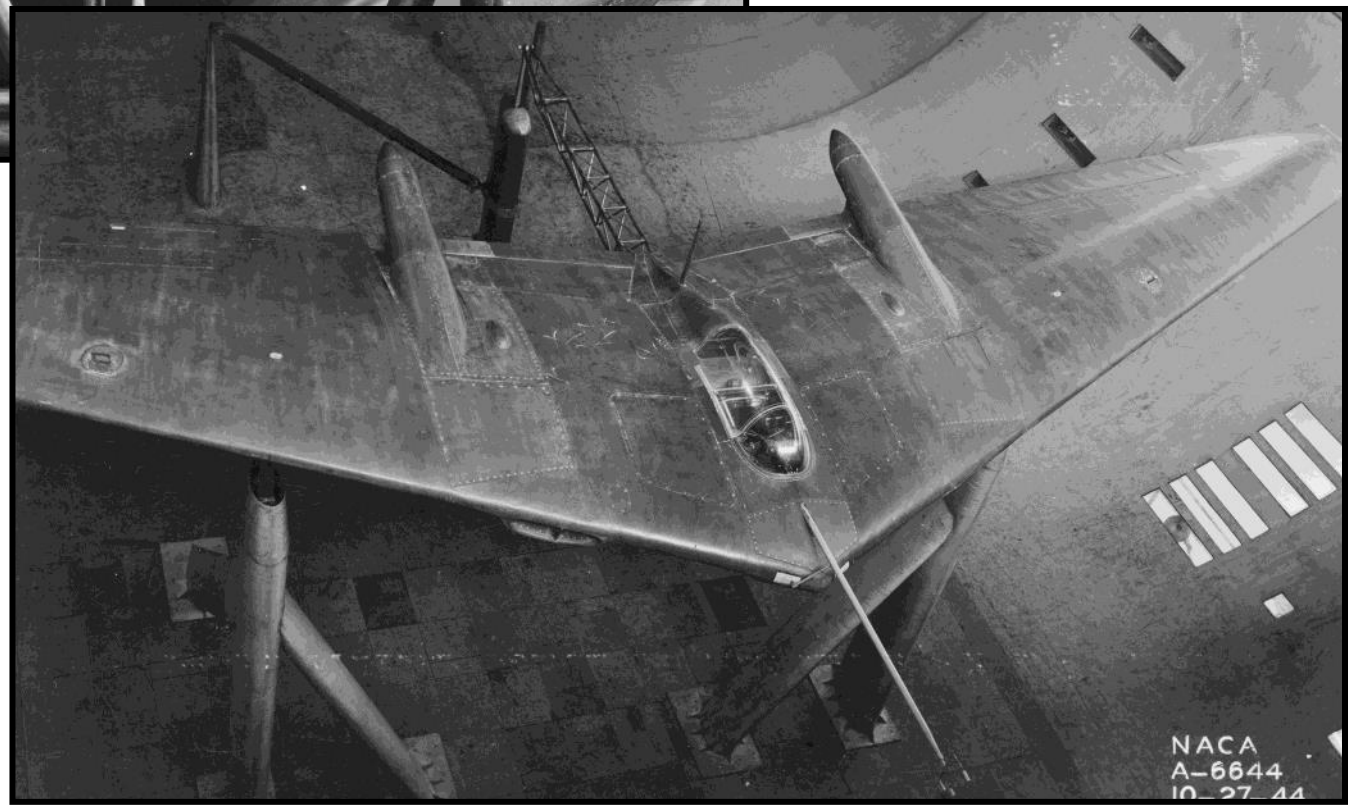
N-9M-2 made its first flight on June 24, 1943 and suffered from the same engine issues that troubled the first aircraft. On April 19, 1944, the N-9M2's test program was interrupted by a gear-up landing at Roach Lake, incurring slight damage to the aircraft, but no injury to the pilot.

During flight test work, three Air Force pilots arrived at the lake to fly the aircraft. One officer, Major Ritchie from Wright-Patterson AFB, Ohio, was reputed to be a 'hot pilot' by some of the men at the test site; the names of the other officers remain elusive. The story goes that these pilots were arguing who would be first to fly and while this was going on, Major Ritchie, decided to quit arguing and went out to the aircraft. Preflight directions were given and he was off to fly the flying wing.

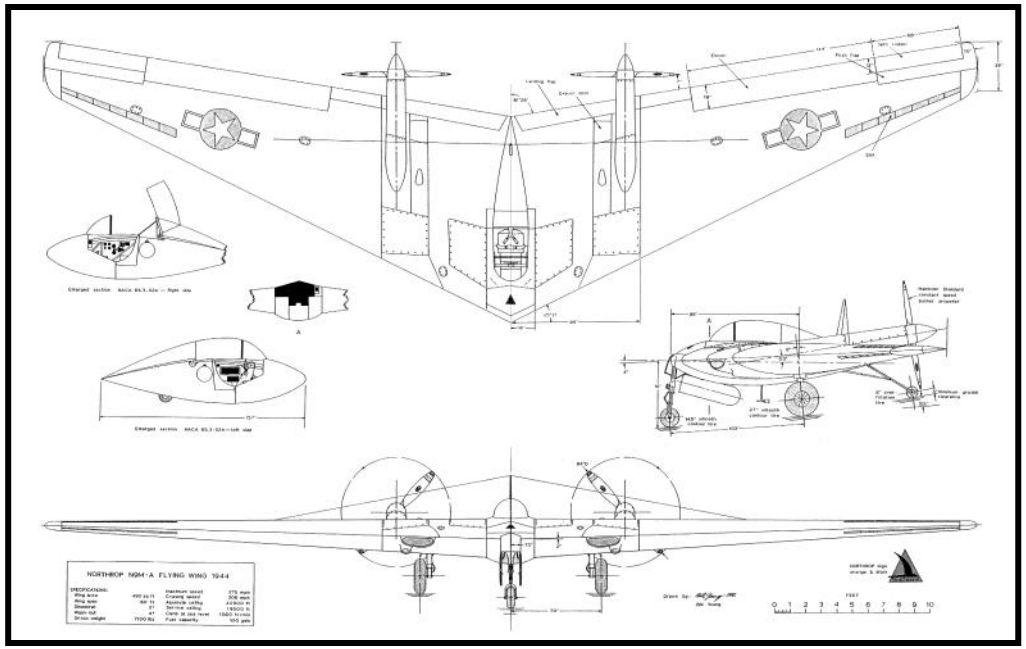
On returning to the lake bed it was noted by the field personnel that he was landing with the wheels still up. Without good radio contact and the failure of much arm waving to alert him to his problem, a wheels-up landing was nonchalantly accomplished. When the airplane came to a stop the pilot climbed out of the cockpit and started to walk away. Then, as if it were an afterthought, he went back to the airplane and placed the landing switch in the down position.

The aircraft was subsequently hoisted up and the landing gear lowered; it was then towed back to Northrop's test site for repair. Ground crewman, Bill Raikes, indicated that the damage from the wheels-up landing was minimal and they had the airplane flying the next day.

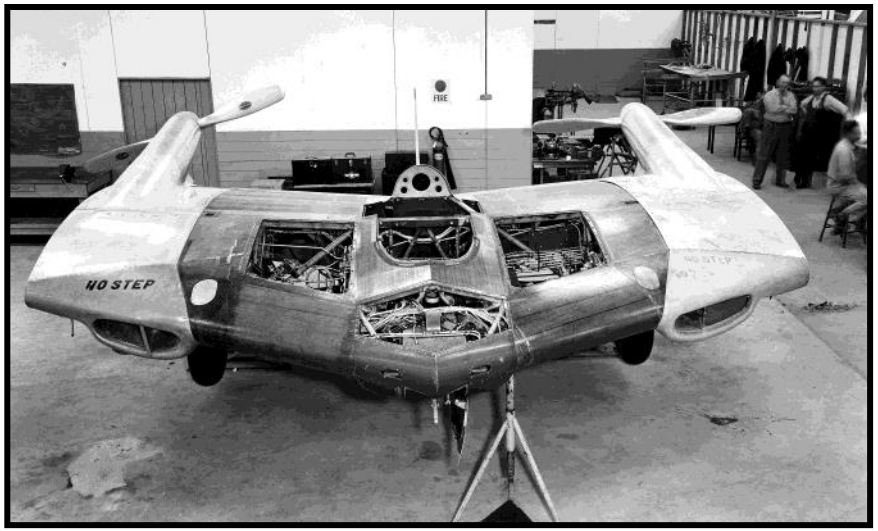




After the loss of N-9M-1, ship 2 was sent to NASA Ames Research Center and tested in the 40x80 foot wind tunnel.



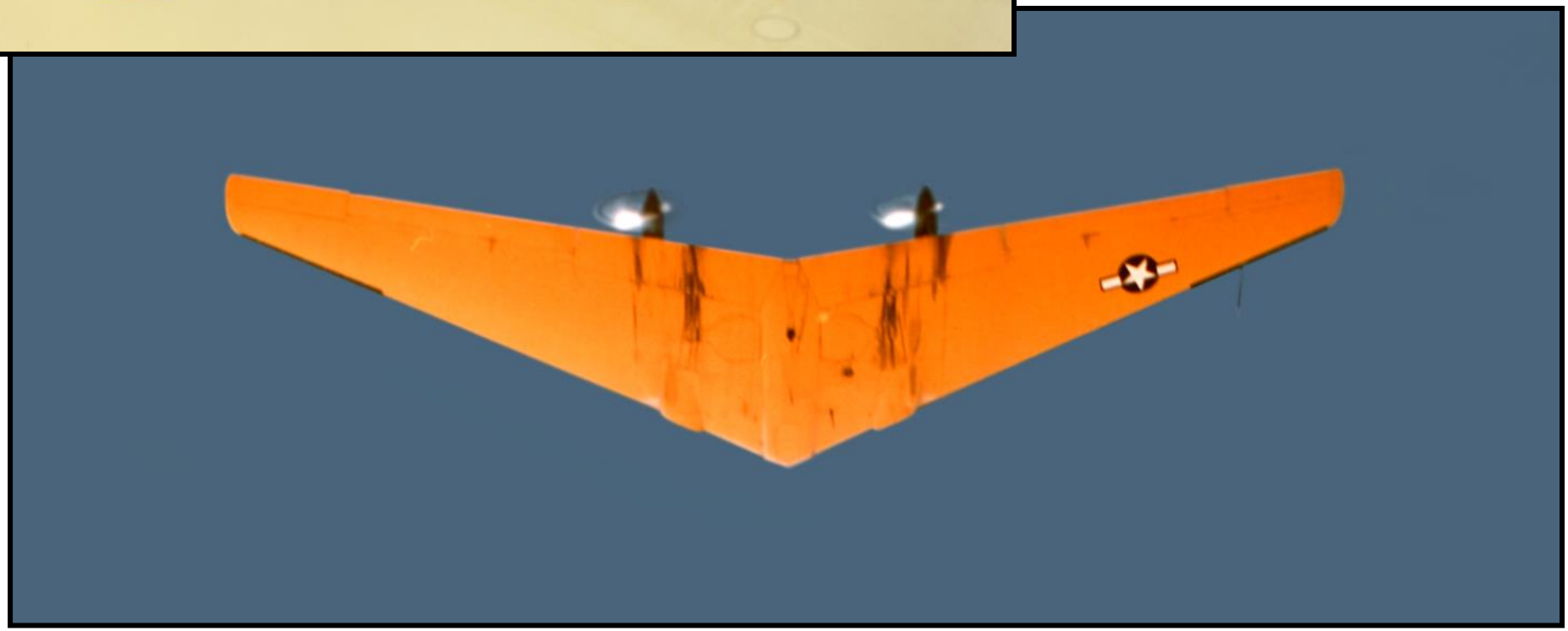
Detailed three view of the N-9MA and N-9MB.



Center fuselage section of the N-9MA under construction at Northrop. The N-9MA used the same Menasco engines with a redesigned control system utilizing improvements learned from the first two aircraft.

The N-9MB center section sits in front of the nearly complete N-9MA in April 1944. Unlike the first three N-9's the N-9MB made use of two specially-built Franklin 8ACSA-538 eight-cylinder engines which provided an additional 40 HP per engine, but were 65 pounds heavier.

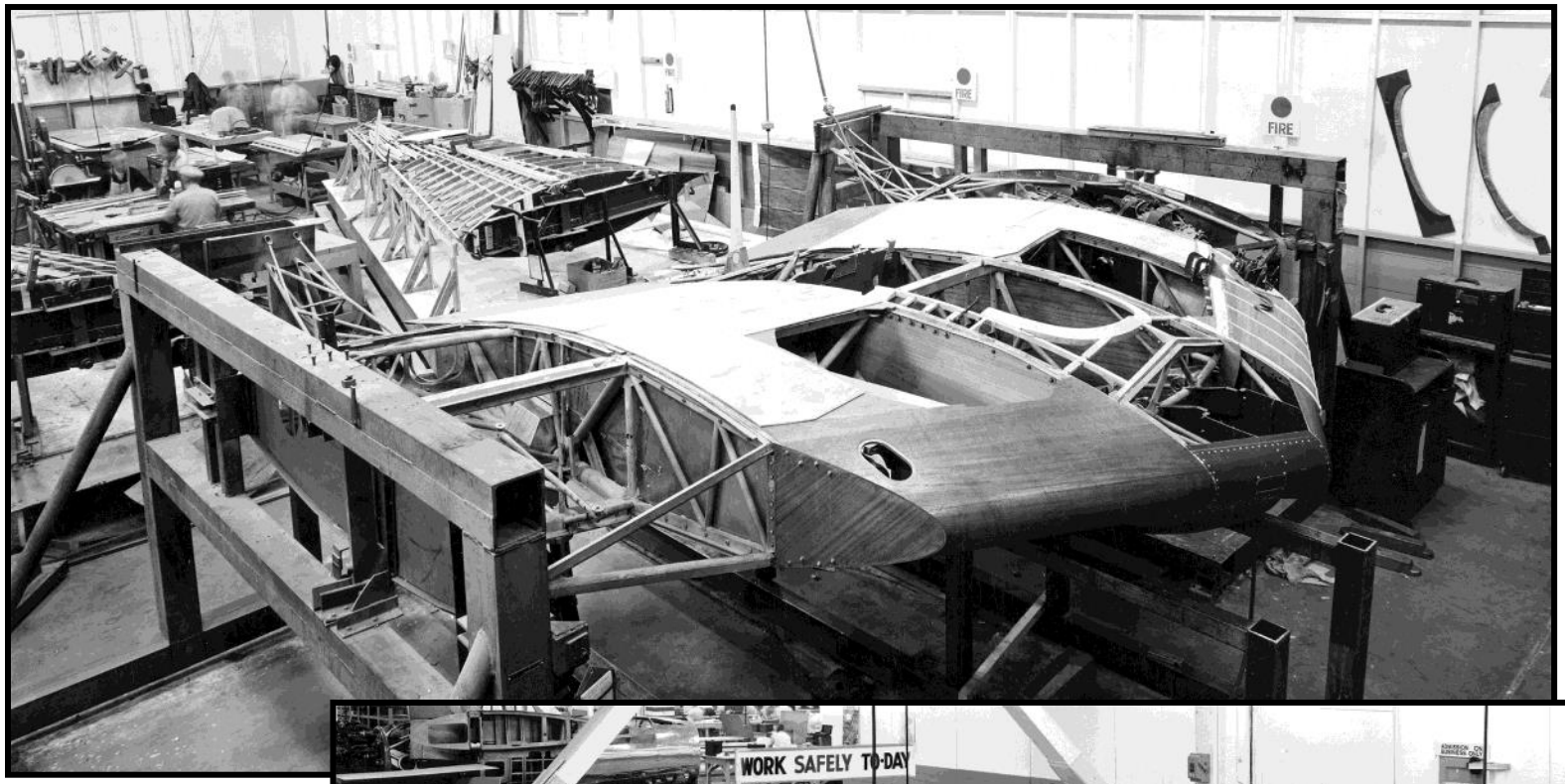
Though initially painted with a yellow top and blue bottom, the paint scheme used on the N-9MA later in the test program differed from the rest of the fleet in having the upper surface painted blue (ANA No. 501) while the underside remained yellow (ANA No. 506). The reason for the change is unclear.

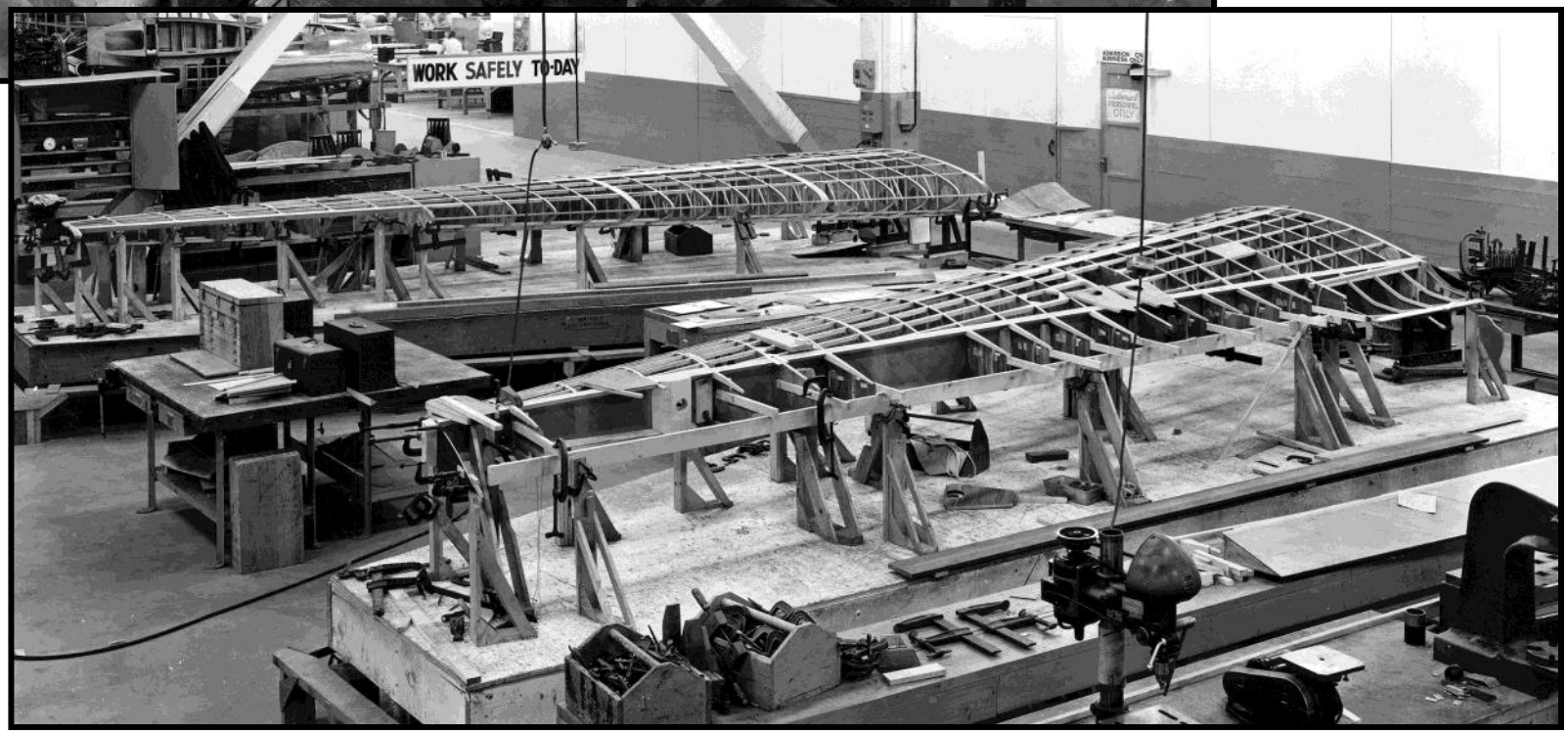


Just a typical day on the flightline at Muroc AAFB in the 1940's. The Northrop N-9MA parked on the ramp while the America's first jet bomber , the Douglas XB-43 Jetmaster, is refueled for another test flight in the background.

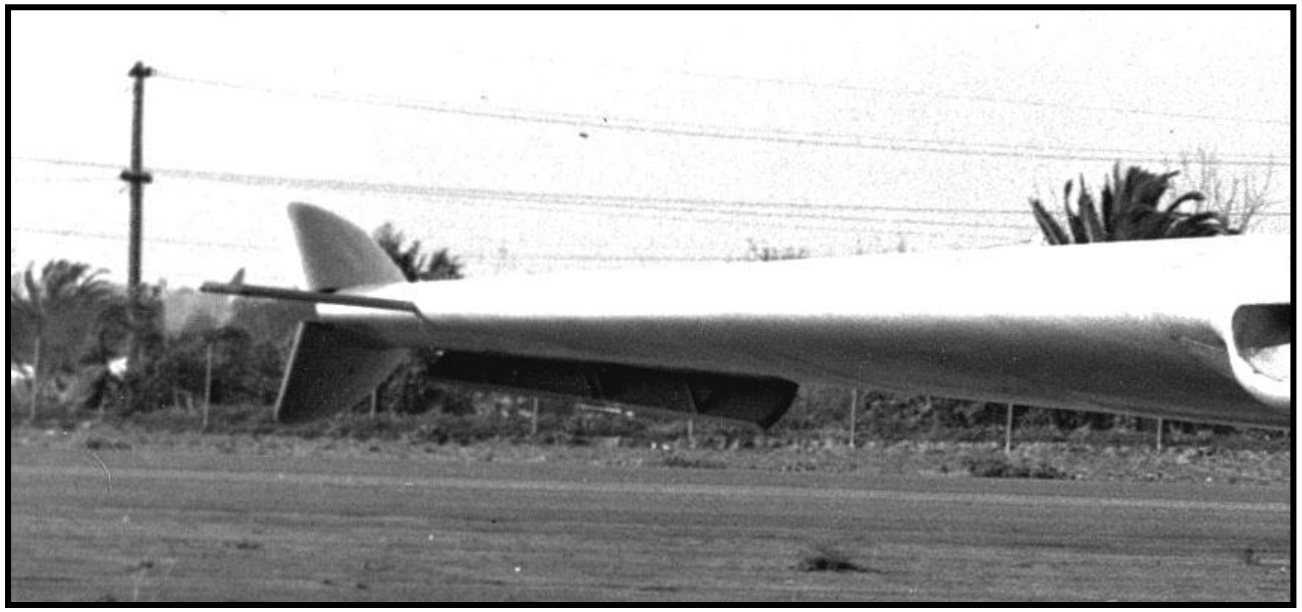
The most visible external difference between the first two N-9M's and the latter two, is the open section on the wing leading edge of the N-9MA and N-9MB used to control tip stalling characteristics typically found on swept wing aircraft at high angles of attack.

Many of the test pilots at Muroc AAFB received a flight in the N-9M with Lt. Bob Hoover being the first military pilot. Shown here, Northrop pilot Harry Crosby gives instructions to Lt. Van Shepard prior to his test flight in the little flying wing.

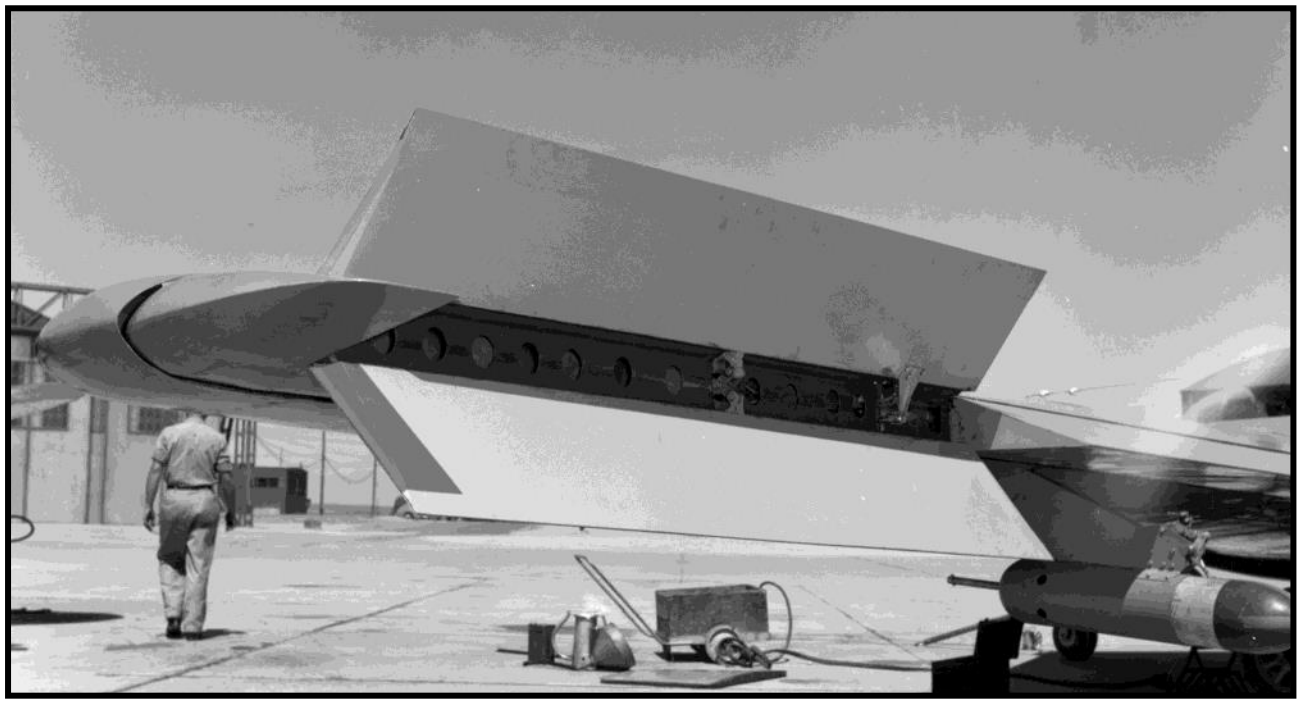




Two views of the N-9MB under construction at Northrop. The internal wing structure below. The N-9MB incorporated several design changes based on the experience of earlier flight testing.



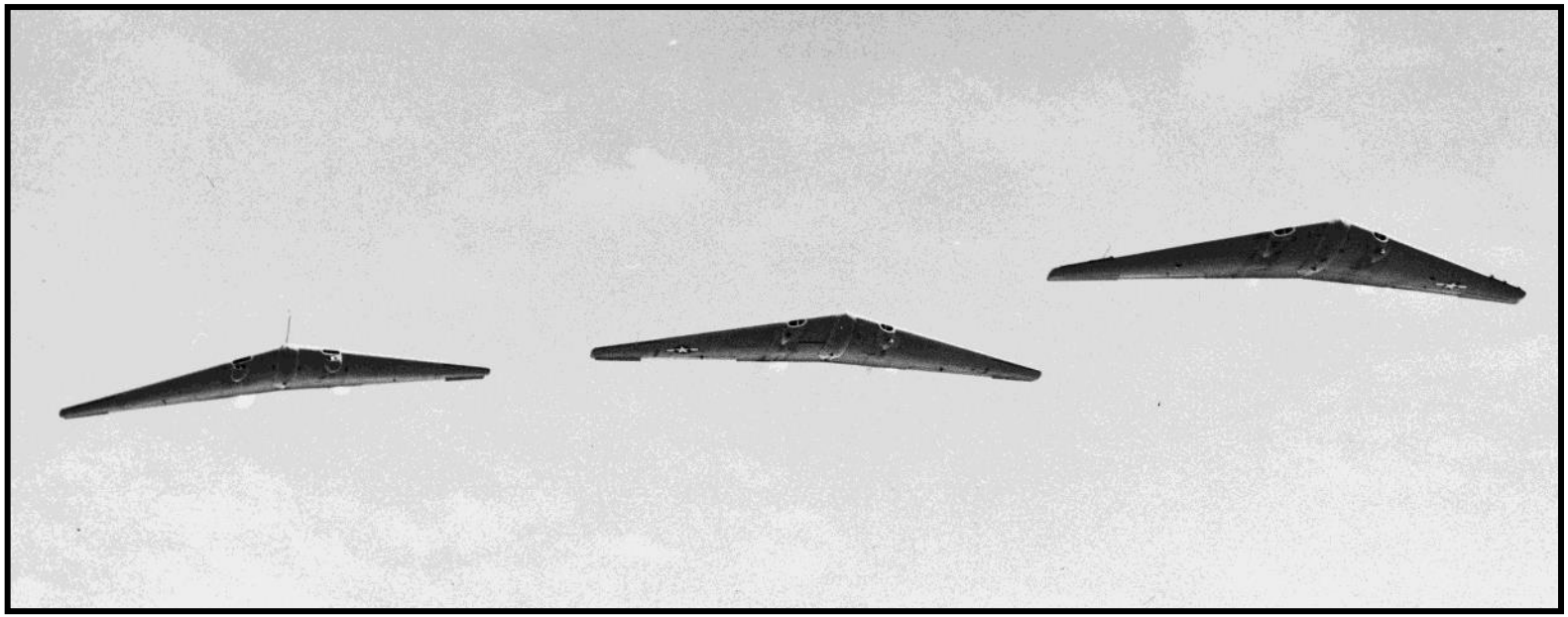
The biggest external difference in the N-9M designs was the control system used by the four aircraft. The N-9M-1 and N-9M-2 made use of retractable drag rudders on the upper and lower of the outer wing as well as the split wing tip speed brake (above). The N-9MA and N-9MB replaced those systems with a split rudder system (below). Each surface could work independent or in conjunction with the other.



To control tip stalling, the N-9M-2 used an externally mounted spoiler (above), while the latter two N-9M's had the system built into the wing structure (below).

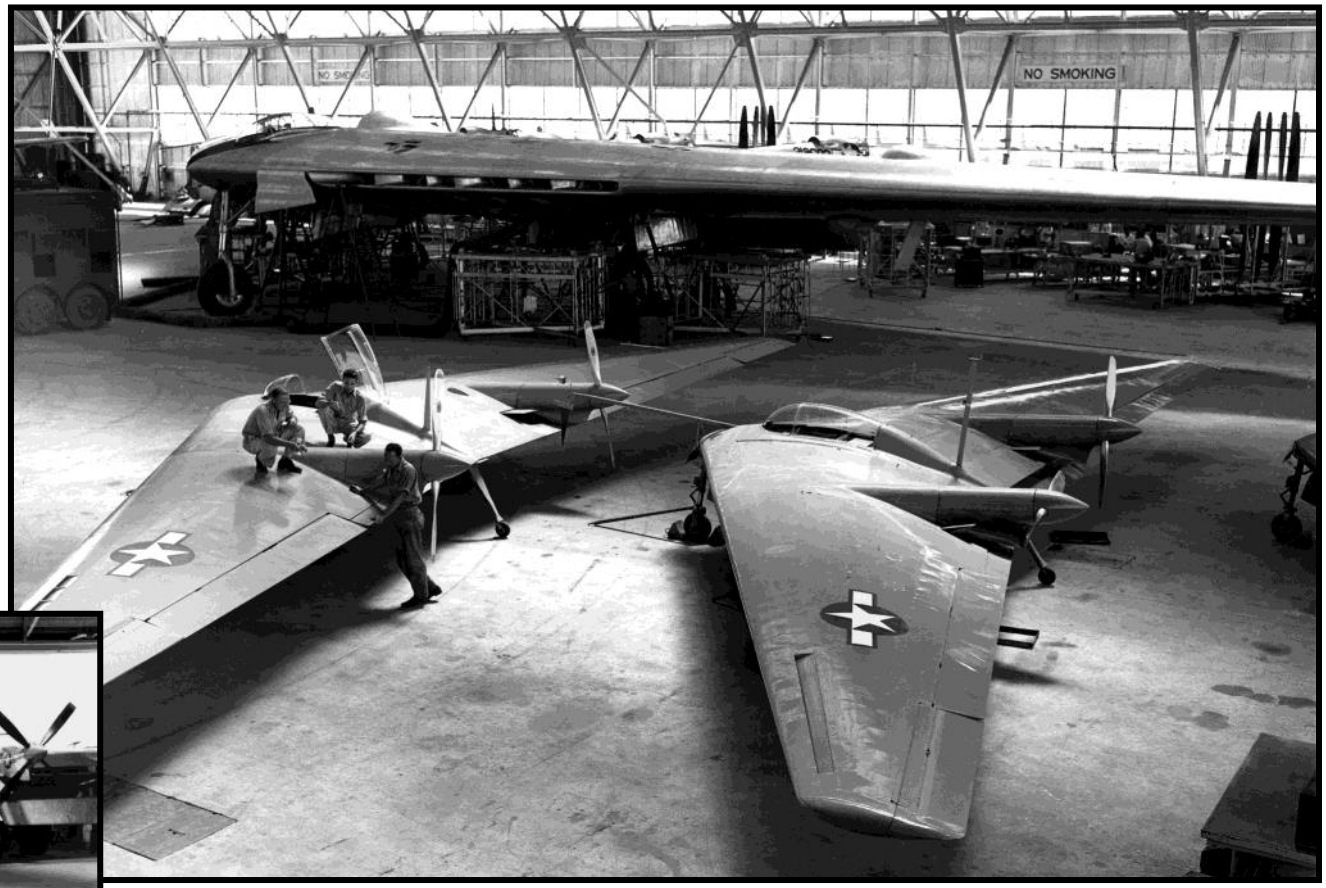
The clean lines of the flying wing design are evident in this view of the Northrop N-9MA in flight over the Southern California mountains.

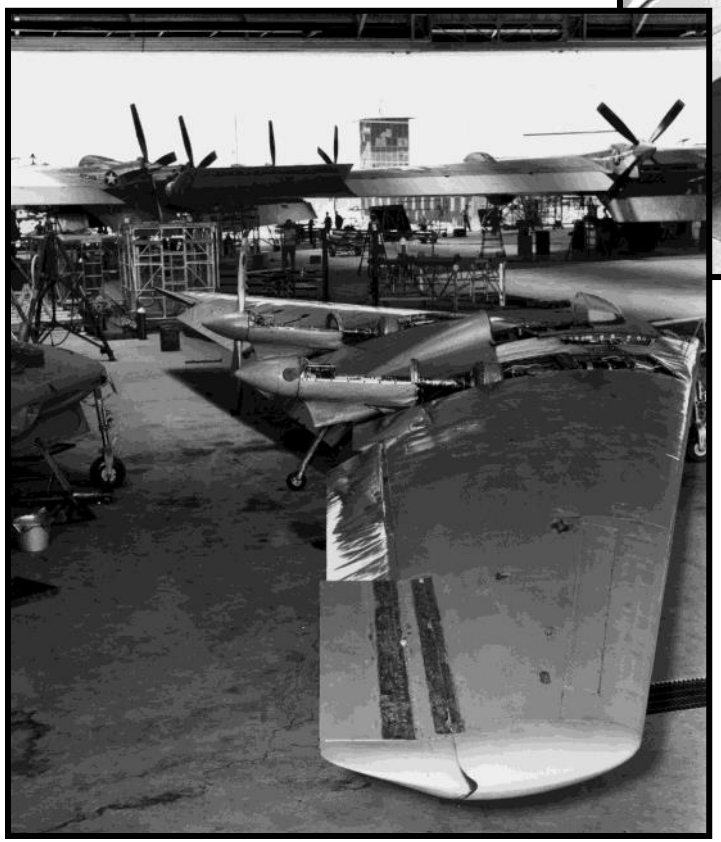
The N-9MB incorporated many of the lessons learned from the testing of the N-1M and earlier N-9M's. With the uprated Franklin engines and improved controls, the flying characteristics N-9MB closely resembled those of the larger XB-35 bomber.



The three surviving N-9M's flew together only once during the flight test program. In February 1945, The N-9M-2 (right), N-9MA (center) and N-9MB (left) made a flight over the high desert of California. This would be the final flight for N-9M-2. Note position of national insignia on the wing of N-9M-2 and the N-9MA is painted with a yellow upper surface and blue lower surface.

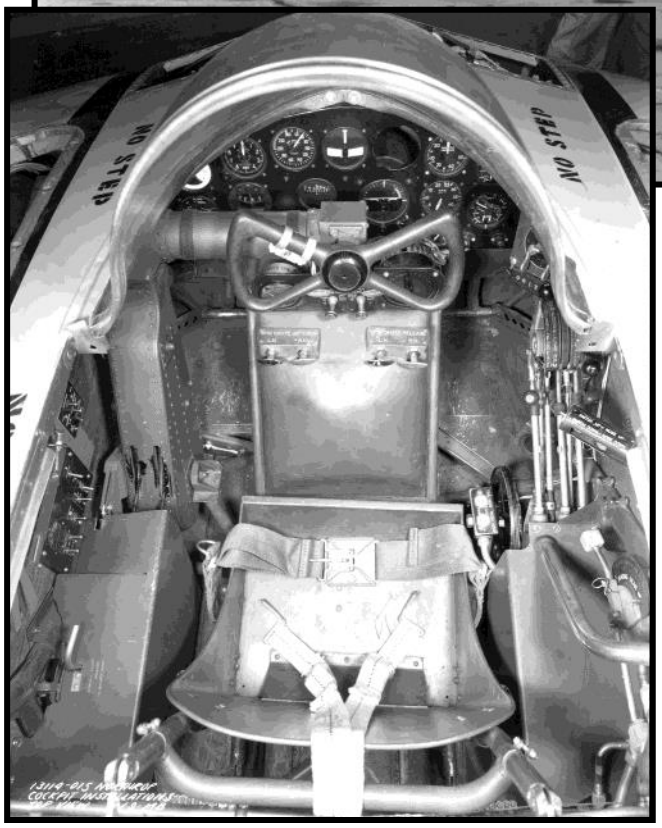
The three N-9M's share the hangar at Muroc with the first XB-35 flying wing bomber. By this time, only the N-9MB was making regular flights with the other two being held in storage for possible future use.



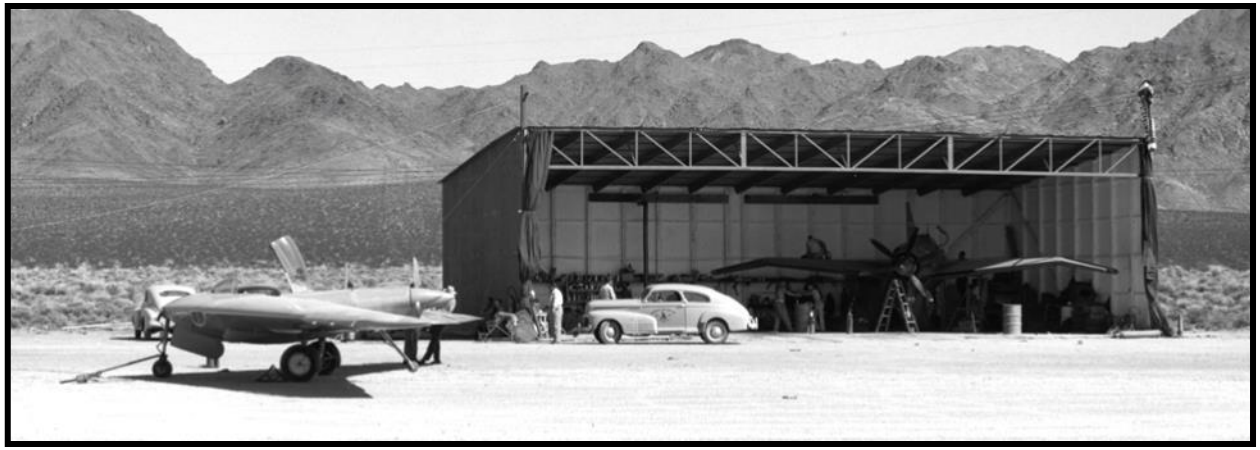


The Northrop hangar at Muroc became crowded after the second XB-35 arrived. Note both XB-35's have been modified with single-rotation propellers.

Capt. Glen W. Edwards (left) poses with the N-9MB after his May 1946 flight. Edwards wrote a fairly positive post-flight report which concluded the N-9M "serves its purpose well as a flying model".

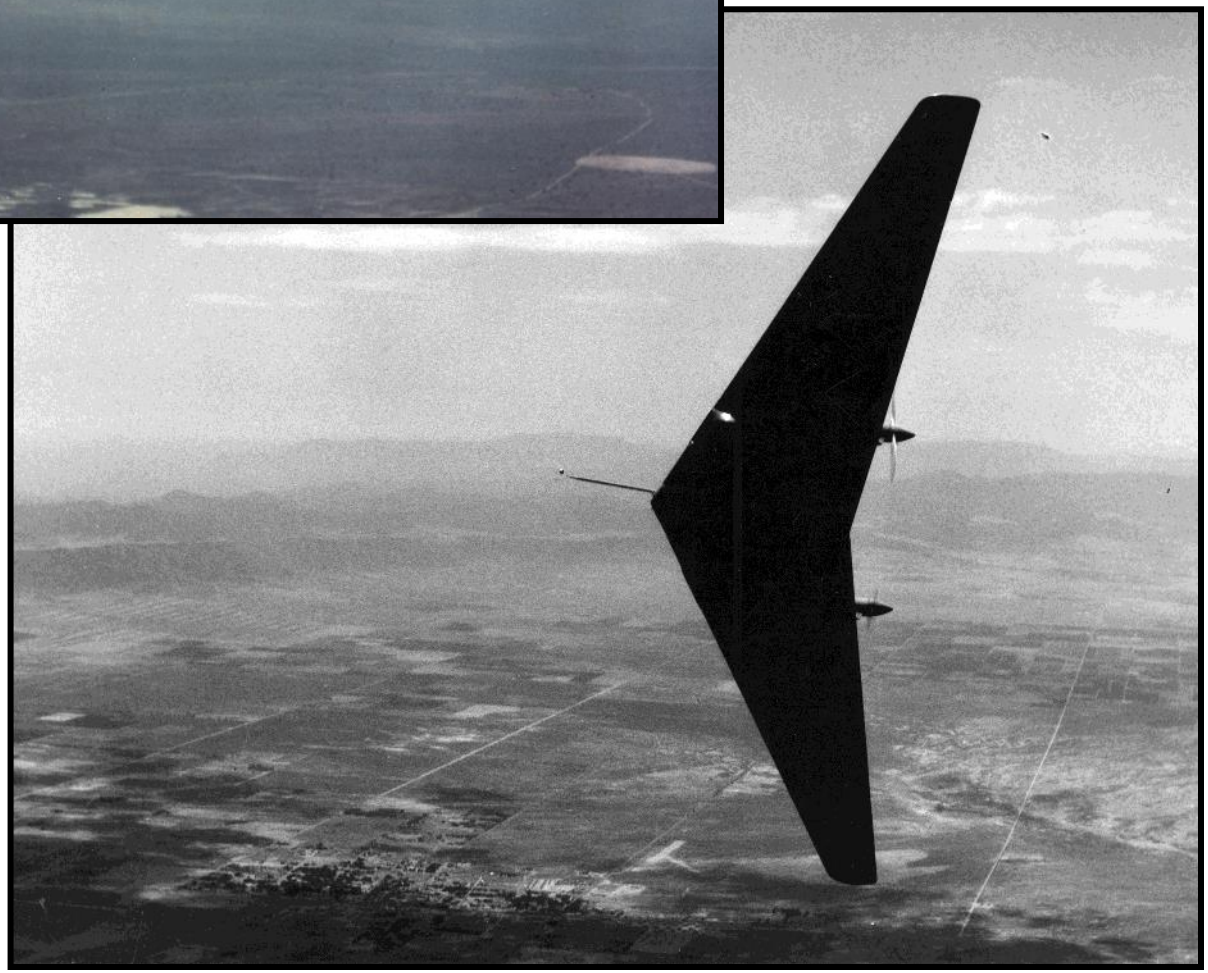


Cockpit layout of the N-9MB.



Northrop built a small test facility on Roach Dry Lake, Nevada for use in testing the N-9M's, XP-56 and other small test craft during times when California rains closed the lakebeds around Muroc.

The N-9MB continued flying long after its two counterparts had been placed in storage. It is believed the Major Frank "Pete" Everest made the last flight in May 1949. During this flight, Everest encountered engine trouble and, due to lack of replacement engines and personnel, the airplane was retired.



The Northrop Aeronautical Institute received many retired airframes in the 1950's including the N-9M-2 and JB-1 (Right). At some point all three surviving N-9M's were stored there. The N9M-2 was dismantled by students in the course of their studies. The final disposition of the N-9MA is unknown, but the N-9MB survived and was donated to the Planes of Fame Museum in Chino, California.

After decades in storage, the N-9MB underwent restoration to flying condition that took over 11 years. Taxi tests of the restored aircraft began in January 1994 (left, above) and flew again November 8th. Shortly thereafter, the N-9MB was flown to Edwards AFB and posed with the only production Flying Wing, the Northrop B-2A Spirit.

The N-9MB made appearances at airshows all over the country for the next 25 years. Unfortunately, the one-of-a-kind airframe was destroyed during a test flight on April 22, 2019.

The author wishes to thank Mr. Gerald H. Balzer for his generous contribution of historical Northrop images and information for which this series of 'Look Back' articles would not have been possible. Mr. Balzer has spent his lifetime preserving, archiving and sharing Northrop historical documentation that would have otherwise been lost.

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