

# North American F-100 Super Sabre



A four-ship formation of F-100Cs

<b>Role</b>	Fighter, Fighter-bomber, Attack aircraft, Wild Weasel
<b>Manufacturer</b>	North American Aviation
<b>First flight</b>	25 May 1953
<b>Introduction</b>	27 September 1954
<b>Retired</b>	1988 Republic of China Air Force
<b>Status</b>	Phased out of service
<b>Primary users</b>	United States Air Force Turkish Air Force Republic of China Air Force French Air Force
<b>Produced</b>	1953-1959
<b>Number built</b>	2,294
<b>Unit cost</b>	US\$697,029 (F-100D) (\$5.7 million in today's dollars)
<b>Developed from</b>	F-86 Sabre
<b>Developed into</b>	North American F-107

The **North American F-100 Super Sabre** was a supersonic jet fighter aircraft that served with the United States Air Force (USAF) from 1954 to 1971 and with the Air National Guard (ANG) until 1979. The first of the Century Series collection of USAF jet fighters, it was the first USAF fighter capable of supersonic speed in level flight. The F-100 was originally

designed by North American Aviation as a higher performance follow-on to the F-86 Sabre air superiority fighter.

Adapted as a fighter bomber, the F-100 would be supplanted by the Mach 2 class F-105 Thunderchief for strike missions over North Vietnam. The F-100 flew extensively over South Vietnam as the Air Force's primary close air support jet until replaced by the more efficient subsonic A-7 Corsair II. The F-100 also served in several NATO air forces and with other US allies. In its later life, it was often referred to as "the Hun," a shortened version of "one hundred."

## **Design and development**

In January 1951, North American Aviation delivered an unsolicited proposal for a supersonic day fighter to the United States Air Force. Named *Sabre 45* because of its 45° wing sweep, it represented an evolution of the F-86 Sabre. The mockup was inspected 7 July 1951 and after over a hundred modifications, the new aircraft was accepted as the F-100 on 30 November 1951. Extensive use of titanium throughout the aircraft was notable. On 3 January 1952, the USAF ordered two prototypes followed by 23 F-100As in February and an additional 250 F-100As in August.

The YF-100A first flew on 25 May 1953, seven months ahead of schedule. It reached Mach 1.05 in spite of being fitted with a de-rated XJ57-P-7 engine. The second prototype flew on 14 October 1953, followed by the first production F-100A on 9 October 1953. The USAF operational evaluation from November 1953 to December 1955 found the new fighter to have superior performance but declared it not ready for wide scale deployment due to various deficiencies in the design. These findings were subsequently confirmed during Project Hot Rod operational suitability tests. Particularly troubling was the yaw instability in certain regimes of flight which produced inertia coupling. The aircraft could develop a sudden yaw and roll which would

happen too fast for the pilot to correct and would quickly overstress the aircraft structure to disintegration. It was under these conditions that North American's chief test pilot, George Welch, was killed while dive testing an early-production F-100A on 12 October 1954. Another control problem stemmed from handling characteristics of the swept wing at high angles of attack. As the aircraft approached stall speeds, loss of lift on the tips of the wings caused a violent pitch-up. This particular phenomenon (which could easily be fatal at low altitude where there was insufficient time to recover) became known as the "Sabre Dance".

Nevertheless, delays in the F-84F Thunderstreak program pushed the Tactical Air Command to order the raw F-100A into service. TAC also requested that future F-100s should be fighter-bombers, with the capability of delivering nuclear bombs.

The North American F-107 was a follow-on Mach 2 development of the F-100 with the air intake moved above and behind the cockpit. It was not developed in favor of the F-105 Thunderchief.

### **Operational history**

The F-100A officially entered USAF service on 27 September 1954 with 479th Fighter Wing at George AFB, CA. By 10 November 1954, the F-100As suffered six major accidents due to flight instability, structural failures, and hydraulic system failures, prompting the Air Force to ground the entire fleet until February 1955. The 479th finally became operational in September 1955. Due to ongoing problems, the Air Force began phasing out the F-100A in 1958, with the last aircraft leaving active duty in 1961. By that time, 47 aircraft were lost in major accidents. Escalating tension due to construction of the Berlin Wall in August 1961 forced the USAF to recall the F-100As into

active service in early 1962. The aircraft was finally retired in 1970.

The TAC request for a fighter-bomber was addressed with the **F-100C** which flew in March 1954 and entered service on 14 July 1955 with the 450th Fighter Wing, Foster AFB, TX. Operational testing in 1955 revealed that the F-100C was at best an interim solution, sharing all the vices of the F-100A. The uprated J57-P-21 engine boosted performance but continued to suffer from compressor stalls. On a positive note, the F-100C was considered an excellent platform for nuclear toss bombing because of its high top speed. The inertia coupling problem was more or less addressed with installation of a yaw damper in the 146th F-100C, later retrofitted to earlier aircraft. A pitch damper was added starting with the 301st F-100C, at a cost of US\$10,000 per aircraft.

The addition of "wet" hard points meant the F-100C could carry a pair of 275 US gal (1,040 l) and a pair of 200 US gal (770 l) drop tanks. However, the combination caused loss of directional stability at high speeds and the four tanks were soon replaced by a pair of 450 US gal (1,730 l) drop tanks. The 450s proved scarce and expensive and were often replaced by smaller 335 US gal (1,290 l) tanks. Most troubling to TAC was the fact, that, as of 1965, only 125 F-100Cs were capable of utilizing all non-nuclear weapons in the Air Force inventory, particularly cluster bombs and AIM-9 Sidewinder air-to-air missiles. By the time the F-100C was phased out in June 1970, 85 had been lost in major accidents.

The definitive **F-100D** aimed to address the offensive shortcomings of the F-100C by being primarily a ground attack aircraft with secondary fighter capability. To this effect, the aircraft was fitted with autopilot, upgraded avionics, and, starting with the 184th production aircraft, the Sidewinder capability. In 1959, 65 aircraft were modified to also fire the AGM-12 Bullpup

air-to-ground missile. To further address the dangerous flight characteristics, the wing span was extended by 26 in (66 cm) and the vertical tail area was increased by 27%.

The first F-100D (54-2121) flew on 24 January 1956, piloted by Daniel Darnell. It entered service on 29 September 1956 with 405th Fighter Wing at Langley AFB. The aircraft suffered from reliability problems with the constant speed drive which provides constant-frequency current to electrical systems. In fact, the drive was so unreliable that USAF required it to have its own oil system to minimize damage in case of failure. Landing gear and brake parachute malfunctions claimed a number of aircraft, and the refueling probes had a tendency to break away during high speed maneuvers. Numerous post-production fixes created such a diversity of capabilities between individual aircraft that by 1965 around 700 F-100Ds underwent High Wire modifications to standardize the weapon systems. High Wire modifications took 60 days per aircraft at a total cost of US\$150 million. In 1966, Combat Skyspot program fitted some F-100Ds with an X band radar transmitter to allow for ground-directed bombing in inclement weather or at night.

In 1961, at England AFB, LA, (401st Tactical Wing), there were four fighter/bomber squadrons. These were the 412th, 413th, 414th and the 415th (Fighting Tigers). During the Berlin Crisis (approximately 09/61) the 615th was deployed to Ramstein Air Base, Germany to support the West Germans. At the initial briefing, the 415th personnel were informed that due to the close proximity of the USSR, if an ICBM were to be launched, they would only have thirty minutes to launch the 415th aircraft and retire to the nearest German bunker.

In 1967, the USAF began a structural reinforcement program to extend the aircraft's service life from the designed 3,000 flying hours to 7,000. USAF alone lost 500 F-100Ds, predominantly in accidents. After one aircraft suffered wing failure, particular

attention was paid to lining the wings with external bracing strips. During the Vietnam War, combat losses constituted as many as 50 aircraft per year. On 7 June 1957, an F-100D fitted with an Astrodyne booster rocket making 150,000 lbf (667.2 kN) of thrust successfully performed a zero length launch. This was accomplished with the addition of a large canister to the underside of the aircraft. This canister contained a black powder compound and was ignited electro-mechanically, driving the jet engine to minimal ignition point. The capability was incorporated into late-production aircraft. After a major accident, the USAF Thunderbirds reverted from F-105 Thunderchiefs to the F-100D which they operated from 1964 until it was replaced by the F-4 Phantom II in 1968.

The F-100 was the subject of many modification programs over the course of its service. Many of these were improvements to electronics, structural strengthening, and projects to improve ease of maintenance. One of the more interesting of these was the replacement of the original afterburner of the J-57 engine with the more advanced afterburners from retired Convair F-102 Delta Dagger interceptors. This modification changed the appearance of the aft end of the F-100, doing away with the original "petal-style" exhaust. The afterburner modification started in the 1970s and solved maintenance problems with the old type as well as operational problems, including compressor stall issues.

The F-100F two-seat trainer entered service in 1958. It received many of the same weapons and airframe upgrades as the F-100D, including the new afterburners. By 1970, 74 F-100Fs were lost in major accidents.

By 1972, the F-100 was mostly phased out of USAF active service and turned over to tactical fighter groups and squadrons in the ANG. In Air National Guard units, the F-100 was

eventually replaced by the F-4 Phantom II, LTV A-7 Corsair II, and A-10 Thunderbolt II, with the last F-100 retiring in 1979.

North American received a contract to modify six F-100As to RF-100As carrying five cameras, three K-17s in a trim trogon mounting for photo-mapping and two K-38s in a split vertical mounting with the cameras mounted horizontally, shooting via a mirror angled at 45° to reduce the effects of airframe vibrations. All gun armament was removed and the cameras installed in the gun and ammunition bays covered by a bulged fairing under the forward fuselage.

The selected pilots trained on the F-100A at Edwards AFB and George AFB in California and then at Palmdale for training with the actual RF-100As they would be deployed with. Flight tests revealed that the RF-100A in its intended operational fit of four external tanks was lacking in directional and longitudinal stability, requiring careful handling and close attention to speed limitations for the drop tanks.

Once pilot training was completed in April 1955, three aircraft were deployed to Bitburg Air Base in Germany, flying to Brookley AFB in Mobile, Alabama, cocooned, loaded on an aircraft carrier and delivered to Short Brothers at Sydenham, Belfast for re-assembly/preparation for flight. At Bitburg they were allocated to Detachment 1 of the 7407th Support Squadron and commenced operations flying over eastern bloc countries at high altitude (over 50,000 ft) to acquire intelligence on military targets. Many attempts were made to intercept these aircraft to no avail, with some photos of fighter airfields clearly showing aircraft climbing for attempted intercepts. The European detachment probably only carried out six missions between mid-1955 and mid-1956 when the Lockheed U-2 took over as the deep penetration reconnaissance asset.

Three RF-100As were also deployed to the 6021st Reconnaissance Squadron at Yokota Air Base in Japan, but details of operations there are not available. Two RF-100A aircraft were lost in accidents; one due to probable over speeding which caused the separation of one of the drop tanks and resulted in complete loss of control, and the other due to an engine flame-out. In mid-1958, all four remaining RF-100As were returned to the USA and later supplied to the Republic of China Air Force in Taiwan.

"High Wire" was a modernization program for selected F-100Cs, Ds and Fs. It consisted of two modifications – electrical rewiring upgrade, and heavy maintenance and IRAN upgrade. Rewiring upgrade operation consisted of replacing old wiring and harnesses with improved maintainable designs. Heavy maintenance and IRAN (inspect and repair as necessary) included new kits, modifications, standardized configurations, repairs, replacements and complete refurbishment.

This project required all new manuals (TOs) and incremented (i.e. -85 to -86) block numbers. All later production models, especially the F models included earlier High Wire modifications. New manuals included colored illustrations. All manuals will have the Roman numeral (I) added after the aircraft number (i.e. T.O. 1F-100D(I)-1S-120, 12 January 1970).

On 16 April 1961 six Super Sabres were deployed from Clark Air Base in the Philippines to Don Muang Airfield in Thailand for air defense purposes; the first F-100s to enter combat in Southeast Asia. From that date until their redeployment in 1971, the F-100s would be the longest serving US jet fighter-bomber to fight in the Vietnam War. Serving as MiG CAP escorts for F-105 Thunderchiefs, MISTY FACs, and Wild Weasels over North Vietnam, and then relegated to close air support and ground attacks within South Vietnam.



The Vietnam War was not known for utilizing activated Army National Guard, Air National Guard or other US Reserve units; but rather, had a reputation for conscription (military draft) during the course of the war. During a confirmation hearing before Congress in 1973, USAF General George S. Brown, who had commanded the 7th Air Force (7 AF) during the war, stated that five of the best Super Sabre squadrons in Vietnam were from the ANG. This included the 120th Tactical Fighter Squadron (120 TFS) of the Colorado Air National Guard, the 136 TFS of the New York Air National Guard TFS, the 174 TFS of the Iowa Air National Guard and the 188 TFS of the New Mexico Air National Guard. The fifth unit was a regular AF squadron manned by mostly Air National Guardsmen.

The Air National Guard F-100 Squadrons increased the regular USAF by nearly 100 Super Sabres in theater, averaging, for the Colorado ANG F-100s, 24 missions a day, delivering ordnance and munitions with a 99.5% reliability rate. From May 1968 to April 1969, the ANG Super Sabres flew more than 38,000 combat hours and more than 24,000 sorties.

The Hun was also deployed as a two-seat F-100F model which saw service as a "Fast FAC" or *Misty* FAC (forward air controller) in North Vietnam and Laos, spotting targets for other fighter-bomber aircraft, performing road reconnaissance, and conducting SAR (Search and Rescue) missions as part of the top-secret project Commando Sabre, based out of Phu Cat and Tuy Hoa Air Bases. It was also the first Wild Weasel SEAD (air defense suppression) aircraft whose specially-trained crews were tasked with locating and destroying enemy air defenses. Four F-100F Wild Weasel Is were fitted with an APR-25 vector radar homing and warning (RHAW) receivers, IR-133 panoramic receivers with greater detection range, and KA-60 panoramic cameras. The APR-25 could detect early-warning radars and, more importantly, emissions from SA-2 Guideline tracking and guidance systems. These aircraft deployed to Korat Royal Thai

Air Force Base, Thailand in November 1965, and began flying combat missions with the 388th Tactical Fighter Wing in December. They were joined by three more aircraft in February 1966. All Wild Weasel F-100Fs were eventually modified to fire the AGM-45 Shrike anti-radiation missile.

The F-100 was progressively replaced by the F-4 Phantom II and the F-105 Thunderchief. The *Hun* had logged 360,283 combat sorties during the war and its wartime operations came to end on 31 July 1971.

The U.S. Air Force Thunderbirds operated the F-100C from 1956 until 1964. After briefly converting to the F-105 Thunderchief, the team flew F-100Ds from July 1964 until November 1968, before converting to the F-4E Phantom II.



## **MAPS F-100D, Serial Number 56-3081**

MAPS Super Sabre was manufactured by North American Aviation in Inglewood, California and delivered to the United States Air Force on June 19, 1957. It was assigned to the 312<sup>th</sup> Fighter-Bomber Wing (part of the Tactical Air Command) at Cannon Air Force Base (AFB) in New Mexico. During this assignment, it was deployed to Seymour-Johnson AFB in North Carolina. In June of 1958, the 312<sup>th</sup> Fighter-Bomber Wing was transferred to George AFB in California. During this assignment, the aircraft had deployments back to Cannon AFB and to Chiayi, Taiwan. In February of 1959, 56-3081 was re-assigned to the 27<sup>th</sup> Tactical Fighter Wing (TAC) also stationed on George AFB. The F-100D had a deployment to Ircirlik Air Base in Turkey during this assignment. In March of 1965, the aircraft was assigned to the 4510<sup>th</sup> Combat Crew Training Wing (TAC) stationed at Luke AFB in Arizona.

In April of 1969, the F-100D was re-assigned from the Tactical Air Command to the Pacific Air Forces when assigned to the 3<sup>rd</sup> Tactical

Fighter Wing stationed in Bien Hoa Air Base in Vietnam. While in country, the aircraft was assigned to the 35<sup>th</sup> Tactical Fighter Wing at Phan Rang Air Base (October 1969) and to the 31<sup>st</sup> Tactical Fighter Wing stationed at Tuy Hoa Air Base (June 1970). Upon return to CONUS, 56-3081 was stationed with the 4403<sup>rd</sup> Tactical Fighter Wing at England Air Force Base, Louisiana.

The F-100D was transferred to the Reserve Services in April of 1972. Its initial reserve assignment was with the 121<sup>st</sup> Tactical Fighter Group (Air National Guard) located at Lockbourne Air Force Base which was 12 miles southeast of Columbus. In October of 1974, the airframe was assigned to the 132<sup>nd</sup> Tactical Fighter Squadron (ANG) in Des Moines, Iowa. September of 1976 brought another assignment, this time with the 131<sup>st</sup> Tactical Fighter Squadron at Lambert Field in Missouri. In

November of 1978 the F-100D was sent to the Military Aircraft Storage and Disposition Center at Davis-Monthan Air Force Base in Arizona. Ten years later, the aircraft was recovered by the Air Force and converted to a QF-100 D target drone. 56-3081 escaped combat damage during its three tours in Vietnam, but as a drone it was hit by an AIM-9 Sidewinder Missile. The missile came in from the upper left side and struck the lower edge of the rudder then punching a hole in the left inboard aileron. While there was no explosion (as this was probably a guidance only test) the nose gear of the aircraft collapsed upon landing and ground off a section of the forward lower intake.

In June of 1998, the airframe was shipped to the Florida Military Aviation Museum in Clearwater, Florida. When the museum

closed a few years later, 56-3081 was disassembled and sent to a swampy field south of Winterhaven, Florida.

In the Fall of 2004, a MAPS team traveled to Winterhaven, Florida to prepare the North American F-100D along with a McDonnell F-101F Voodoo (Serial # 57-0342) and a Convair F-102A Delta Dagger (Serial # 51-0986) back to MAPS.

Disassembly started on November 12, 2004 with arrival on November 16, 2004. These three aircraft were provided through the U.S. Air Force Museum accreditation that was achieved late in 2002. This initial shipment contained primarily the fuselage sections of the airframes. Restoration started in June of 2005. Retrieval of the wings and other parts was delayed while funds were raised to defray movement costs. These parts were retrieved and moved to MAPS on December 16, 2006. The F-100D was restored and dedicated on June 17, 2012.

## **Variants**

### **YF-100A**

Prototype, Model NA-180 two built, s/n 52-5754 and 5755.

### **YQF-100**

9 test unmanned drone version: 2 D-models, 1 YQF-100F F-model, (see DF-100F), and six other test versions.

### **F-100A**

Single-seat day fighter; 203 built, Model NA-192.



F-100As different tail fins, 1955.

### **RF-100A ("Slick Chick")**

Six F-100A aircraft modified for photo reconnaissance in 1954. Unarmed, with camera installations in lower fuselage bay. Used for over flights of Soviet Bloc countries in Europe and the Far-East. Retired from USAF service in 1958, the surviving four aircraft were transferred to the Republic of China Air Force and retired in 1960.

### **F-100B**

See North American F-107

### **F-100BI**

Proposed interceptor version of F-100B, did not advance beyond mock-up.

### **F-100C**

Seventy Model NA-214 and 381 Model NA-217. Additional fuel tanks in the wings, fighter-bomber capability, probe-and-drogue refueling capability, uprated J57-P-21 engine on late production aircraft. First flight: March 1954; 476 built.

### **TF-100C**

One F-100C converted into a two-seat training aircraft.

### **F-100D**

Single-seat fighter-bomber, more advanced avionics, larger wing and tail fin, landing flaps. First flight: 24 January 1956; 1,274 built.



F-100Ds of the 416th Tactical Fighter Squadron at Da Nang Air Base, South Vietnam, in 1965

## **F-100F**

Two-seat training version, armament decreased from four to two cannon. First flight: 7 March 1957; 339 built.



A USAF F-100F of the 352d TFS at Phu Cat Air Base, South Vietnam, 1971.

## **DF-100F**

This designation was given to one F-100F that was used as drone director.

## **NF-100F**

Three F-100Fs used for test purposes, the prefix "N" indicates that modifications prevented return to regular operational service.

## **TF-100F**

Specific Danish designation given to 14 F-100Fs exported to Denmark in 1974, in order to distinguish these from the 10 F-100Fs delivered 1959–1961.

## **QF-100**

Another 209 D and F models were ordered and converted to unmanned radio-controlled FSAT (Full Scale Aerial Target) drone and drone directors for testing and destruction by modern air-to-air missiles used by current US Air Force fighter jets.



A QF-100D pilotless drone near Tyndall Air Force Base, Florida (USA), in 1986.

**F-100J**

Un-built all-weather export version for Japan.

**F-100L**

Un-built variant with a J57-P-55 engine.

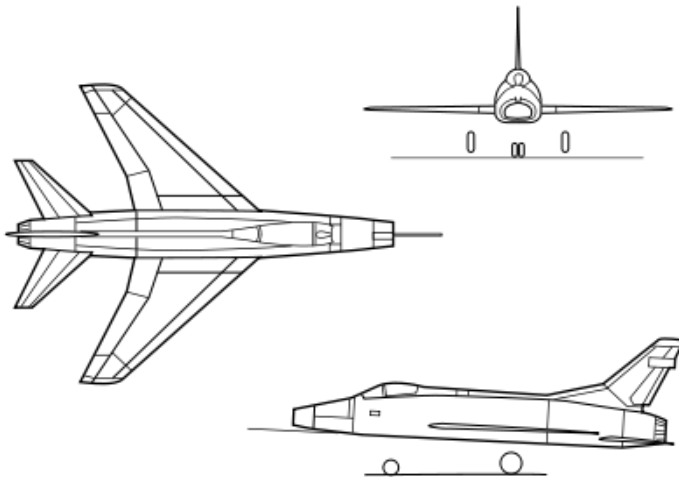
**F-100N**

Un-built version with simplified avionics.

**F-100S**

Proposed French-built F-100F with Rolls-Royce Spey turbofan engine.

**General characteristics (F-100)**



- **Crew:** 1
- **Length:** 50 ft. (15.2 m)
- **Wingspan:** 38 ft. 9 in (11.81 m)
- **Height:** 16 ft. 2¾ in (4.95 m)
- **Wing area:** 400 ft<sup>2</sup> (37 m<sup>2</sup>)
- **Empty weight:** 21,000 lb. (9,500 kg)
- **Loaded weight:** 28,847 lb. (13,085 kg)
- **Max takeoff weight:** 34,832 lb. (15,800 kg)
- **Power plant:** 1 × Pratt & Whitney J57-P-21/21A turbojet
  - **Dry thrust:** 10,200 lbf (45 kN)
  - **Thrust with afterburner:** 16,000 lbf (71 kN)
- **\*Zero-lift drag coefficient:** 0.0130
- **Drag area:** 5.0 ft<sup>2</sup> (0.46 m<sup>2</sup>)
- **Aspect ratio:** 3.76

### Performance

- **Maximum speed:** 750 kn (864 mph, 1,390 km/h, Mach 1.13)
- **Range:** 1,733 NM (1,995 mi, 3,210 km)
- **Service ceiling:** 50,000 ft. (15,000 m)
- **Rate of climb:** 22,400 ft./min (114 m/s)
- **Wing loading:** 72.1 lb./ft<sup>2</sup> (352 kg/m<sup>2</sup>)
- **Thrust/weight:** 0.55
- **Lift-to-drag ratio:** 13.9

### Armament

- **Guns:** 4× 20 mm (0.787 in) Pontiac M39A1 revolver cannon
- **Missiles:**
  - 4× AIM-9 Sidewinder *or*
  - 2× AGM-12 Bullpup *or*
  - 2× or 4× LAU-3/A 2.75" unguided rocket dispenser
- **Bombs:** 7,040 lb. (3,190 kg) of weapons, including
  - Conventional bombs *or*
  - Mark 7 nuclear bomb *or*
  - Mk 28 nuclear bomb *or*
  - Mk 38 nuclear bomb *or*



- Mk 43 nuclear bomb

### **Avionics**

- Minneapolis-Honeywell MB-3 automatic pilot
- AN/AJB-1B low-altitude bombing system
- AN/APR-26 rearward radar warning