

F-104 STARFIGHTER

in action



DON GREER



Aircraft Number 135
squadron/signal publications

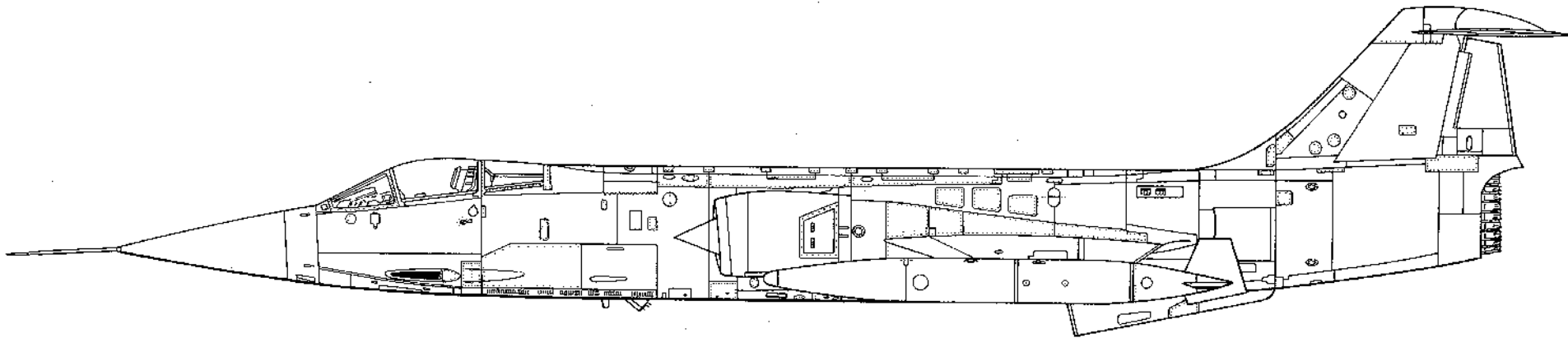
F-104 STARFIGHTER

in action

by Phillip Friddell

Color by Don Greer & Tom Tullis

Illustrated by Joe Sewell & Lori Basham



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An F-104C Starfighter of the 479th Tactical Fighter Wing flies over the California high desert near George Air Force Base during late 1959. The aircraft carries three fuselage bands identifying it as being assigned to the wing commander.

LOCKHEED



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Dedication

For my dad, who helped a very small boy learn to love airplanes.

Acknowledgements

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This formation of Tactical Air Command F-104C Starfighters is believed to have been assigned to the 479th Tactical Fighter Wing, but have not had their distinctive unit markings applied. Of the four aircraft, 57-0915 crashed in October of 1959 and only 0926 survived its Air Force career to be preserved at Fargo, North Dakota. The others crashed at different times and were destroyed. (Lockheed)



Introduction

The Lockheed F-104 Starfighter has proven itself to be one of the world's great aviation enigmas, a special purpose fighter never used as its designers intended, yet possessing performance far in excess of that found in any of its contemporaries. Designed as a relatively inexpensive, simple air superiority fighter, the F-104, in the end, was neither particularly cheap or simple. Yet it soldiers on in the air forces of several nations, a tribute both to its concept and its design, which dates back to the Communist invasion of South Korea.

The Korean War was an eye opener for the United States Air Force. Initially, USAF planners anticipated fighting an obsolescent Communist air arm armed with piston-engined fighters. The introduction of the MiG-15 came as a rude shock to the United Nations' air forces. Superior to all combat aircraft in Korea except the F-86 Sabre, the MiG-15 proved both an embarrassment and a source of considerable concern to the Air Force. Although inferior to the North American F-86 Sabre in a number of respects, the MiG's rate of climb and maneuverability in combat led many to call for a new high performance jet fighter, able to outfly and outfight any enemy aircraft. The new aircraft would be a fighter pilot's aircraft, reversing the trend towards heavier, more complicated fighter/fighter-bombers.

Lockheed had been thinking along these lines since 1950. One of aviation's more creative minds, Clarence L. "Kelly" Johnson, was involved with the program from the beginning and had designed a revolutionary new fighter, far different from anything previously flown. The design appeared to be spectacularly promising and in December of 1952, Lockheed submitted a preliminary design, L-246, to the Air Force for consideration. This unsolicited proposal was accepted and, in March of 1953, the Air Force chose the F-104 over designs submitted by Republic and North American. The initial contract was for only two XF-104 prototypes and one year of authorized flight testing.

Design development and aircraft construction proceeded at a rapid pace and the first XF-104 was presented to the Air Force for flight testing (Phase I and II) in February of

The number one XF-104 (53-7786, FG-786) on the ramp at Edwards Air Force Base, California. The aircraft was unarmed, although it was originally planned to arm production Starfighters with a pair of 30MM cannons. This aircraft was destroyed in a crash on 19 April 1955. (Lockheed)



1954. The prototype was unlike anything the Air Force had flown before. It had a long thin needle nosed fuselage, with extremely thin mid-mounted wings with pronounced anhedral and a horizontal stabilizer set high on the fin. Initial flight tests were flown by Lockheed at their North Base facility located at Edwards AFB, with subsequent testing to be performed by the Air Force. In keeping with their Star series of names, Lockheed gave the XF-104 the name Starfighter.

High speed taxi and lift-off tests were made on 27 February 1954, with the first flight taking place on 5 March. During both the first and second flights, the aircraft's landing gear failed to retract and fuel pressure problems were experienced as well. Performance on these flights was far less than expected due to the forced substitution of a 7,800 lbs (10,300 lbst in afterburner) J-65 engine rather than the as yet unavailable 9,600 lbst (14,800 lbst in afterburner) J-79 intended for production F-104s. During flight testing at Edwards the XF-104 was re-engined with an afterburning variant of the J-65, a Buick-built Curtiss-Wright adaptation of the British Sapphire engine. This helped, but the prototype still did not have the performance figures predicted by Lockheed.

During testing, the XF-104 reached Mach 1.7 and an altitude of over 50,000 feet. Based on this performance, the Air Force ordered seventeen service test YF-104As and recommended that the aircraft be placed into production once the J-79 became available in quantity.

YF-104A

The first YF-104A was delivered to the Air Force in February of 1956. The YF-104A differed from the XF-104 in a number of ways. The fuselage was some five feet six inches longer due to the installation of the J-79 engine, the nose gear now retracted forward instead of rearward as on the XF-104, a fairing had been added along the aircraft's spine and the air intakes were modified with center body shock cones. These shock cones were the cause of some concern since Lockheed wanted to publicly unveil the aircraft and the Air Force did not want the shape of the shock cones to be revealed. The answer was in a pair of sheet metal covers that were put over the intakes during the rollout ceremony on

The first and second XF-104 prototypes in formation over Edwards AFB. The wing tanks carried on FG-786 were not used on the production aircraft. The second XF-104 prototype (53-7787, FG-787) outlived FG-786, but not for long. It was destroyed in a crash on 11 July 1957. (Lockheed)



16 February 1956. These covers quickly became known as "flight falsies."

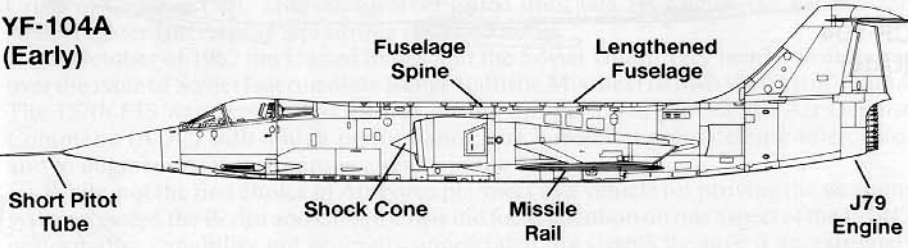
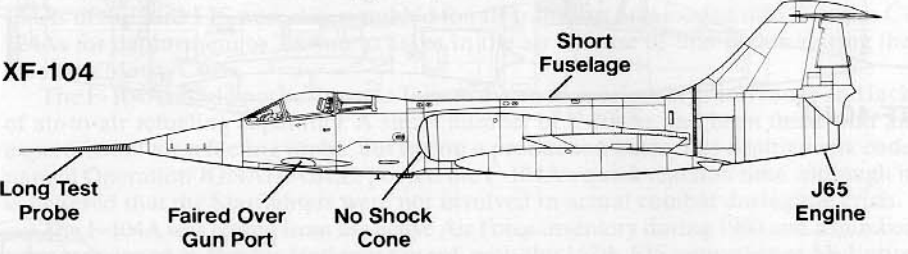
All seventeen YF-104As were used by Lockheed and the Air Force to test various components of the F-104 weapons system, including the proposed internal M61 cannon armament, wingtip mounted AIM-9 Sidewinder missiles and wingtip external fuel tanks. On 28 February 1956, YF-104A number one exceeded Mach 2, becoming the first fighter in the world to be capable of double Mach speeds.

The YF-104A revealed some deficiencies including a lack of low speed maneuverability, compressor problems with the J-79 engine, a tendency for the nose to pitch up at high angles of attack and difficulty with the Lockheed designed downward ejection seat, an escape system adopted due to its light weight and lack of complexity.

In addition to the YF-104As, Lockheed was also contracted for seven preproduction F-104As and by 5 December 1956 all of these had been delivered to the Air Force. These aircraft were modified during the test program with a small ventral fin to improve lateral control and blown flaps to improve the aircraft's high sink rate. These modifications were retrofitted to early YF-104As. During Phase VI tests, at least one YF-104A and three preproduction F-104As were fitted with full armament and electronics for weapons testing.

At the completion of flight testing, the surviving YF-104As and preproduction F-104As were brought up to production standards and ultimately issued to service squadrons.

Fuselage Development



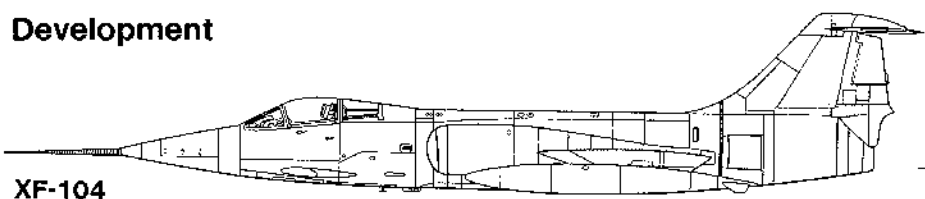
One of the seventeen YF-104As (55-2963) on the ramp at Elmendorf AFB, Alaska, for cold weather testing. This aircraft was assigned to the Air Force Flight Test Center (AFFTC) and carried Arctic markings applied on the tail surfaces. The legend Phase V above the U. S. Air Force probably refers to the stage of testing the aircraft was in. (Isham Collection)

Many early Starfighters led multiple lives, 55-2966 was a YF-104A originally assigned to the Air Force Flight Test Center. The entire nose appears to have been painted Red-Orange and it was equipped with underwing tanks and a non-standard test boom in place of the pitot tube at Edwards AFB during May of 1959. During 1961, the aircraft was modified to QF-104A drone standards. (AFFTC/Isham Collection)

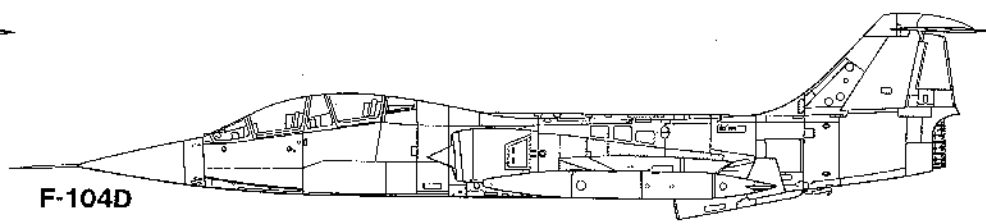


Development

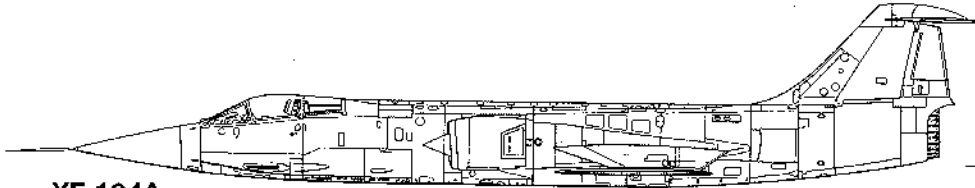
XF-104



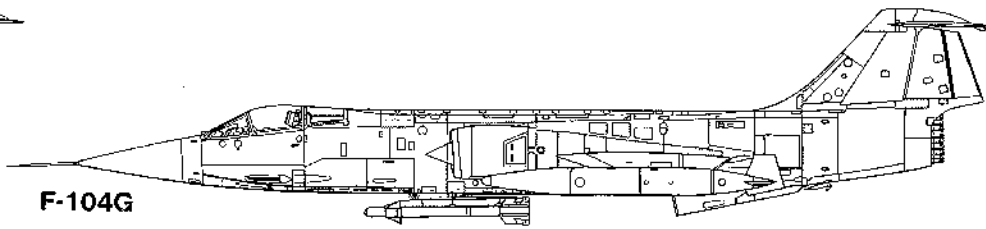
F-104D



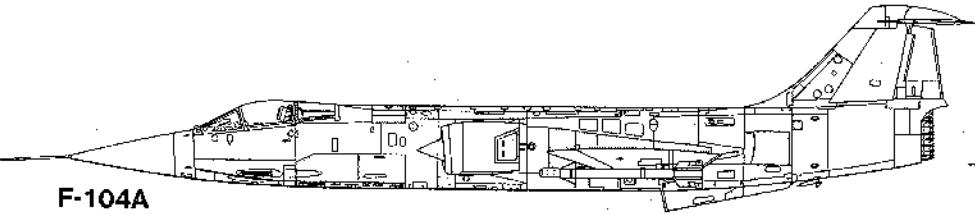
YF-104A



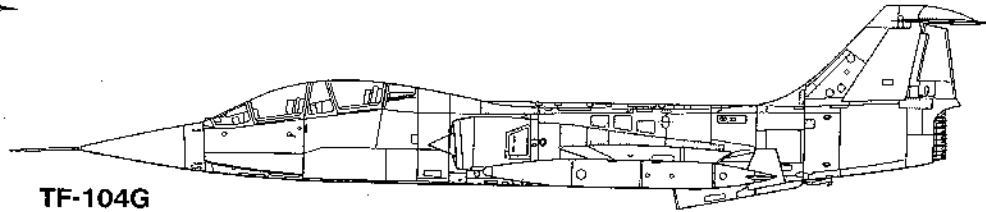
F-104G



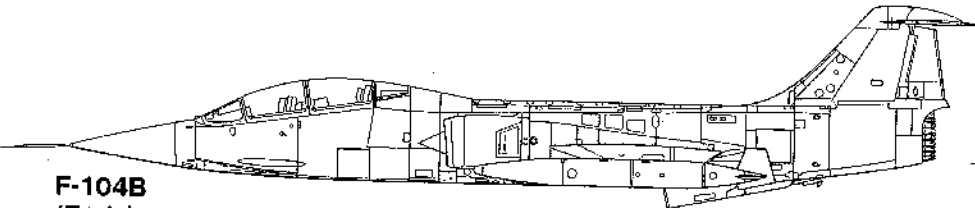
F-104A



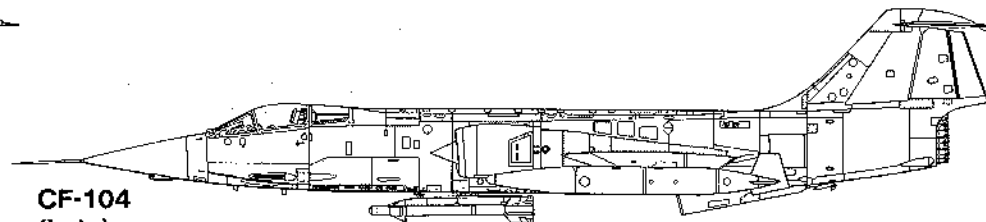
TF-104G



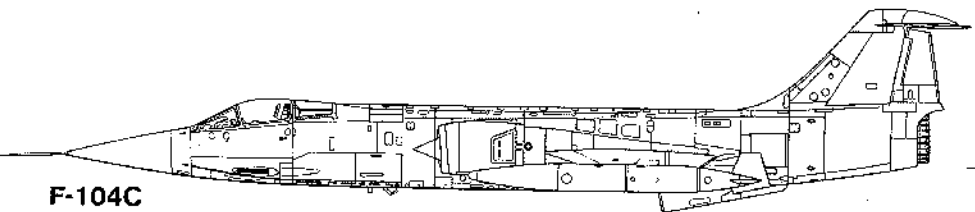
F-104B
(Early)



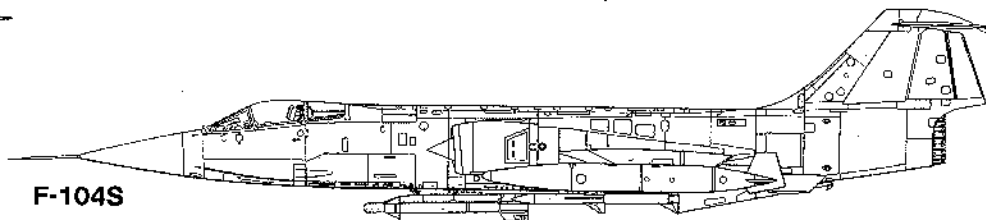
CF-104
(Late)



F-104C



F-104S



F-104A

On 2 March 1956 the USAF ordered 146 production F-104A Starfighters. These aircraft differed from the earlier YF-104A in that they had a strengthened airframe, installation of the ventral fin as standard and blown flaps. Early F-104As were armed with two AIM-9 Sidewinder missiles on the wingtips and, although they had provision for the M61 cannon, the cannon port was faired over. Extended difficulties with the M61 Vulcan 20MM cannon system led to a decision to produce the F-104A without the internal gun. As a result, most active Air Force F-104As spent most of their operational career with their gun ports faired over and ballast fitted in place of the M61.

Installation of the 9,600 lbt (14,800 lbt in afterburner) General Electric J79-GE-3A took place during 1957, with the improved J79-GE-3B being fitted in April of 1958, some three months after the F-104A had entered service with the 83rd Fighter Interceptor Squadron (FIS). When the F-104A entered service it was not in the air superiority role that Lockheed had originally envisioned, but in the role it was least suited for, that of interceptor. This reassignment of roles was due in part to the problems with the M61 and the fact that Air Defense Command urgently needed an aircraft to bridge the gap between the drawn down of the F-102 and the introduction of the F-106.

Four ADC squadrons equipped with the F-104A/B during 1958: the 83rd FIS at Hamilton AFB (February), the 337th FIS at Westover AFB (April), the 538th at Larson AFB (June) and the 56th FIS at Wright Patterson AFB (July). In October of 1958 twelve F-104As of the 83rd FIS were disassembled for air transport and loaded into Douglas C-124As for deployment to Taiwan to assist in the air defense of that nation during the Quemoy/Matsu Crisis.

The F-104As could not be flown to Taiwan due to their relatively short range and lack of air-to-air refueling capability. A small number of F-104As had been fitted with an experimental air refueling probe, but not on a production basis. The deployment, code named Operation JONAH ABLE, proved the F-104A's quick reaction time, although it is believed that the Starfighters were not involved in actual combat during the crisis.

The F-104A was retired from the active Air Force inventory during 1960 and a number were reassigned to the Air National Guard, with the 157th FIS activating at McEntire ANGB (March), the 151st FIS at McGhee Tyson (April) and the 197th FIS at Skyharbor Airport, Arizona (June). These aircraft were employed to the fullest extent during the tense days of 1961 and 1962, with the 157th FIS deploying to Moron Air Base, Spain and the 151st and 197th FIS going to Ramstein Air Base, West Germany, during the Berlin Crisis of October 1961. This deployment lasted until late 1962 when the Federalized ANG Fighter Interceptor Squadrons returned home.

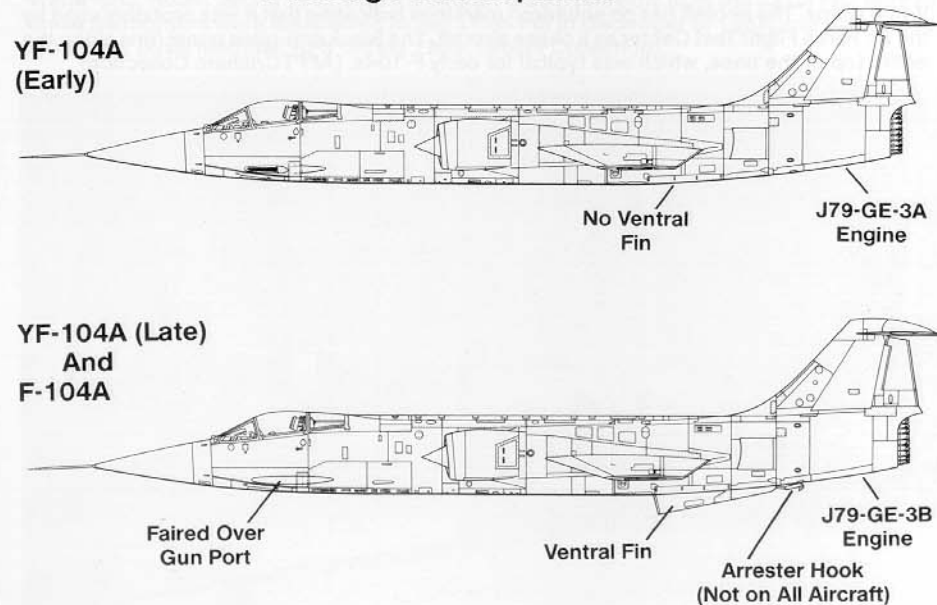
In October of 1962 the United States and the Soviet Union very nearly went to war over the issue of Soviet Intermediate Range Ballistic Missiles (IRBMs) in Castro's Cuba. The 157th FIS was deployed to Florida during this period to provide the Air Defense Command (ADC) with a high performance, quick reaction point defense interceptor and to augment ADC squadrons already in the area.

While not the first choice of Air Force planners as a vehicle for proving the weapons system concept, the Berlin and Cuban Crisis did focus attention on one aspect of the F-104's performance capability not generally appreciated. Its simplicity gave it an extremely quick reaction time and its phenomenal performance gave it a VFR interception capability not found in any other interceptor then in service. Consequently, the 319th FIS at Homestead AFB and the 331st FIS at Webb AFB, re-equipped with the F-104A during 1963, their aircraft being reclaimed from Air National Guard units! The 319th stayed in Florida to guard against Cuban incursions into U.S. air space until December of 1969



This F-104A of the 56th FIS has the M61 cannon port faired over and missile rails for AIM-9 Sidewinders on the wingtips. The Starfighter had the performance to be an interceptor, but its weapons limitation (two AIM-9B Sidewinders), short range and lack of an effective radar limited the F-104A to the point of defense role. 0587 served with the 56th, the 157th, the 331st and the 319th before being destroyed in a crash in 1968. (Fridell Collection)

Fuselage Development



and the 331st deployed to Puerto Rico during the Dominican Republic Crisis of May 1965. When these units retired their Starfighters it ended the active duty service of the F-104A, although several aircraft were retained at Edwards Air Base for use by Air Systems Command.

The F-104A had had a short life span with the Air Force, but it had an even shorter one with the U.S. Navy. The Navy required the use of a Mach 2 fighter to test the AIM-9 family of air-to-air missiles at supersonic speeds, but its own high performance jets, such as the Chance Vought F8U Crusader, were not yet in service. As a result, three F-104s were assigned (on loan) to NWTC China Lake during 1959, with the majority of the tests being performed during 1960 and 1961. The three aircraft involved were a YF-104A (55-2956) and two production F-104As (56-0740 and 56-0757) which were crewed by Air Force personnel from the 83rd FIS. The YF-104 survived the test program to become a QF-104A drone, while F-104A 56-0740 crashed at China Lake on 22 September 1960, and the second aircraft (56-0757) met a similar fate on 7 April 1961.

These aircraft were unique in that they received full Navy markings during their time at China Lake, with the Air Force serial number being modified to the current Navy-style Bureau Number (BuNo) which was carried on both the aft fuselage and, in abbreviated form, on the vertical stabilizer. The last three digits of the serial number appeared on the aircraft nose as a side number.

QF-104A

Systems Command had, of necessity, been involved with the F-104 program from the very beginning, but their association with the Starfighter type deepened during 1959 when Lockheed, in conjunction with the Sperry-Phoenix Company, began work on

This F-104A on the ramp at Edwards AFB during the mid-1960s has a Light Gray fuselage and White wings. The aircraft has no squadron markings indicating that it was probably used by the Air Force Flight Test Center as a chase aircraft. The Black anti-glare panel runs along the entire top of the nose, which was typical for early F-104s. (AFFTC/Isham Collection)



what was to become the QF-104A, a Mach 2 target drone. The first flight of a QF-104A took place during late 1960 and ultimately a total of twenty-two aircraft, all early production F-104As, were modified to QF standard. As originally planned, six QF-104As were to be maintained for use at Eglin AFB Auxiliary Field Number 3, with the remaining aircraft to be maintained in storage at Sacramento ALC (the depot responsible for Starfighter support) until they were needed to replace expended drones.

The QF-104A was part of an overall system that included the drone, a DT-33A airborne director, a mobile ground director station, and four Eglin Test Range drone control sites. The ground director station was particularly valuable to the program since the QF-104s were seldom destroyed and were usually recovered for future use, primarily in testing of the IM-99A and IM-99B Bomarc air defense missile.

The QF-104A modification consisted of the removal of all combat and fire control systems and subsystems and the installation of radio receivers, transponder beacons, a telemetry transmitting system, an electronic scoring system, an optical scoring system (made up of five 16MM cameras), a smoke generator, a self-destruct system, a field arrestor hook and additional fuel tanks in the gun bay area providing an additional 100 gallons of internal fuel capacity. Range was further extended by the continued use of the Starfighter's wingtip tanks along with optional 195 gallon pylon tanks.

Full provision was retained for a pilot to allow for aircraft ferry flights and a minimum of communications gear was kept in the aircraft for use during manned flights. An upward-firing Lockheed C-2 ejection seat replaced the F-104A's original downward-firing unit, providing the drone pilots with a far better chance of escaping from a stricken aircraft.

The QF-104A's operational use was plagued with the compressor stall problems associated with the original J79-GE-3A power plant. They also experienced landing gear retraction problems and suffered from severe tire wear until director proficiency during landings increased. All operational QF-104As were flown by the 3205th Drone Squadron

An F-104A of the 83rd Fighter Interceptor Squadron taxis past another F-104A parked in a revetment on Taoyan Air Base, Taiwan on 15 September 1958. The F-104s were deployed to Taiwan as part of Operation JONAH ABLE to assist with the air defense of the island during the Quemoy/Matsu Crisis. (via Larry Davis)



(DS), with the 3201st Maintenance Group (MG) and the 3208th Test Group (TG) providing operational support. The QF-104A was the longest lived of all the American Starfighter variants, outlasting the Starfighters of both ADC and TAC. The last QF-104 operations took place during the early 1970s, proving to an extent the versatility of the basic F-104 design.

Taiwan

During 1960, twenty-one F-104As and five F-104Bs were transferred to the 28th Fighter Squadron, Chinese Nationalist Air Force. Later, a number of these F-104A/Bs were sent to Jordan and Pakistan after being replaced by F-104Gs and two-seat TF-104Gs. All F-104s served with the 5th Fighter Wing based at Ching Chuan Kang Air Base (CCK) near Taipei, and the F-104Gs still provide air defense for Taiwan.

Jordan

Another nation to use the F-104A was Jordan, which bought thirty-two F-104As and four F-104Bs, formerly operated by Taiwan, during 1966. Initial deliveries began in 1967, when two F-104As and three F-104Bs were flown into Amman. This delivery came just prior to the outbreak of the 1967 Arab-Israeli War and the U.S. removed the F-104s to Turkey just before the outbreak of hostilities.

Jordan lost her entire air force during the war and desperately needed to re-equip if a credible deterrent was to be maintained. The U.S. government initially refused to return the F-104s flown to Turkey and King Hussein began to hint that he might accept MiG-21s offered to him by the Soviet Union. The U.S. then agreed to supply Jordan with the F-104A, although the order was cut in half. Deliveries began in mid-1969, equipping Number 9 Squadron at Prince Hassan Air Base.

One Starfighter of Number 9 Squadron saw combat in November of 1972, when an F-104A was used in a failed coup against the King. Jordan operated the F-104 until 1979, when they were replaced by the Northrop F-5E Tiger II. The survivors were finally parked on various bases to serve as decoys.

Three Air National Guard squadrons made extensive use of the F-104A. These three F-104As are assigned to the 157th FIS, South Carolina ANG. Most Air Guard squadrons are staffed by high-time pilots who fly because they want to, circumstances that may have contributed to the outstanding safety record enjoyed by the ANG F-104 squadrons. (157 FIS via Isham)



This F-104A of the 151st FIS Tennessee Air National Guard, previously deployed to Taiwan during Operation JONAH ABLE, served with several ADC and ANG units and finally was destroyed in a crash while assigned to the 319th FIS. The aircraft has the M61 cannon port faired over which was typical of most early F-104As. (Isham Collection)

The 4760th Combat Crew Training Squadron (CCTS) operated ADC Light Gray F-104As from Webb AFB, Texas, during 1967 with the aircraft drawn primarily from the 331st FIS. Both of these Starfighters were transferred to the 319th FIS in December of 1967, and then put to storage at Davis Monthan AFB during 1969. (Isham Collection)



Pakistan

The final nation to operate the F-104A was Pakistan, the only nation to use the Starfighter in air-to-air combat. Operated by Number 9 Squadron at Risalpur, the F-104A first went into combat during 1965 when Flight Lieutenant Amjad Hussain shot down two attacking Indian Mystere fighters over Sargodha Air Base.

The F-104A went into combat against the MiG-21FLs of the Indian Air Force during December of 1971. Military professionals and the aviation world at large, had long awaited combat between these two aircraft, often described in the aviation press as "natural enemies."

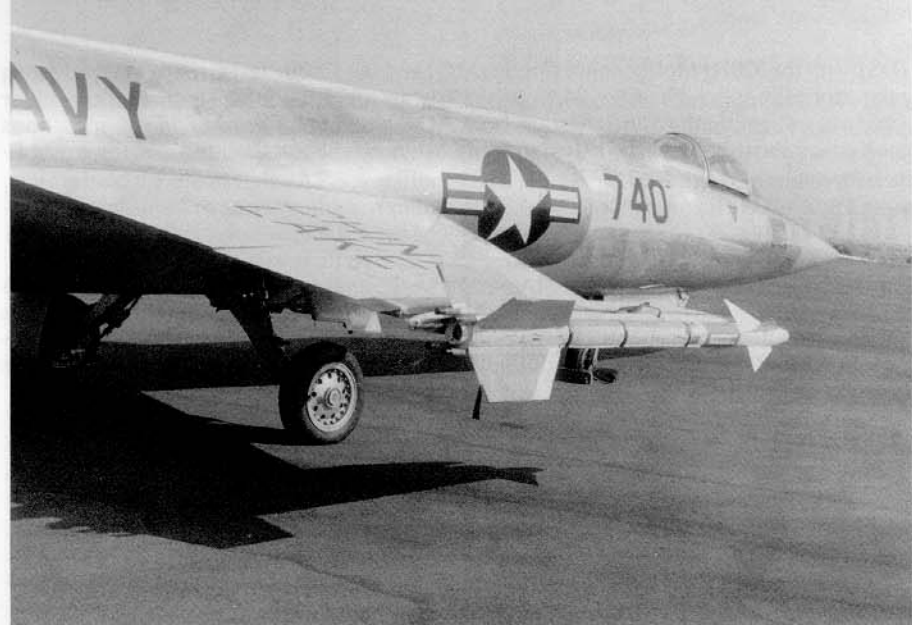
The Starfighter's first kill was not a MiG however. An Su-7 Fitter and Folland Gnat of the IAF were destroyed by F-104As on 4 December. India lost a Canberra to the F-104A during a low level chase on the night of 8 December and an Indian Navy Alize ASW aircraft was destroyed on 10 December, shot down into the sea by an F-104A of No 9 Squadron.

The first F-104/MiG-21 combat came on 12 December, when a pair of Pakistani F-104As were detected flying at low level towards Indian airfields or port installations bordering the Gulf of Kutch. Two MiG-21FLs were scrambled from Jamnagar and attacked the F-104s shortly. One of the Starfighters broke off and disengaged, while the other was engaged by Flight Lieutenant Soni who chased the Starfighter out over the Gulf, destroying it at extreme range with cannon fire.

Two other combats occurred on the last day of the war, 17 December 1971. In the first, a lone F-104A was intercepted near Uttaslai and the Starfighter was seen to crash after being attacked with both missiles and gun fire from an intercepting MiG-21. The second and third F-104 kills claimed that day were achieved near Umarkot. In this engagement, one Starfighter attempted a gun attack on a MiG, but, in a turning combat, was shot down.

In air-to-air combat against the MiG-21, the F-104s were not fought to their best advantage, all engagements reportedly being turning fights where the MiG-21's superior maneuverability came into play. One can only speculate how the fights might have turned out had the Starfighters had the speed and altitude they needed to fight as Kelly Johnson had designed them to.

This F-104A (56-0757) was the third Starfighter assigned to the Navy, however, it did not survive the assignment, being lost in an accident on 7 April 1961. The aircraft had a Dayglo Orange stripe around the fuselage just under the canopy, White wings and a Natural Metal fuselage. (USN via Friddell)

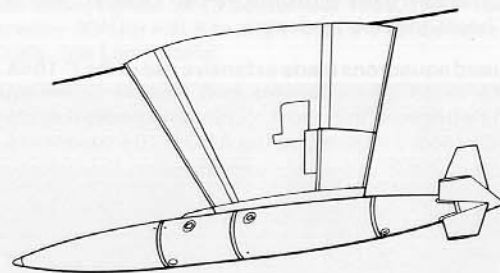


This AIM-9 Sidewinder air-to-air missile was configured for test work and was painted in high visibility markings. The aircraft carried the legend CHINA LAKE in Black on the White wing and Natural Metal fin. A total of three Starfighters were flown in Navy markings. (USN via Friddell)

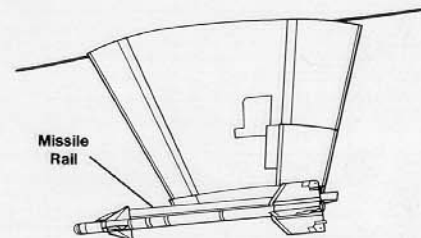
Wingtip Stores

F-104A

339 Gallon
Wing Tank

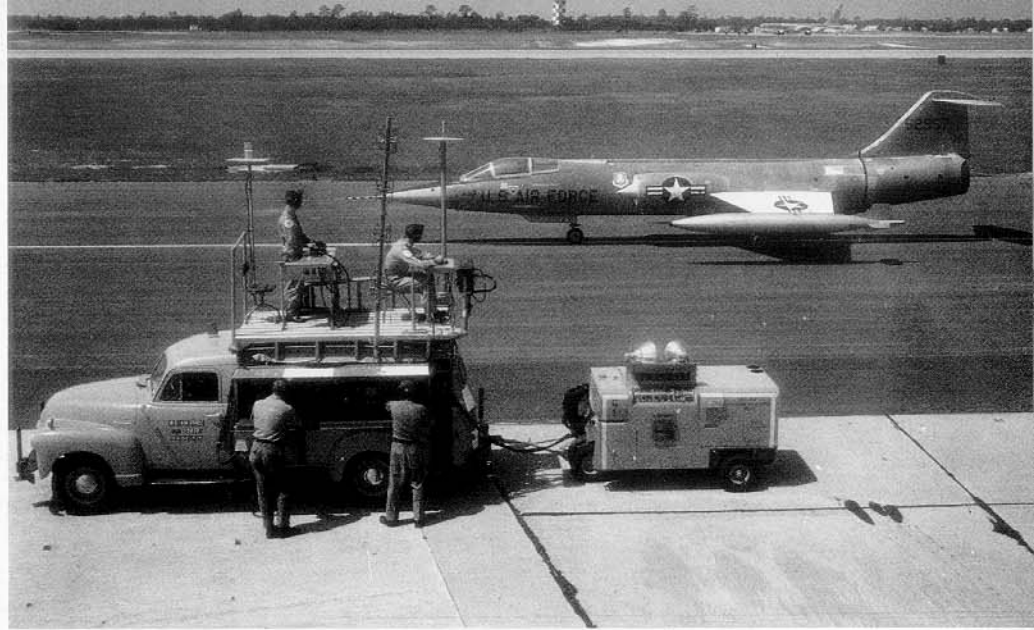


AIM-9B
Sidewinder
Missile





A few Starfighters never saw active service with a squadron at all. This F-104A (56-0735) went to the AFFTC during 1959 and was then modified to the QF-104A standard and assigned to the 3205th Drone Squadron at Eglin AFB. The marking on the nose is a caricature of an F-104 and the speckled appearance of the pitot boom appears deliberate, consisting of multi-colored dots over White. (Lockheed)



Ground controllers taxi a QF-104A (55-2957) drone target along the taxiway at Eglin Air Force Base, Florida. The QF-104s were assigned as reusable targets to the Armament Development and Test Center, which was responsible for testing all new air-to-air, air-to-ground and ground-to-air weapons being developed for the Air Force. (Via Larry Davis)

A piloted QF-104A drone (56-741) taxis in at Eglin AFB, Florida. The QF-104 also had provision for a pilot to allow the aircraft to be ferried between bases. The QF-104's color scheme of overall Dayglo Orange with White wings faded quickly, giving the aircraft a tattered and ragged appearance. (Marty Isham)



NF-104A

The NF-104A was a research variant of the F-104A fitted with a 6,000 lbst LR-121/AR-2 rocket motor for use by the USAF Test Pilot School for high altitude work, including zoom climbs that took the aircraft and its pilot quite literally to the edge of space. The aircraft differed from a standard F-104A in having a tail mounted rocket motor, the increased a chord fin and rudder assembly introduced on the F-104B, revised intake shock bodies, small reactive rockets to provide directional control in the upper stratosphere and a nitrogen pressurized cockpit.

The NF-104As were specialized aircraft and were difficult to fly (one highly publicized crash very nearly killed test pilot Charles "Chuck" Yeager). Of the three aircraft modified to NF-104A standard, one aircraft crashed in December of 1963 (Yeager's), one was grounded following an explosion caused by a failed O-ring which allowed leaking hydrogen peroxide (associated with the reactive control system) into the aircraft's rear fuselage and the third survived its operational life, was retired and is now on display at the USAF Test Pilots School.

Three Starfighters were reconfigured to the NF-104A configuration, which consisted of a tail-mounted 6,000 lbst rocket motor and reactive controls. These aircraft proved to be extremely dangerous, and only one of them (56-0760) survived. This aircraft is now on display at Edwards AFB. (USAF via Isham)



The 6,000 lbst LR-1212/AR-2 rocket motor of the NF-104A made it the hottest and, without a doubt, the most dangerous of all the F-104 variants. This aircraft (56-0760) survived its active career at Edwards AFB and is presently mounted on a pylon at the base. Famed test pilot Chuck Yeager was nearly killed flying one of the NF-104As on 10 December 1963 when control problems forced him to eject. (USAF)

F-104B

On 16 January 1957, a second Starfighter variant took to the air for the first time with the maiden flight of the two seat F-104B. Intended primarily as a training version of the F-104A, the F-104B added a second seat behind the pilot in the area formerly taken up by the M61 gun bay. The M61 system was deleted and its sole armament was a pair of wingtip mounted AIM-9B Sidewinder missiles. The F-104B also differed from the F-104A in that the nose gear was repositioned to the front of the landing gear well and retracted rearward instead for forward as on the F-104A. Additionally, the vertical stabilizer was increased in area by some twenty-one percent and featured a power boost rudder.

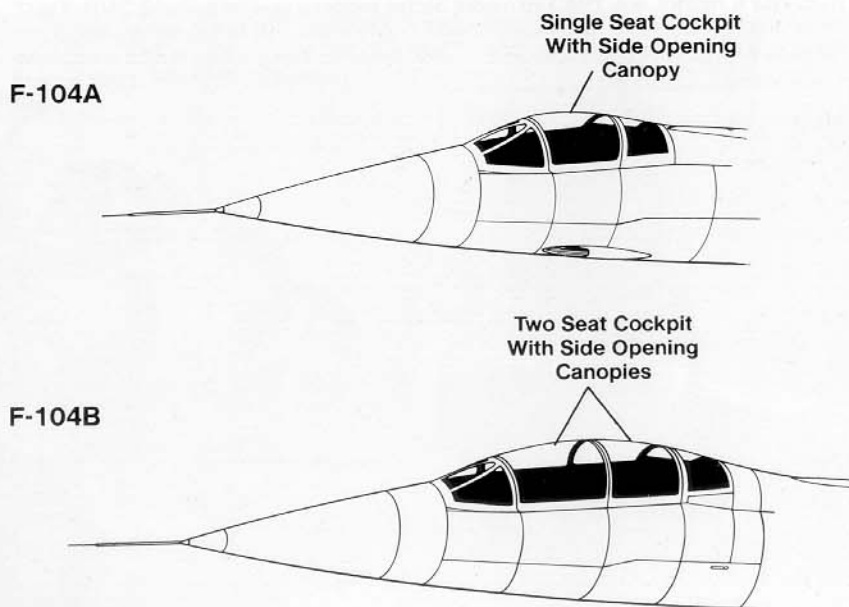
The F-104B suffered acutely from lack of range, as did all of the early Starfighter variants, but its performance led the Air Force to consider using it for high altitude psychological and suitability testing and for screening potential aircrews of future high performance aircraft. A total of twenty-six F-104Bs were produced, with the first unit to receive the aircraft being 83rd FIS at Hamilton AFB, California. The F-104B served alongside F-104As in most squadrons, serving as a unit transition and proficiency trainer.

This F-104B was an important aircraft in the development of the F-104 series. It served with the Air Force Flight Test Center during the Starfighter's "Big Tail" evaluation (January/February 1958) and had previously been used by the Air Force for the F-104B Phase II evaluations. It later went back to Lockheed for ejection seat trials and was lost in an accident during June of 1958. (Isham Collection)



In June of 1960, this F-104B was transferred from the 337th FIS to the Tennessee Air National Guard. When the aircraft (57-1296) arrived at McGhee Tyson Air National Guard Base to begin service with the 151st FIS, it still carried the markings from its former owners, including the name *Double Trouble* on the nose. During 1968 this aircraft was transferred to the Royal Jordanian Air Force. (Minert via Isham)

Canopy Development





An F-104B of the 83rd Fighter Interceptor Squadron on display during an open house air show. The F-104B canopy had a narrow frame between the two individual cockpit canopy sections. The two seat Starfighter had the M61 cannon deleted and the opening faired over. (Via Larry Davis)

This F-104B of the 134th Fighter Group, Tennessee Air National Guard on the ramp of its home base, has the tip tanks painted white to match its White wings and has been retrofitted with an F-104D style canopy. This aircraft (57-1302) served with the 538th FIS, the 197th FIS (where it was crashed and rebuilt), the 331st FIS and the 4760th CCTS. It was finally was transferred to Jordan where it crashed March of 1967. (134th FG via Minert via Isham)



F-104C

The original F-104 requirement was for a tactical fighter to replace the North American F-100 Super Sabre, and Lockheed had continued to develop the aircraft with the intention of providing the Air Force with the aircraft it had originally wanted since the F-104A had obviously fallen short of that goal. From this effort emerged the third F-104 production variant, the F-104C tactical fighter, which first flew in 1958.

Externally nearly identical to the F-104A, the F-104C was powered by a 10,000 lbst (15,800 lbst in afterburner) J79-GE-7A, an engine with 1,000 pounds more static thrust than the earlier J-79-GE-3B of the F-104A/B. This additional power allowed the F-104C to be equipped to carry a variety of underwing and under fuselage ordnance. Additionally, the F-104C had an improved fire control system and a removable probe and drogue air-to-air refueling equipment (experimentally fitted to some F-104As). These changes resulted in an improved aircraft, although one that was becoming more difficult for inexperienced pilots to fly.

Seventy-seven F-104Cs were built, initially going to four squadrons of the 479th Tactical Fighter Wing (TFW) at George AFB, California, during 1958 and 1959. Project GRINDSTONE, a program initiated during 1961 to upgrade the F-104C, gave the Starfighter additional air-to-air firepower in the form of two AIM-9 missile rails offset to either side of the fuselage centerline forward of the main landing gear wells. The F-104C was the only American F-104 variant to carry these missile rails.

The F-104C was used primarily by the 479th Tactical Fighter Wing (TFW) at George AFB, California. The 479th TFW, which had received its first Starfighters during in 1958, made its initial overseas deployment in November of 1959, to Moron Air Base, Spain and the wing kept one squadron there on a rotational basis until 1963. The Berlin Crisis of

1960 affected Tactical Air Command F-104Cs much the same as it had the F-104As in ANG service. During this period the Moron-based squadron transferred to Bitburg Air Base, West Germany, while the squadrons at George deployed to Hahn Air Base and Ramstein Air Base, both in West Germany.

By early 1962, all but the Moron based squadron were back at George AFB. The Cuban Missile Crisis saw all of the 479th's aircraft (except for the Spain contingent) deploy to Key West, Florida, where they remained until the end of the crisis. During 1963 a number of Starfighters from the 479th were employed in operational testing, with a detachment going to the Arctic in November as part of Project DIAMOND LIL, which was followed by another Arctic assignment during 1965.

1965 also saw Starfighters committed to a far different climate as the 479th sent a squadron to DaNang Air Base, Republic of Vietnam, to provide air defense against possible offensive air strikes by the North Vietnamese Air Force. The F-104C's air-to-ground capabilities were also tested during this deployment and found to be somewhat less than ideal for the situation found in Southeast Asia. The 479th also sent detachments to Kung Kuan, Taiwan, during this period. On 20 September 1965, MAJ Philip W. Smith was shot down over Hainan Island at night by Chinese F-6 (MiG-19) fighters becoming the only F-104 pilot to become a POW in SEA.

The initial F-104C deployment to Vietnam lasted until November of 1965, at which time the 479th's aircraft returned to the United States. A second deployment was made in June of 1966, when a squadron from the 479th was assigned to duty with the 8th TFW at Udorn Air Base, Thailand, where they remained, largely engaged in fruitless MiG Cap activities, until July of 1967. During their stay in SEA, the 479th TFW's squadrons logged some 2,269 combat sorties for a total of 8,820 combat hours.

This was the last active duty assignment for the F-104C. The tactical Starfighters were phased out of service shortly after the last of the 479th's aircraft had returned to the United States.

An F-104C from an unidentified unit reveals its side opening canopy and offset air-to-air refueling probe on the port fuselage side. The F-104C was small enough to be a fighter pilot's dream, but it turned out to be neither maneuverable nor versatile. (Wogstad Collection)



This F-104C Starfighter was a record setter. Flown by CAPT Joe Jordan, it was used to set a world altitude record of 103,389 feet on 14 December 1959. It was the first aircraft to take off on its own power and exceed 100,000 feet. The Starfighter crashed and was written off in May of 1961. (Friddell Collection)



Enough F-104Cs were saved from storage at Davis Monthan AFB to equip the two squadrons of the Puerto Rican ANG, the 198th TFS and 156th TFS, where they soldiered on until final retirement during 1975. The phaseout of the F-104 from the Puerto Rican ANG signalled the end of active U.S. military service for this remarkable aircraft, but a number of Starfighters still remained, both in Systems Command and, with a mission similar to the Systems Command aircraft stationed at Edwards AFB, with the National Aeronautics and Space Administration (NASA).

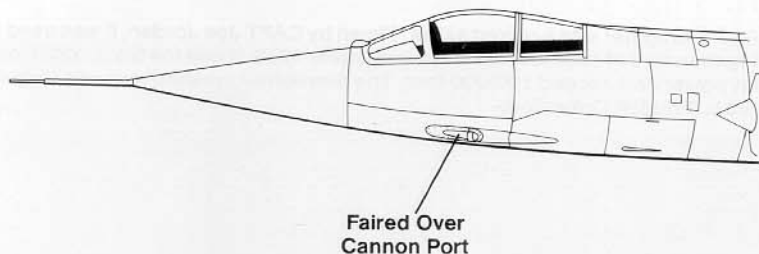
F-104D

A two-seat variant of the F-104C was built under the designation F-104D. Configured much the same as the earlier two seat F-104B, the F-104D had the M61 gun system replaced with a second cockpit. Twenty-one F-104Ds were ultimately built and delivered to Tactical Air Command as a combat capable two-seater.

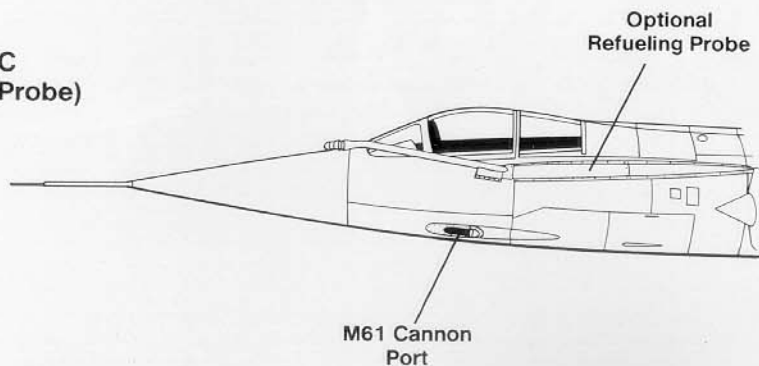
Externally, the F-104D differed from the earlier F-104B two seat trainers in one respect. The canopy was higher and had a separate clear connecting panel between the side opening canopy sections.

Refueling Probe

F-104A



F-104C
(With Probe)

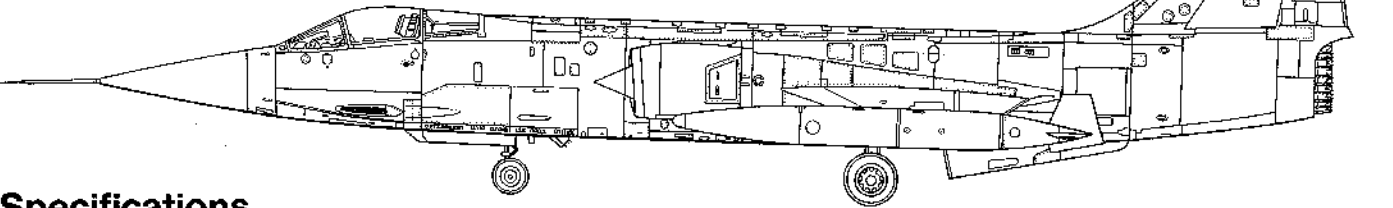
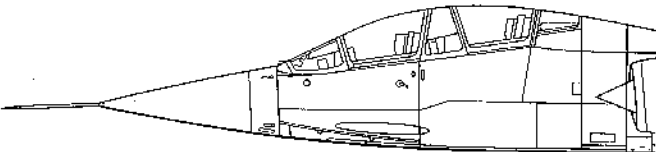


A tight echelon formation of F-104Cs from the 479th TFW. The F-104C was equipped with the M61 cannon and was stressed to carry ordnance both underwing and under the fuselage. FG-0903 and 0906 both crashed during active service and FG-0908 was shot down over South Vietnam during in 1965, while assigned to the 436th TFS. Only one aircraft (FG-0908) is equipped with optional refuelling probe. (Lockheed)

During the 1950s and 1960s Air Force fighters carried highly colorful markings. This F-104C of the 479th TFW at George AFB had Red, Blue and Green command stripes painted around the nose and fuselage, a Red chevron (outlined in White) in front of the intake and a Red (outlined in White) shooting star on the fin. The detachable refueling probe was carried only on the port side. (Isham Collection)



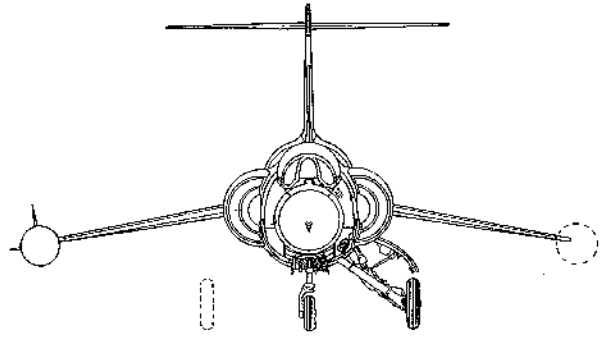
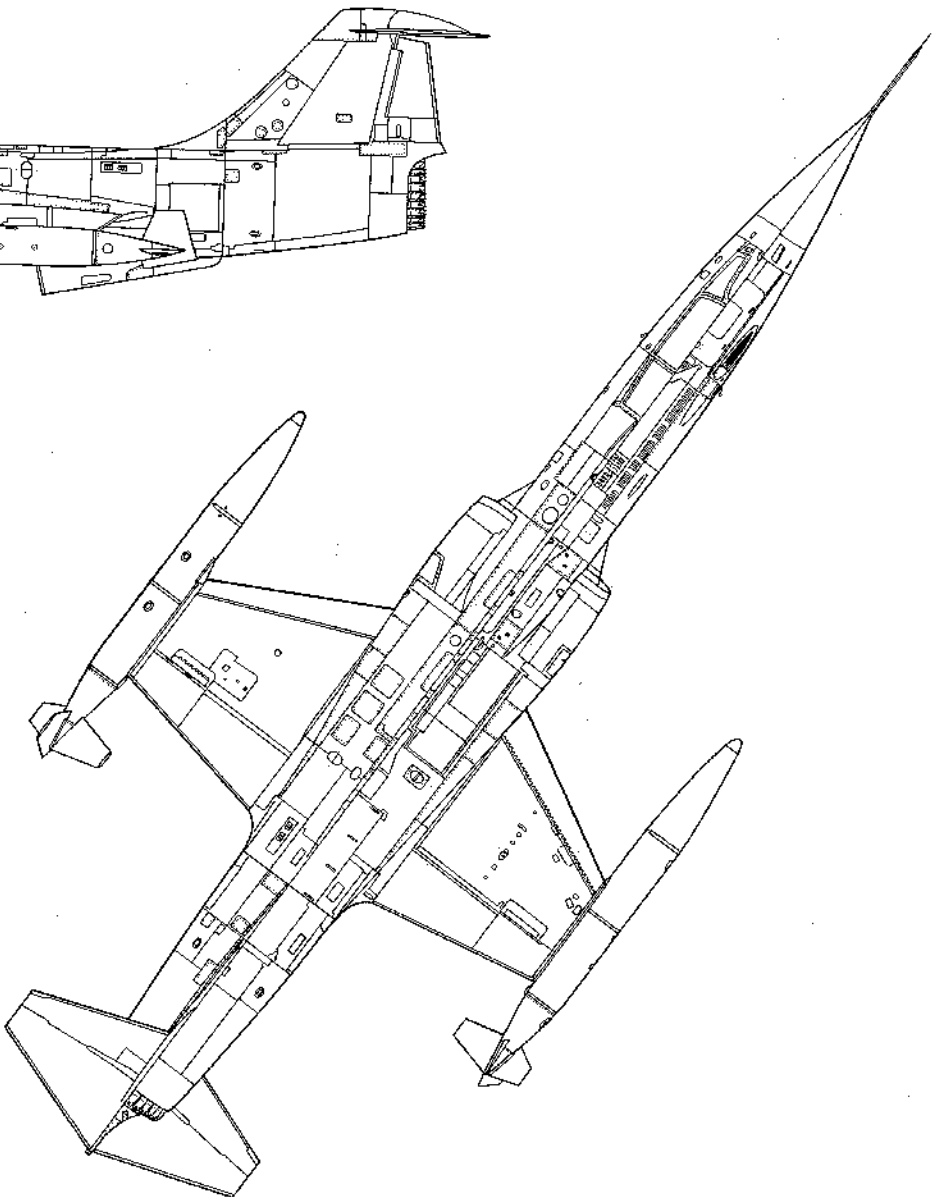
F-104D Forward Fuselage



Specifications

Lockheed F-104C Starfighter

- Wing Span21 feet 11 inches (6.68m)
- Length54.77 feet (16.69m)
- Height13.49 feet (4.11m)
- Empty Weight12,760 pounds (5,787.9kg)
- Maximum Weight27,850 pounds (12,632.7kg)
- Powerplants.....One 15,800 lbst General Electric J79-GE-7A engine
- Armament.....One M61 20MM cannon and up to four AIM-9 Sidewinder missiles, or various air-to-ground weapons.
- Performance
- Maximum Speed1,450 mph (2,333.4km/h)
- Service ceiling58,000 feet (17,678m)
- Range1,380 miles (2,220km) with four tanks
- CrewOne





The Air Force was able to get Starfighter losses down to a reasonable level, but never managed to eliminate them. All of these F-104C Starfighters of the 479th TFW were lost in service: FG-0903 in July of 1966, FG-0906 in June of 1960, FG-0907 in January of 1959 and FG-0908 in July of 1965 at Da Nang Air Base, Republic of Vietnam. (Minert via Isham)

The F-104C could carry a wide variety of ordnance on the two underwing pylons and the single centerline fuselage pylon, however, external stores greatly degraded its performance and range. This F-104C of the 479th TFW at George AFB, carries a practice bomb carrier on the centerline for a trip to the bombing range. (Isham Collection)



A trio of F-104C Starfighters of the 476th Tactical Fighter Squadron, 479th Tactical Fighter Wing share a revetment at Kungkwun Air Base on Taiwan during 1965. The 479th TFW supplied Starfighter detachments to Taiwan during 1965/66 to bolster the island's air defenses. (Via Larry Davis)





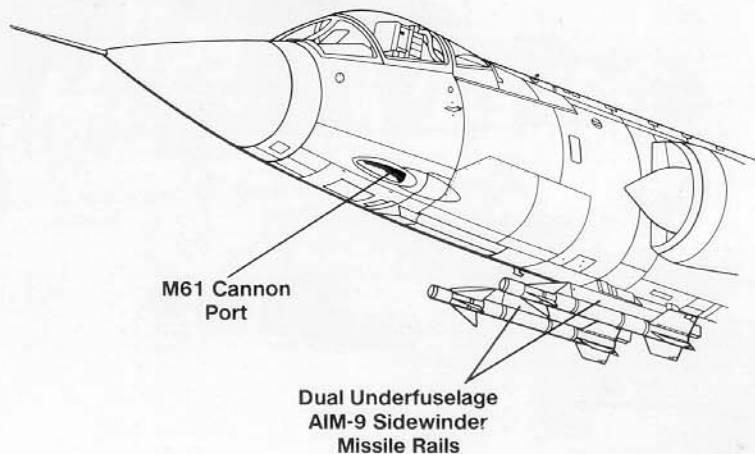
The F-104C was the first Starfighter to carry fuselage mounted missile rails for a pair of AIM-9 Sidewinder missiles. This F-104C (57-0927) was one of the first aircraft to carry the rails and was involved with the early trials. This aircraft carries no national markings, but does have white wings characteristic of F-104Cs and Ds. (Isham Collection)



A camouflaged F-104C Starfighter of the 8th Tactical Fighter Wing heads for a target in South Vietnam armed with a pair of 750 pound M117 bombs on the underwing pylons. The aircraft was based at Udorn Royal Thai Air Base, Thailand during November of 1966. (USAF via Isham)

Sidewinder Missile Upgrade

F-104C
(Late)



A pair of F-104Cs of the 8th TFW armed with 750 pound M117s head out on another ground attack mission during November of 1966. Some Southeast Asia based Starfighters carried nose art, but it was usually on the port side only. 56-0910 went to the Puerto Rican Air National Guard after its use in Southeast Asia, then to Lowry AFB for display. (USAF via Isham)





This F-104D (57-1315) on the ramp at China Lake was assigned to the AFFTC as a photo chase aircraft and carries the Air Force Systems Command insignia on the fuselage. The structure surrounding the afterburner nozzle was an experiment aimed at reducing the F-104's considerable infrared signature. (USN/Friddell Collection)

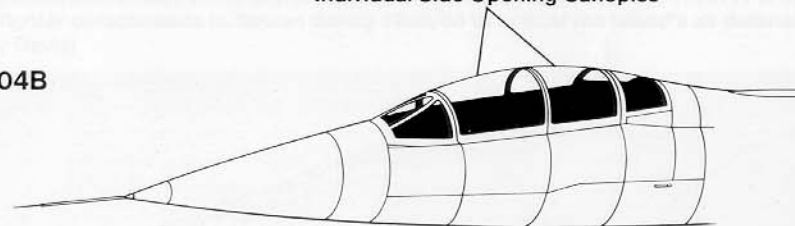
A camouflaged F-104C of the 198th Tactical Fighter Squadron, 156th Tactical Fighter Group, Puerto Rico Air National Guard on the ramp at San Juan International Airport during 1969. The PRANG was the last USAF unit to fly the F-104 Starfighter. (Isham Collection)



Canopy Development

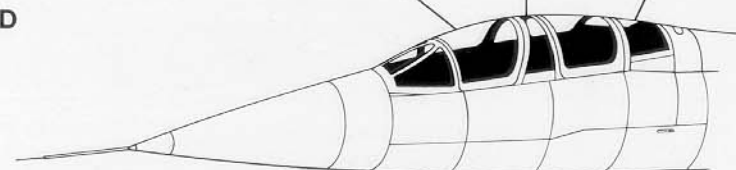
Two Seat Cockpit With Individual Side Opening Canopies

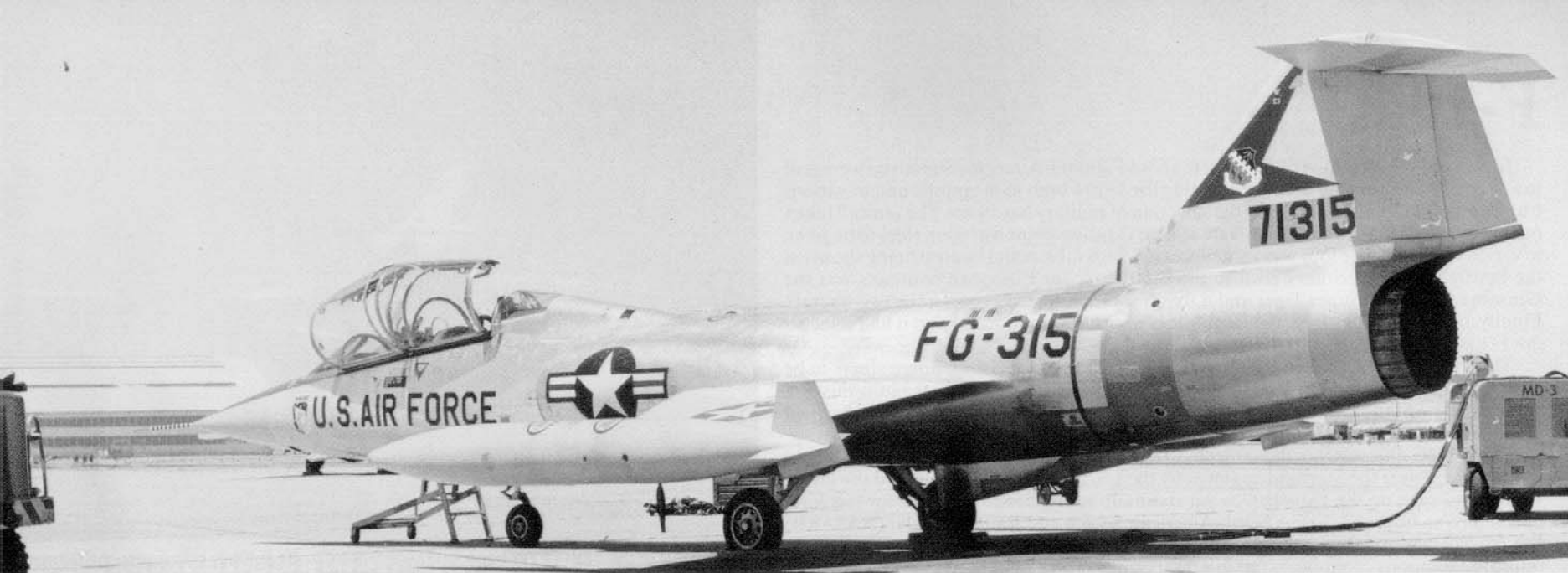
F-104B



F-104D

Individual Canopy Section
Clear Fixed Panel
Individual Canopy Section





This F-104D was assigned to the Air Force Flight Test Center and was used as a photographic chase aircraft between 1962 and 1967. Later it was flown by the 198th TFS and then exported to Taiwan. The nose and wingtip tanks appear to be in Dayglo Red, as was the vertical fin. (Peter Jackson via Isham)

The German government realized early on that Germany was not the best place to teach new pilots how to fly the Starfighter. This F-104D from the 479th TFW was a German-owned, USAF operated F-104G on the ramp at Luke AFB. The F-104D is unusual in that it is configured with wingtip Sidewinder rails and underwing pylon fuel tanks. (Isham Collection)



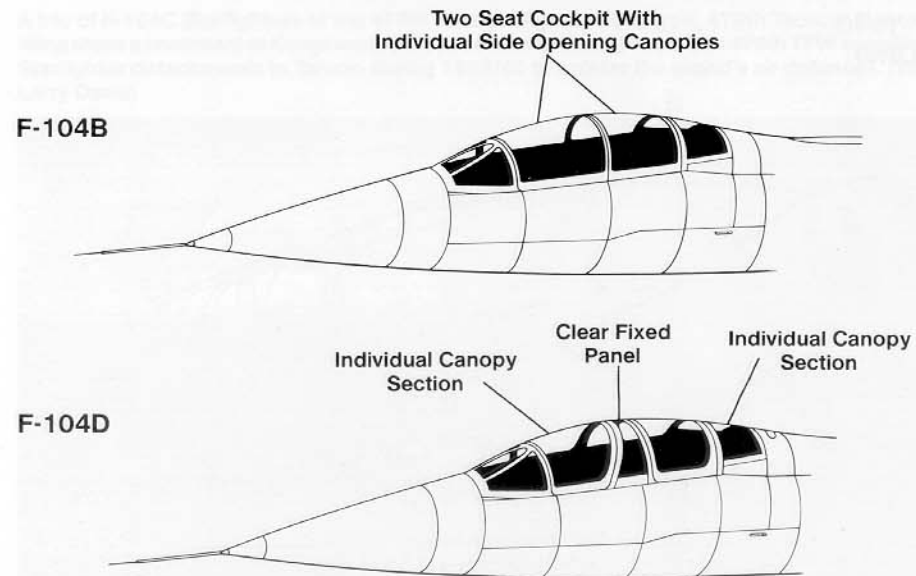


This F-104D (57-1315) on the ramp at China Lake was assigned to the AFFTC as a photo chase aircraft and carries the Air Force Systems Command insignia on the fuselage. The structure surrounding the afterburner nozzle was an experiment aimed at reducing the F-104's considerable infrared signature. (USN/Fridell Collection)

A camouflaged F-104C of the 198th Tactical Fighter Squadron, 156th Tactical Fighter Group, Puerto Rico Air National Guard on the ramp at San Juan International Airport during 1969. The PRANG was the last USAF unit to fly the F-104 Starfighter. (Isham Collection)



Canopy Development



F-104G

In July of 1958, a team of pilots from the 83rd Fighter Interceptor Squadron were sent to Europe for the purpose of demonstrating the F-104, both to the public and to various European officials responsible for the selection of military hardware. The aircraft taken on the tour were all F-104Bs which were selected to allow demonstration rides to be given to various officials. The tour was very successful with substantial interest being shown in the Starfighter. The primary rival to the Starfighter for European contracts was the Grumman F11F-1F Super Tiger and a fly-off was conducted between the two aircraft. Finally, on 6 November 1958, the Republic of Germany announced that it had selected the F-104 as its next generation fighter.

The initial contract called for thirty-two F-104D two seat conversion trainers to be built under the designation F-104F and sixty-six advanced single seat multi-mission variants of the Starfighter to be designated the F-104G. The formal contract was signed on 18 March 1959.

The F-104G differed from the earlier F-104C in a number of ways and was a substantial improvement over the Starfighters flown by the USAF. The F-104G featured the larger vertical tail used on the F-104B/D, a substantially strengthened airframe for low level operations, an improved F-15A North American Search and Ranging Radar (NASARR) fire control system, all weather avionics, an additional hard point under each wing, improved weapons capabilities (up to 4,000 pounds) and a Lockheed C-2 upward firing ejection seat which replaced the earlier downward ejection seat. To handle the increased weight of the munitions the F-104G was capable of carrying, the main landing gear wheels and tires were enlarged. To improve the aircraft's maneuverability, full span combat maneuvering flaps were added to the wing leading edge.

The F-104G was powered by a 10,000 lbst (15,600 lbst in afterburner) General Electric J79-GE-11A engine which, while it did not generate more power than the earlier J79-GE-7 engine used on the F-104C, was a much more reliable engine. Later in its career (1967), European F-104Gs had the Lockheed C-2 ejection seat replaced by a Martin-Baker GQ-7 (F) zero-zero ejection seat.

Most F-104Gs were built in Europe although some 138 aircraft were produced by Lockheed while the German consortium was being set up. Many of these aircraft were used to establish the U.S. based Starfighter training program for German and NATO pilots. Some of the companies involved in the F-104G program were: Arge Sud, comprised of Messerschmitt, Heinkel, Siebelwerke and Dornier in Germany. This group built some 210 F-104Gs for Germany. Arge Nord, made up of Fokker and Aviolanda in the Netherlands and Hamberger Flugzeugbau and Verienigte Flugtechnische Werke in Germany. This consortium built some 255 aircraft, with all final assembly work being done by Fokker. SABCA/Avions Fairey, a consortium based in Belgium that built some 188 aircraft, with most going to the Belgian Air Force and Germany. Fiat/Aermacchi, which built a total of 229 F-104Gs for Italy, the Netherlands and Germany.

TF-104G

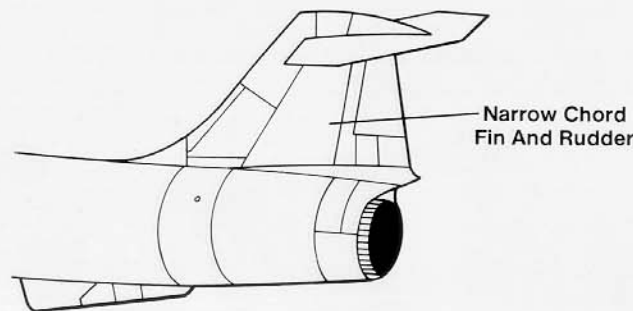
The TF-104G was basically a combat capable two seat variant of the F-104G with the M61 cannon and centerline under fuselage pylon being deleted to make room for the second seat. The TF-104G also used the later style canopy introduced on the F-104D.



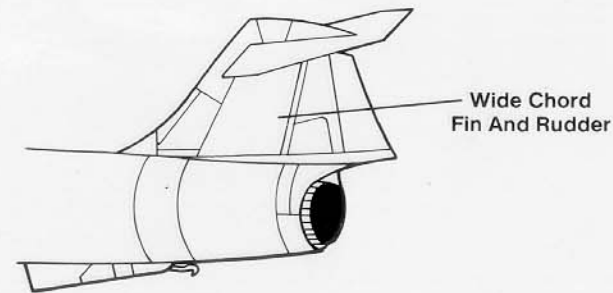
This F-104G of the 58th TFTW based at Luke AFB, Arizona actually belongs to the Germans. The aircraft are kept in the U.S. and are part of the F-104 transition training program run by American instructors. This F-104G has the forward and rear sections of the wing tanks painted Black, with Red and Yellow stripes on the tank fins. The horizontal stabilizer was also in Red, Yellow and Black stripes. (Phillip Friddell)

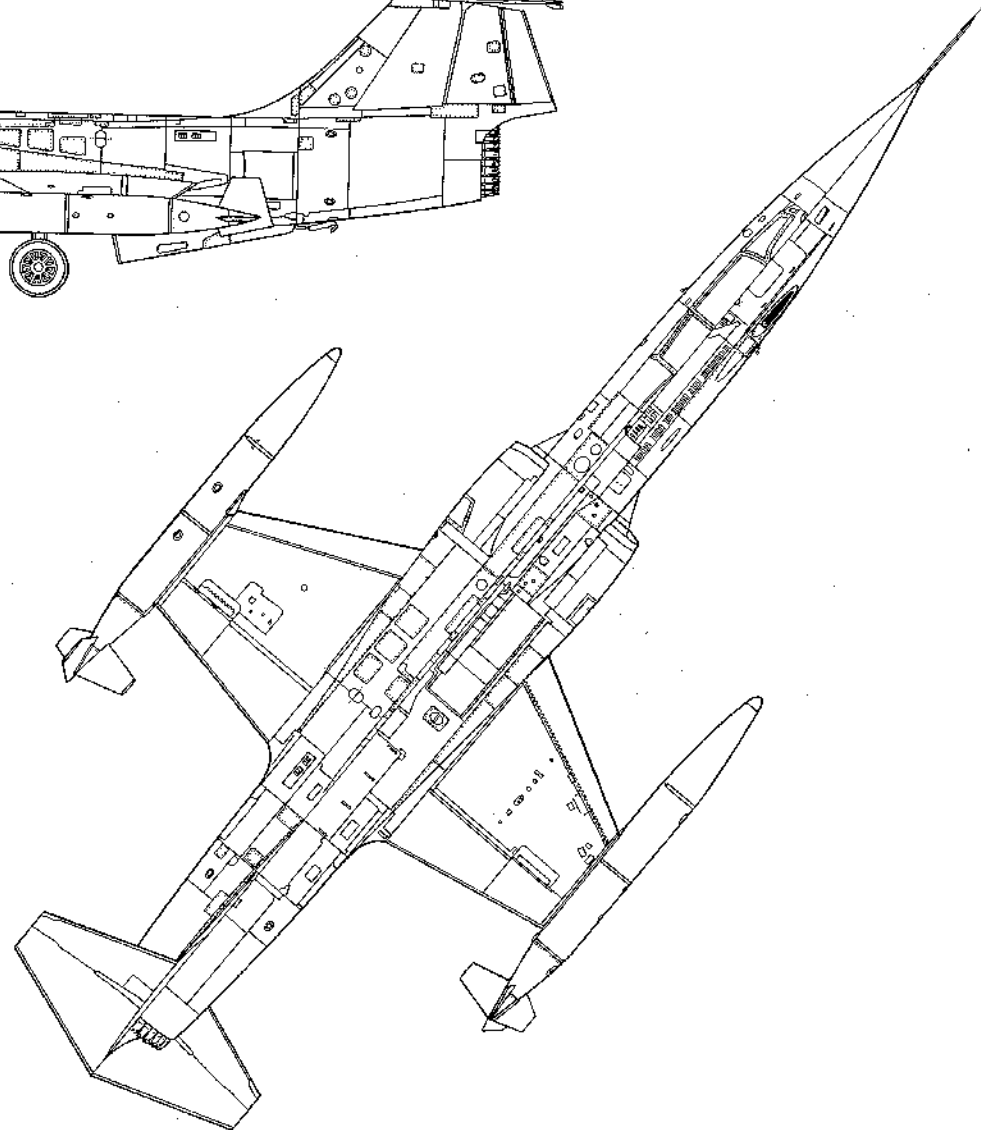
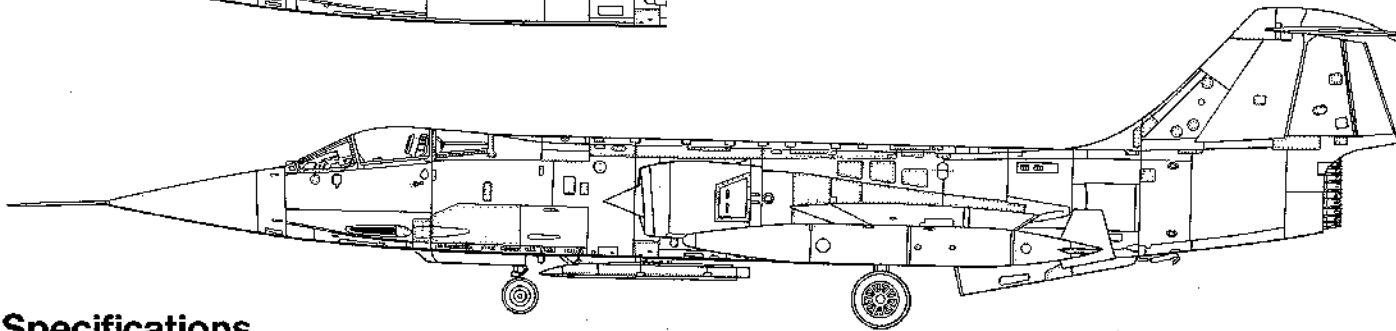
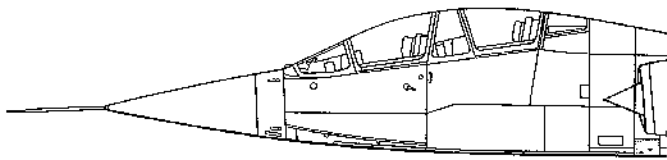
Fin Development

F-104A/C



F-104B/D/G

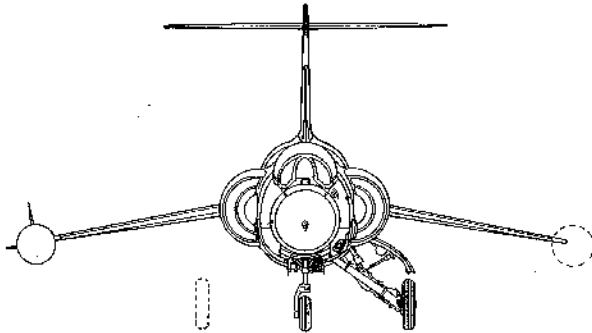




Specifications

Lockheed F-104G Starfighter

Wing Span	21 feet 11 inches (6.68m)
Length	54 feet 9 inches (16.69m)
Height	13 feet 6 inches (4.11m)
Empty Weight	14,082 pounds (6,387.6kg)
Maximum Weight	28,779 pounds (13,054kg)
Powerplant.....	One 15,800 lbst General Electric J79-GE-11A engine
Armament.....	One M61 20mm cannon and up to four AIM-9 Sidewinder missiles or 4,000 pounds of air-to-ground weapons.
Performance	
Maximum Speed	1,450 mph (2,333km/h)
Service ceiling	58,000 feet (17,678m)
Range	1,380 miles (2,220km) with four tanks
Crew	One



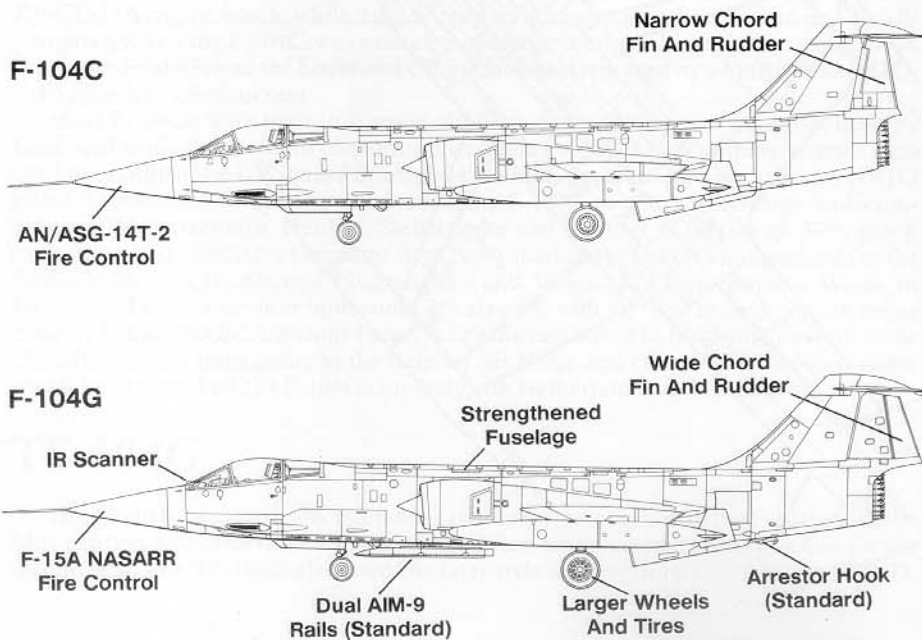


This F-104G was the first Military Assistance Program aircraft built by Lockheed and was completed on 10 August 1962. The dark areas on the intake lips are heating elements which were unique to MAP variants of the F-104G. The doors are still open on the braking parachute housing under the rear fuselage. (Isham Collection)

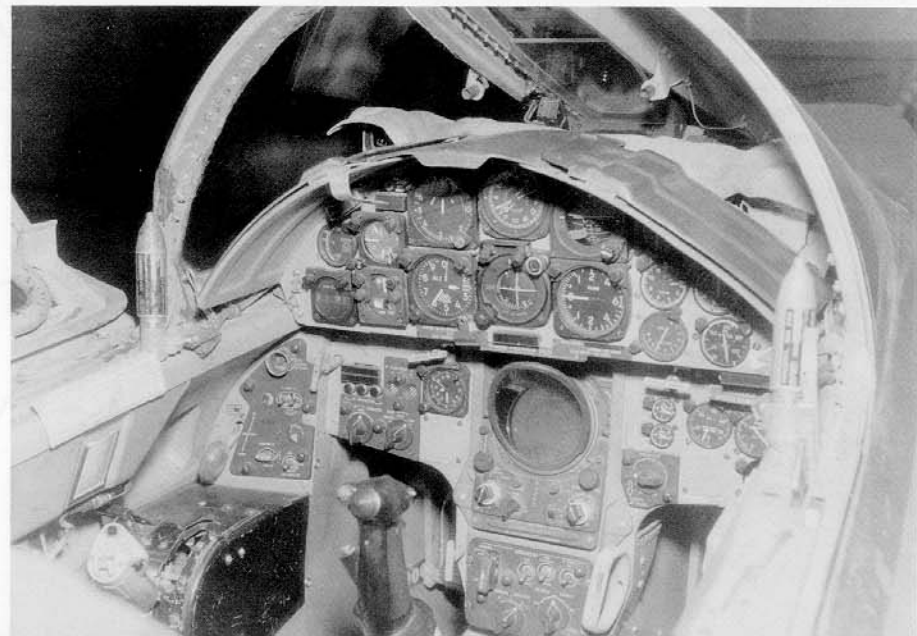


An F-104G fully loaded with 750 pound M117 bombs on the four underwing pylons and a fuel tank on the under fuselage centerline pylon. The F-104G was among the fastest tactical fighters in the world, but this load would have rendered the aircraft subsonic! The gunport for the M61 cannon is faired over on this Starfighter. (Lockheed via Friddell)

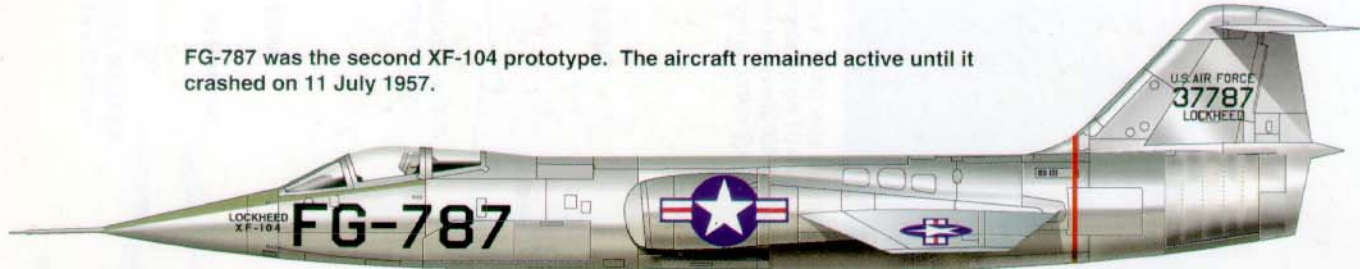
Fuselage Development



The cockpit of the F-104G was dominated by the centrally mounted radar screen for the F-15A NASARR fire control system (just below the instrument panel). The two cylinders on either side of the windscreen are explosive charges designed to blow the canopy free in the event of an emergency. (Lockheed via Friddell)



FG-787 was the second XF-104 prototype. The aircraft remained active until it crashed on 11 July 1957.



This F-104A was assigned to the 151st FIS, Tennessee Air National Guard and had the M61 cannon port faired over.



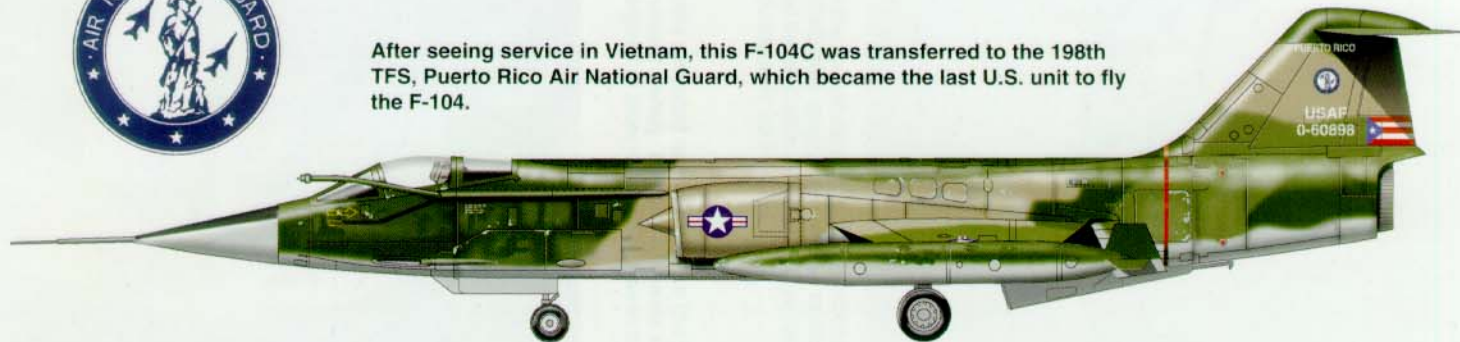
The Navy operated two F-104As and one YF-104A on loan from the 83rd Fighter Interceptor Squadron to conduct high speed AIM-9 Sidewinder testing.



This F-104B was one of three assigned to No 9 Squadron, Royal Jordanian Air Force as conversion trainers.



After seeing service in Vietnam, this F-104C was transferred to the 198th TFS, Puerto Rico Air National Guard, which became the last U.S. unit to fly the F-104.





No 336 Squadron, Royal Hellenic Air Force (Greece) painted this F-104G with a special color scheme as a fairwell to the F-104. The unit is scheduled to re-equip with A-7s.



A sharkmouthed F-104J of No 207 Squadron, Japanese Air Self Defense Force based at Naha, Okinawa.



"The Saint" was carried on the fuselage and fin of this CF-104G of No 421 Squadron, Red Indians, Canadian Armed Forces while based in West Germany.



The West German Navy flew a number of F-104G Starfighters in the maritime strike role.

MFG-2



An Italian-built F-104S Starfighter of No 191 Squadron, Turkish Air Force based at Balıksir, Turkey during 1993.



F-104G in Service

Germany

Germany's first Starfighters, two-seat F-104Fs, arrived at Furstenfeldbruck during 1960 to begin training operations. The first F-104G squadron, JBG31 *Boelcke*, was declared operationally ready on 20 February 1962. The initial group, of what would become a total of twelve Luftwaffe fighter groups slated to receive the F-104, was up to full strength and operational by late 1963.

Unfortunately, the Luftwaffe had taken the Starfighter into service directly from their first-generation F-84Fs and F-86s, and did not have the experience with supersonic high performance fighters that the USAF had gained with the North American F-100. While no one could possibly fault the skill or dedication of German aircrews, the fact remained that the F-104 flew like no other aircraft before it and was particularly unforgiving of pilot error. Losses were relatively high and, unfortunately, exceedingly well publicized. 1965 proved, in a negative way, to be a banner year for the Luftwaffe, with over thirty F-104s being lost to accidents, along with a high number of pilots.

By 1967, Germany's Starfighter fleet had been re-equipped with Martin Baker ejection seats and the accident rate had fallen to acceptable levels, but the damage had been done. The early accident rate, plus an ongoing scandal that involved Lockheed in alleged kick-backs to foreign officials thought to be in a position to influence defense contracts, created a cloud that stayed with the German F-104s until the end of their service.

The German Air Force used the F-104G for a wide variety of tasks including training, interception, ground attack and, both with the dedicated RF-104G and with camera and sensor pods, photographic reconnaissance. The Starfighter was also used by the German Navy, which ultimately accepted 146 F-104Gs configured with air-to-surface anti-ship missiles for use as maritime strike aircraft.

The advent of more modern and capable aircraft such as the F-4F and RF-4E Phantom brought an end to the career of the Starfighter in German service. First to go were the RF-104Gs, replaced by RF-4Es by May of 1972. The Luftwaffe's remaining F-104s were replaced on a gradual basis and by the end of the 1980s none were left in regular squadron service.

Netherlands

The Netherlands also evaluated the Starfighter during 1959, placing it in competition with the Northrop N156F Freedom Fighter, Republic F-105 Thunderchief and Dassault Mirage III to replace the Dutch Air Force's obsolescent F-84Fs, F-86Ks and Hawker Hunters. The F-104 was the winner of the competition, went into production (subassemblies only) at Fokker and into service with the Royal Netherlands Air Force.

No 306 Squadron, based at Volkel, was the first Dutch F-104G unit becoming first a Starfighter training unit and, in 1964, a photographic reconnaissance unit. Nos 311 and 312 Squadrons later joined No 306 at Volkel, both operating in the fighter-bomber role.

Nos 322 and 323 Squadrons, based at Leeuwarden, provided the Netherlands with a supersonic interception capability until October of 1984, when the Starfighter was

replaced in Dutch Air Force service by the General Dynamics F-16A Fighting Falcon. For a time the Dutch also operated a "phasing out" unit manned by aircrews not slated for the F-16 program. The last Dutch F-104 squadron re-equipped in 1984, marking the end of twenty-one years of continuous service.

Belgium

The Belgian Air Force received their first F-104Gs during late 1963. The Starfighter replaced the Belgian Air Force's Avro CF-100s and Republic F-84Fs, both still capable but rapidly aging fighters.

Belgian F-104s operated with two wings during their service career. Number One Wing operated out of Beauvechain in the fighter-interceptor role and was made up of Nos 349 and 350 Squadrons. The Belgian F-104 aerial display team, the "Slivers," operated within Number One Wing from 1969, providing European air show audiences with tremendous and highly impressive flying displays.

Number Ten Wing was the tactical air support component of the BAF, with Nos 23 and 31 Squadrons operating from Kleine Brogel in the strike fighter role. Ten Wing had no acrobatic team, but the wild tiger-striped Starfighter entries that No 31 Squadron sent to NATO's "Tiger Meets" were a vivid reminder of the BAF's spirit and proud heritage.

Appropriately, No 31 Squadron was the last Belgian unit to operate the F-104, retiring their aircraft in 1983. Of the 112 F-104s operated by the Belgian Air Force during the type's service career, forty-one were lost to accidents of various types. At first glance this seems to be a high loss rate, but when distributed over the 20 years of operational service the loss ratio can be seen for what it actually was; an extremely low attrition rate.

Except for the serial number and intake heating panels, this aircraft could pass for an USAF F-104B or F-104D, but it is in fact a German owned TF-104G assigned to the AFFTC at Edwards AFB in April of 1972. The TF-104G used the later style canopy introduced on the F-104D. (USAF via Isham)



Belgium's Air Force operated similar equipment to that of the Federal Luftwaffe and in much the same climactic conditions, yet their initial accident rate was far lower than that of their German neighbors.

Of the surviving Belgian F-104s, some went into storage, while at least fifty aircraft (forty F-104Gs and ten TF-104Gs), along with thirty spare J79-GE-11 engines and various other parts were sold to Radcomm Systems, Inc., of Richmond, California, for subsequent resale. In common with most other NATO countries, Belgium's Starfighters were replaced with F-16As.

Italy

The Italian Air Force was quick to adopt the Starfighter as a service aircraft and was fortunate in that the Italian aircraft industry played a major part in the production of the F-104 for the European market. The F-104G and later, the Italian-designed and developed F-104S, were to play a crucial part in Italy's aerospace industry.

Italy is one of the few nations of Western Europe not to equip its Air Force with the F-16, preferring instead to use the Tornado and the Starfighter, and the F-104G and F-104S still comprise a major portion of the Italian Air Force (some twelve squadrons). Starfighters serve as interceptors, ground attack and strike aircraft and photo-reconnaissance platforms. Very few F-104Gs remain in Italian service, most being replaced in the strike role by the Tornado, and as an interceptor by the F-104S.

Norway

The Norwegian Air Force received their first F-104Gs in August of 1963, when No 331 Squadron at Bodo Air Base transitioned to the F-104 from the North American F-86

Sabre. The initial Norwegian purchase was reduced to twenty-one aircraft when it was determined that the Northrop F-5A could provide Norway with the ground attack capability it needed at a much reduced cost.

No 331's aircraft were all MAP-funded and carried USAF serial numbers. The squadron operated the Starfighter until 1981, accumulating some 60,956 flight hours on the type while operating in some of Western Europe's worst weather. In June of 1981, No 331 Squadron transitioned to the General Dynamics F-16A, delivering its F-104s to RAF Sculthorpe in Great Britain, for subsequent delivery to the Turkish Air Force.

A second Norwegian Starfighter squadron was established in April of 1973, when No 334 Squadron received its first aircraft. Only one of the squadron's aircraft was U.S. produced, with the remaining twenty-two aircraft assigned being built by Canadair. The squadron operated the F-104 until April of 1983, losing only four aircraft. The departure of the last No 334 Squadron Starfighter for Turkey marked the end of the F-104's service with the Norwegian Air Force.

Denmark

Denmark operated the F-104G from late 1964, when initial deliveries began of some twenty-five F-104Gs supplied under MAP with this initial complement of F-104s going to No 726 Squadron. No 723 Squadron became the second Danish Air Force Unit to operate the type, receiving their Starfighters during 1965. In addition, four TF-104Gs were added to the force, bringing Denmark's total complement of F-104s to twenty-nine.

The Danish Air Force increased the number of aircraft assigned to its operational squadrons during 1973, creating a requirement for additional Starfighters. Consequently fifteen Canadian-built CF-104s and seven CF-104Ds were purchased from the Canadian

Carrying a load of rocket pods and a practice bomb dispenser, this camouflaged F-104G of JGB-34 taxis out for a mission. The Gray/Green NATO camouflage scheme blended well with the often overcast conditions found in Western Europe. JGB-34 typically candy-striped the pitot tubes of their aircraft, but this Starfighter has only half of the pitot striped. (German AF)

The first F-104G produced for Germany taxis out for a test flight. The overall natural metal F-104G carried the national insignia on the forward fuselage and a serial number 104 in Black on the fin. This aircraft was the first of several hundred produced for Germany. (Lockheed)



government during 1971 while the *Flyvevabnet* was involved in the planning stages of its restructuring.

Nos 723 and 726 Squadrons operated the F-104 from Aalborg throughout the Starfighter's service career, retiring the type in April of 1986. Denmark lost only a dozen F-104s during the aircraft's operational service with its air force. This is particularly noteworthy when compared to initial Luftwaffe losses, which occurred in much the same weather and operational conditions as those experienced by both the Danes and the Norwegians.

In common with many other MAP supplied F-104s, Denmark's surviving Starfighters ended up one military career only to begin another, being transferred to the Turkish Air Force shortly after their removal from Danish service.

Greece

The Royal Hellenic Air Force received its first MAP-funded F-104Gs during April of 1964. The aircraft has remained in service well into the 1990s with two squadrons; No 335 at Tanagra performing the interception role, and No 336 at Araxos serving in the fighter-bomber role. Most Greek Starfighters were Canadair-built CF-104Gs, with several having been transferred into Greek service from Spain.

Greece was ultimately to receive thirty-six F-104s through MAP and maintained an enviable safety record with the aircraft. During the first year of operation by the Hellenic Air Force, No 335 Squadron was able to fly some 1,000 hours without accident, proving once again that careful training and maintenance could make the Starfighter as safe a fighter as any other of its generation.

An F-104G of JGB-34 taxis out for a sortie with a practice bomb dispenser on the centerline pylon and four fuel tanks. JGB-34 was a *Jabo*, or fighter-bomber unit, operating in the low-altitude strike role. German F-104Gs also had a nuclear mission against targets in Eastern Europe. (German AF)

Spain

Spain required modern combat aircraft for her Air Force more urgently than most other European nations, since her most modern combat type was the F-86 Sabre and her oldest combat aircraft actually dated back to the Second World War. Spanish interest in the F-104 led to contractual negotiations through the Military Assistance Program and the first Spanish Starfighters were off-loaded from a transport at the Rota Naval Base near Cadiz in March of 1965. These aircraft, five Canadair-built CF-104Gs and two TF-104Gs, became the nucleus of Spain's Starfighter component.

The F-104s were assigned to No 104 Squadron, a former F-86 unit operating out of Torrejon Air Base. Integration into service began almost immediately and the F-104 was successfully phased into Spanish service during 1965. The Starfighter served with the Spanish Air Force until 1973 when No 104 Squadron's aircraft, which had been provided under MAP funding, were returned to U.S. control for subsequent delivery to the air forces of Greece and Turkey.

Spain's experience with the sometimes difficult and trying F-104 differed in one respect from that of the other air arms using the type; no aircraft were lost due to accidents during the aircraft's service with the Spanish Air Force. This record was admittedly helped by Spain's dry climate, near-ideal flying weather and the limited number of sorties flown when compared to other European air forces, but it is still impressive. Spain's F-104s were replaced in service by the F-4C Phantom II.

The pilot of 22-04, an F-104G of JBG-33, prepares to taxi out for another low level mission. The camouflage used for Air Force F-104Gs was Dark Gray and Dark Green over Light Gray. The pitot tube on JGB-33 aircraft was striped in Red and White. (German AF)



Turkey

Turkey's involvement with the F-104 began in 1968, with initial deliveries being supplied under MAP. Since that time Turkey has purchased F-104s from virtually anyone willing to sell them, using the type both to modernize their air force (replacing their F-100s and F-102s) and to establish a combat capability equal to that of other nations in the region. Turkish units operating the F-104 at one time numbered six squadrons, including Nos 141 and 142 Squadrons at Murted, Nos 191,192 and 193 Squadrons at Balikesir and No 161 Squadron at Bandrina.

The Turkish invasion of Cyprus in July of 1974, resulted in a temporary arms embargo being placed against the Turks, greatly reducing the amount of aid received from the United States. This resulted in the placing of orders with Italy for a number of Aeritalia F-104S Super Starfighters. Acquisition of the Super Starfighter seems to assure that the Turkish Air Force will operate the F-104 well into the next century.

RF-104G, 21+11, of MFG-2, taxis out for a brief sortie. F-104s are not noted for their long range and this aircraft is clean, with no external fuel tanks. The pilot of this aircraft is wearing an Orange flight suit, seldom seen during tactical operations but of considerable benefit to a pilot forced down over the sea. (Friddell Collection)

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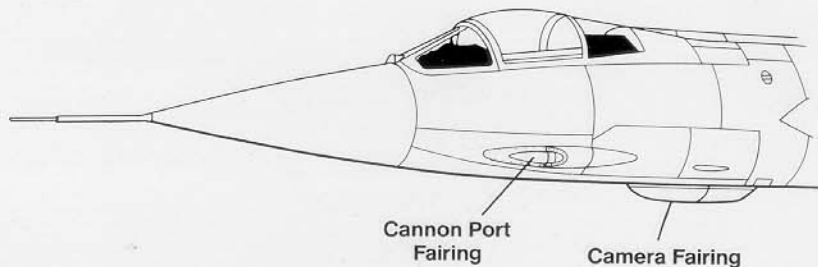
An RF-104G of the German Navy is prepared for a mission during the NATO *Big Click* photo reconnaissance meet. The light colored bands on wing tanks are Dayglo Orange. The RF-104G did not carry the M61 gun system and had the gun port faired over. The fairing behind the nose wheel door that covered the KS-67 cameras has been removed. (Udo Weisse)

RF-104G

F-104G



RF-104G





This F-104G of MFG-2 has faded Dayglo Orange panels on the wing tanks. These markings are used as a safety marking for peacetime operations and would have been deleted in the event of war. German Navy F-104Gs are used for the maritime strike role and can carry anti-ship missiles. (Rick Morgan Collection)

This Fokker-built F-104G of No 306 Squadron is equipped with an under fuselage camera pod and was based at Volkel. D-8119 carries no unit markings and is configured for long range operations with four external fuel tanks. This F-104G was one of the Dutch F-104s sold to Turkey during 1983. (Lee Bracken via Frank Garcia)

An F-104G of No 323 Squadron, Royal Netherlands Air Force taxis out for a training mission. No 323 Squadron provided a major part of the Netherlands' air defense system and their Starfighters were optimized for the intercept mission. This aircraft is equipped with AIM-9 Sidewinder fuselage pylons and wingtip fuel tanks. The white stripe at the top of the fin is common on Dutch F-104s. (Lee Bracken via Frank Garcia)





This No 312 Squadron F-104G had the wing tank fins painted Gloss Yellow, with Black tiger stripes applied over the base color for participation in a NATO Tiger Meet. The aircraft carries the standard NATO camouflage of Dark Gray and Dark Green uppersurfaces over Light Gray undersurfaces. (Jack Morris)



Most European air forces operated the F-104G in Natural Metal at one time or another. This F-104G, FX26 of No 1 Wing, Belgian Air Force carries no unit markings of any kind. The lack of wing tanks, however, indicates that it was an interceptor from either Nos 349 or 350 Squadrons. (Kerr Collection)

This F-104G of No 31 Squadron, Belgian Air Force was specifically painted for participation in the 1978 NATO Tiger Meet. It carried the No 10 Wing badge on the vertical fin, along with a badge under the canopy done specially for the 1978 meet. (Belgian AF)



A Lockheed-built TF-104G of No 10 Wing in flight over the Belgian countryside. The fin badge consists of Red griffon on a Blue field. Camouflaged Belgian Starfighters carried a three tone uppersurface of Dark Green, Medium Green and Tan over Light Gray undersurfaces with White codes. (Belgian AF)





The last Belgian F-104 on its final flight from Kleine Brogel to the storage site at Koksijde. The No 10 Wing Starfighter carried a commemorative *Bye 104* badge on the intake and a No 10 Wing badge on the fin. No 10 Wing was the fighter-bomber component of the BAF and this aircraft would have normally carried wing tanks. (Belgian AF)



FB-W was an F-104G of No 331 Squadron, Royal Norwegian Air Force used in the interceptor role. No 331 Squadron normally repeated the aircraft individual identification letter on both the vertical fin and the outboard wing tank fin. This Starfighter is carrying a tank from another aircraft; the F-104 is W for Whiskey, the drop tank is marked D for Delta. (Defense Command, Norway)

A clean F-104G of No 331 Squadron, Royal Norwegian Air Force. This overall Natural Metal Starfighter had its individual aircraft number on the fin, just above the squadron flash and its serial number in front of the fuselage warning stripe in Black. In this configuration the F-104G would be an extremely fast, but short-ranged, fighter. (Defense Command, Norway)





This overall Natural Metal TF-104G of No 331 Squadron Royal Norwegian Air Force carries no markings other than the serial on the fuselage and the individual aircraft number (last three digits of the serial) on the fin. The radome below the anti-glare panel is in Gloss Light Gray. (E. Jose)



Late in their operational careers, Norwegian CF-104Gs were camouflaged in a Dark Olive Green over Light Gray scheme. This aircraft of No 331 Squadron is armed with a pair of late model AIM-9 Sidewinder missiles and has been modified with an ECM blister on the radome under the nose and Radar Airborne Warning (RAW) blisters on both sides of the tail cone. (Defense Command, Norway)

R-707, an F-104G Starfighter of the Royal Danish Air Force is refueled on the ramp of its home base during 1968. The aircraft is in overall Light Gray with the rear most portion of the fuselage left in Natural Metal. The aircraft serial number was carried on the fin under the fin flash in Black.

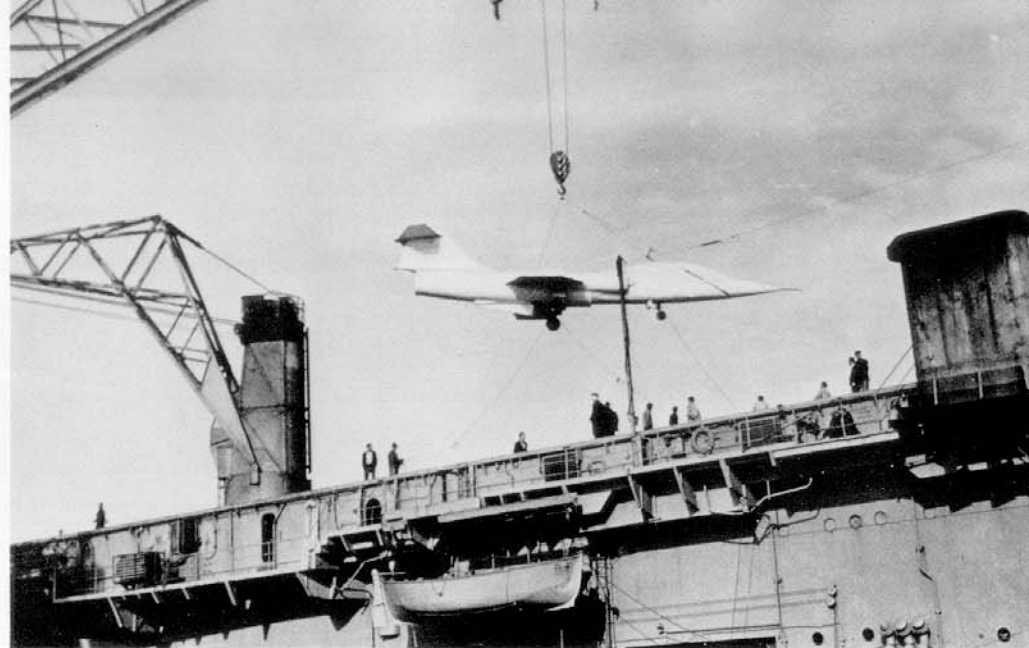


This Greek Air Force Starfighter of No 336 Squadron, No 116 Combat Wing was based at Araxos. Greek F-104Gs carried a camouflage scheme similar to the USAF Southeast Asia camouflage and carried a Buzz number on the rear fuselage. The lower half of the radome was Light Gray, with a Black anti-glare panel on the radome only. (John Kerr Collection)





The Greek Air Force seldom comes to mind when NATO's famed Tiger Meets are discussed, but their F-104Gs have participated in the events on many occasions. This F-104G (22314) was in standard camouflage but carried a Tiger's head painted on the fuselage side just forward of the intake. (Friddell Collection)



One of two TF-104Gs is off-loaded at the Spanish naval base at Rota in March of 1965. Spanish Starfighters were thoroughly cocooned for their ocean voyage from the United States since the F-104G had no provision for air refuelling and lacked the range for a trans-Atlantic flight. All Spanish F-104s were operated by No 104 Squadron. (Spanish AF)

Six F-104Gs of No 104 Squadron, Spanish Air force fly in formation over the Spanish countryside. The aircraft had a Light Gray fuselage, White wings and Natural Metal engine area. Spain used the F-104 as an interceptor and flew less hours than other NATO forces. This, plus Spain's excellent weather conditions, helped her to become the only country to never lose a Starfighter. (Spanish AF)



Spanish F-104Gs carried a variety of markings. The aircraft in the foreground, 181-25, has the last two number of its serial, 33, painted on the rear fuselage. Number 181-2 just behind it carries the only the nose number, the third aircraft appears to be clean, with no fuselage markings at all, while the last aircraft appears to have a number just in front of the speed brake. (Spanish AF)





Italy used large numbers of F-104Gs equipping some twelve squadrons. The Italian Air Force used the Starfighter in the air defense, strike fighter, reconnaissance and maritime strike roles. The 3-46 code on the fuselage identifies this F-104G as belonging to the 28th Gruppo, 3rd Stormo based at Villafranca-Verona. (E. Jose)

The Nationalist Chinese Air Force (CNAF) on Taiwan have operated several variants of the Starfighter, including the F-104A, F-104B, F-104G and TF-104G. This F-104G was based at Ching Chuan Kang Air Base near Taipei during 1969 and was in the standard overall Light Gray interceptor paint scheme. There have been reports, all unconfirmed, that CNAF F-104s have engaged Mainland Chinese MiGs in combat. (Marty Isham)



A Turkish Air Force F-104G on the taxiway at Balıkesir Air Base during October of 1988. Turkey has operated some six F-104 units and has purchased large numbers of Starfighters from other NATO forces as they have retired their F-104s. (S. Capoglo)



CF-104

The Canadian search for replacement for the F-86 (Canadair CL-13 Sabre) led to the selection, in 1959, of the F-104 as Canada's new tactical fighter. Canadair Ltd. was granted a license to build the aircraft in Canada under the designation CF-104. The CF-104 proved to be one of the major variants of the Starfighter being built both for the Royal Canadian Air Force/Canadian Armed Forces and various NATO forces under MAP (140 F-104Gs). The first CF-104 (Canadair CL-90) rolled out on 18 March 1961.

Major differences between the F-104G, on which the CF-104 was based, and the Canadian Starfighter, were slight and largely limited to differences in avionics and other internal equipment. The most significant difference was that in early CF-104s built for Canadian forces, the M61 cannon was deleted with the resulting space being taken up by additional fuel, which increased internal fuel by some 121.89 gallons. CF-104s also carried the NASSAR R-14A radar in place of the NASSAR F-15FA-41B radar carried on the F-104G, with the Canadian variant units optimized for the air-to-ground mode.

Canadian operational philosophy at that time stated that the Starfighter would be assigned primarily to Europe in support of NATO and that Canadian CF-104s would be used primarily as a tactical nuclear weapons delivery system in the event of a European war with the Soviet Union. Therefore, all CF-104s were configured with low-level tactical nuclear strike as their primary role. Initially, the only exception to this concept was No 1 Wing, tasked with reconnaissance using the VICON reconnaissance pod mounted on

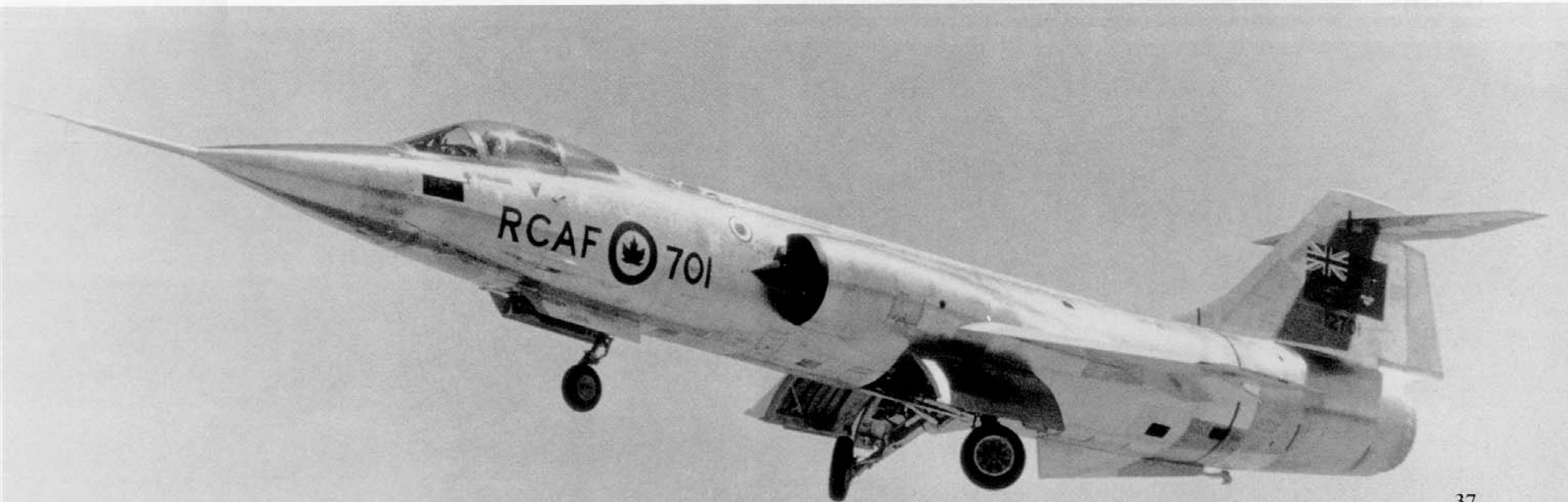
the fuselage centerline station and houses four Viten 70MM cameras. The entire pod weighs less than 300 pounds.

A total of eight Starfighter squadrons were assigned as part of the CAF's overseas NATO commitment during the cold war years. Initial European assignments were made to Number One Air Division and consisted of four fighter wings, two in France and two in Germany. The French edict that no foreign troops or nuclear weapons would be allowed to remain on French soil saw the transfer of the French based CF-104s of Nos One and Two Wings to Lahr Air Base in West Germany.

The Royal Canadian Air Force became a part of the restructured Canadian Armed Forces on 28 February 1968. During 1970, it was announced that Canada would reduce its F-104 commitment to NATO to three squadrons and that the Canadian Starfighters would abandon their nuclear strike role in favor of the conventional strike role. This change of role called for the reinstallation of the M61 cannon and the addition of Electronic Counter Measures (ECM) equipment. Two Radar Warning (RAW) blisters were added to the rear fuselage along side the exhaust and a similar blister was added under the nose on the radome.

Canadian use of the CF-104 ended in 1986, with the advent of the McDonnell Douglas CF-18 Hornet in CAF service and some late model CF-104s were sold to Norway.

This CF-104 (12701) was the first Canadian-built Starfighter which made its first flight in July of 1961. Canadian CF-104 Starfighters were not fitted with the M61 Vulcan cannon system and both the gun port and gun gas vents were faired over. (Canadian Armed Forces)





The Royal Canadian Air Force became a part of the Canadian Armed Forces on 28 February 1968, and all of its aircraft were repainted with the legend CAF instead of RCAF on the fuselage. Canada's Starfighters were intended to fill the nuclear strike role and did so until 1972, when the surviving CF-104s switched to the conventional tactical strike role. (John Kerr Collection)

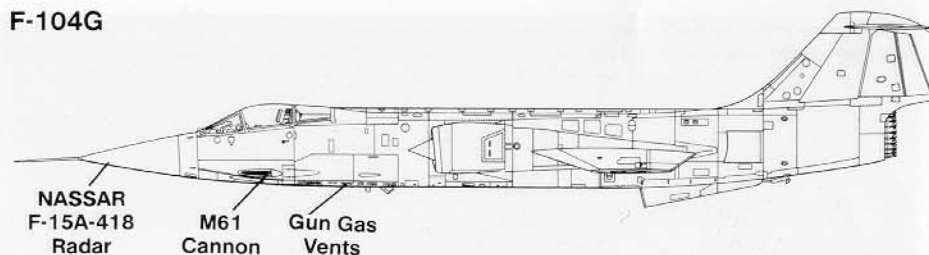
This CF-104 was assigned to No 48 Test Squadron and flew from CFB Cold Lake during 1967. The Natural Metal aircraft was trimmed with bright Red crash position indicator foil, had a Dark Gray rear fuselage, Gloss White wings and a Red horizontal tail. The aircraft carries the later style Maple Leaf national insignia and Canadian flag fin flash. (Canadian Armed Forces)



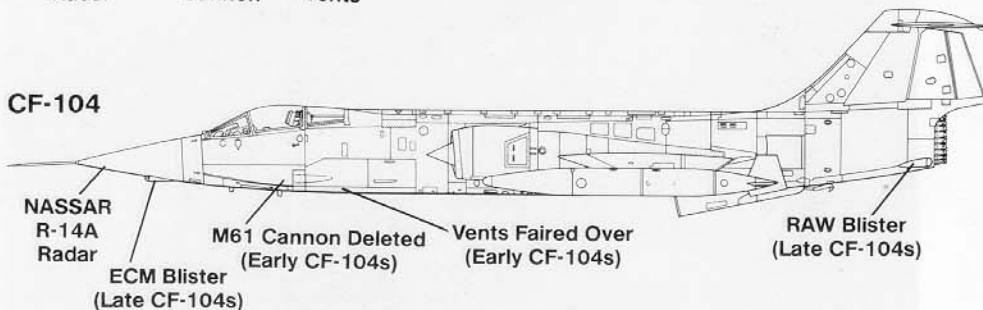
A Cold Lake (the location of the CAF's gunnery range) based CF-104 fires a load of CRU-7 rockets during air-to-ground gunnery practice in 1974. The aircraft carries the Armed Forces logo in Black on either side of the fuselage roundel in both English and French. The CANADA on the intake was in Red. (Canadian Armed Forces)

CF-104

F-104G

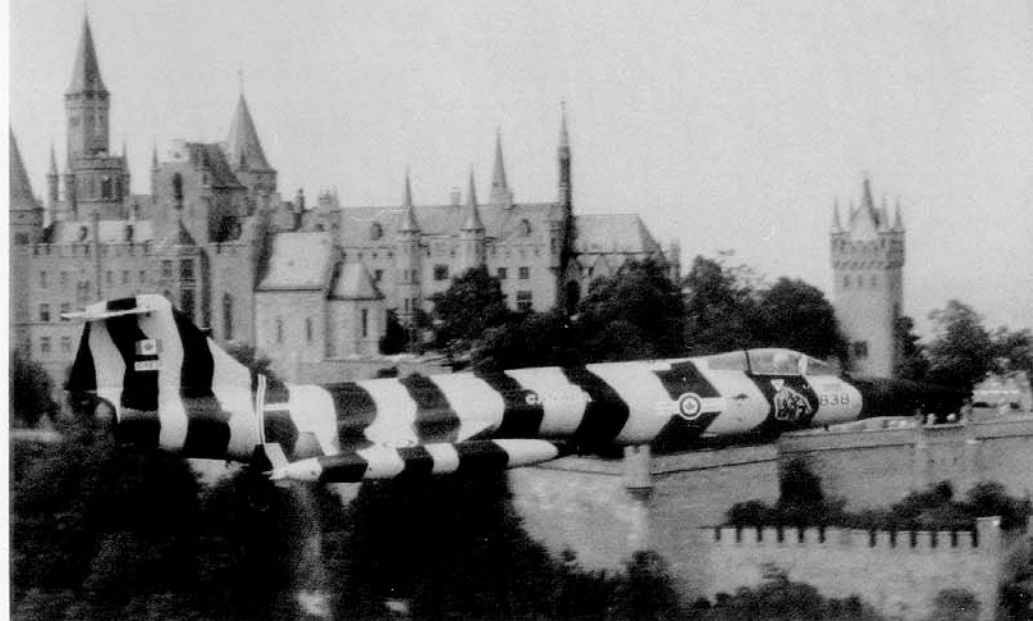


CF-104





This CF-104D trainer carried the CAF legend in French on the starboard fuselage and in English on the port side in Red with Black shading. The CAF legend and aircraft number on the nose and aircraft serial on the tail were in Black. Canadian Starfighters had the prefix "104" applied in front of the aircraft's serial number starting in 1968. (John Kerr Collection)



An F-104S of the 33rd Stormo, Italian Air Force flies in close formation with a Yellow and Black Tiger striped CF-104 of No 439 Squadron, Canadian Armed Forces during a NATO Tiger Meet. Both aircraft are basically clean, operating with wingtip tanks only. (Italian Air Force)

A tiger-striped CF-104 of No 439 Squadron flies past Hohenzollern Castle, Germany during June of 1977. The small wing makes the Starfighter relatively stable at low altitudes, making the CF-104 well suited for low altitude high speed ingress into a target area in time of war. This aircraft is fitted with rear-mounted Radar Warning (RAW) blisters and a under nose ECM blister. (Canadian Armed Forces)

When the Canadians changed their European based Starfighters from Nuclear Strike to conventional ground attack in 1971, the M61 cannon was retrofitted into the aircraft. This display shows the gun and conventional ordnance carried by the CF-104, although the seven round rocket launcher was used for training only. (Canadian Armed Forces)





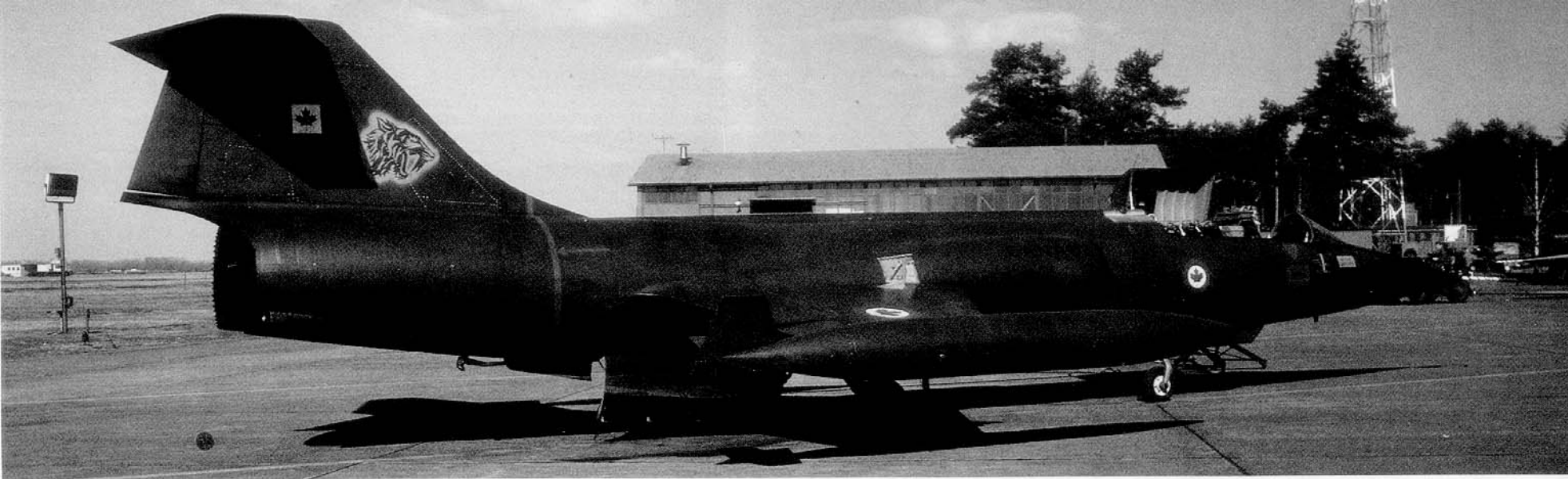
A CF-104 taxis in at CFB Lahr (West Germany) during September of 1980. The aircraft is painted in a two-tone Green and Gray upper surface camouflage over Light Gray undersurfaces and is carrying a practice bomb dispenser on the centerline station and rocket pods on the wing pylons. (Canadian Armed Forces)

In addition to the Dark Green and Dark Gray upper surface camouflage, CAF Starfighters also carried reduced visibility national insignia, in which the White areas have been deleted. All other lettering is in Black. The blister next to the tail cone is one of the two rear mounted Radar Warning antennas. (Walter H. Zuleger)



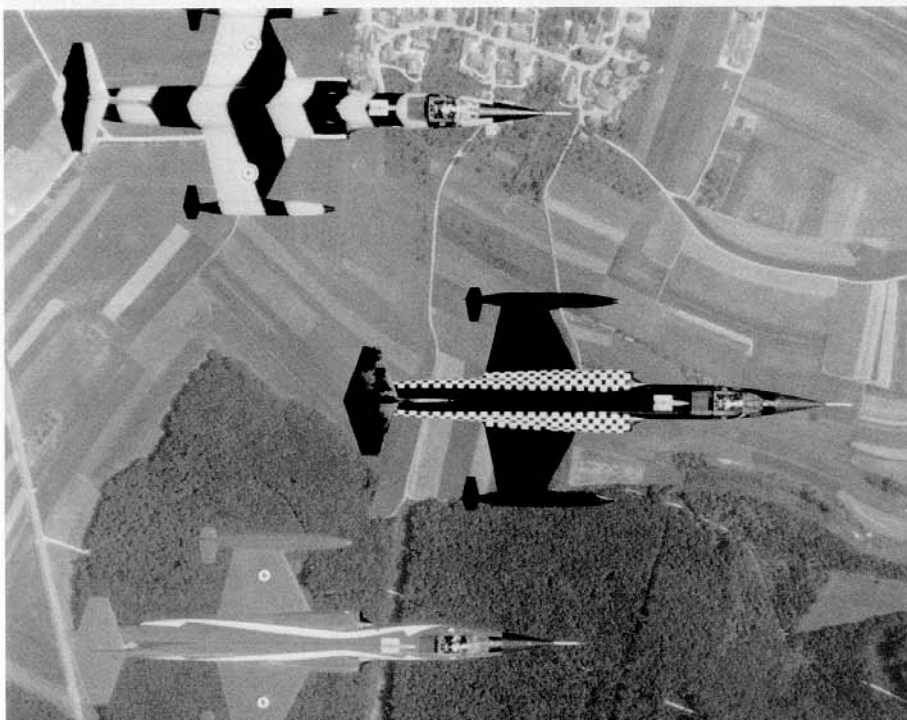
Armed with a practice bomb dispenser on the centerline station and seven shot rocket pods on the wing stations, a CAF CF-104 taxis in after another training sortie. The CAF withdrew its CF-104s from Europe during 1986, replacing the Starfighter with the McDonnell-Douglas Hornet. (Walter H. Zuleger)





This CF-104 of No 439 Squadron was camouflaged overall Olive Green, but carried has the Tiger's head squadron marking in full color on the fin. The camouflage would be fairly effective in the low altitude strike operations flown by CAF Starfighters, but the squadron badge and full color national insignia would compromise the camouflage. (Puch via Rick Morgan)

A trio of specially painted Canadian Armed Forces CF-104s in formation near Baden, Federal Republic of Germany, during 1986. These Starfighters belong to (bottom to top) No 421 Squadron (Red Indian) in Red and White, No 441 Squadron (Silver Fox) in Black and White and No 439 Squadron (Sabre Toothed Tiger) in Yellow and Black. (Canadian Armed Forces)



No 417 Squadron's specially painted commemorative aircraft in flight near CFB Cold Lake during 1986. The F-104 took to exotic paint schemes more readily than most military aircraft thanks to its pleasing, streamlined shape. This Starfighter was Red, Blue and White with a White 417 on the fin. (Canadian Armed Forces)



F-104J

Japan's first jet interceptor was the F-86D Sabre, 114 of which were ultimately supplied to the Japan Air Self Defense Force (JASDF). These served alongside Mitsubishi-produced F-86F-40 Sabre day fighters and provided Japan with a modest, although rapidly aging, interceptor force during the late 1950s and early 1960s. It was obvious to all, however, that Japan's geographical relationship to the Soviet Union made replacement of the North American fighters a high priority.

For a time the Japanese government considered acquiring a variant of the Grumman F11F Tiger, the F11F-1F Super Tiger, but in November of 1959, a decision was reached to produce the Starfighter in Japan under the designation F-104J. A license agreement was reached where Mitsubishi Heavy Industries would produce the aircraft, first assembling the aircraft from Lockheed supplied kits, then proceeding to full production. The first F-104Js were reassembled from aircraft produced by Lockheed in Burbank, with twenty-nine additional aircraft being built from Lockheed-supplied subassemblies. The first Japanese Starfighter flew from Komaki on 8 March 1962. After assembly of these twenty-nine aircraft, all subsequent F-104Js were built entirely in Japan by Mitsubishi.

The first Japanese Starfighter squadrons were No 202 Hiko-tai, based at Nyutabaru and No 201 Hiko-tai flying from Chitose. All operational F-104Js were optimized for the interception role, normally carrying four AIM-9 Sidewinders and two underwing fuel tanks, as the Japanese constitution specifically forbids possession of weapons, including aircraft, with an offensive capability. The Starfighter served the JASDF until the mid-1980s, when the last front-line F-104Js were replaced by McDonnell-Douglas F-4EJ Phantom IIs and F-15J Eagles.

Surviving F-104Js went to the Air Proving Wing at Gifu, which ultimately was to provide the storage facility for the type, with a number being scheduled for conversion to supersonic drones.



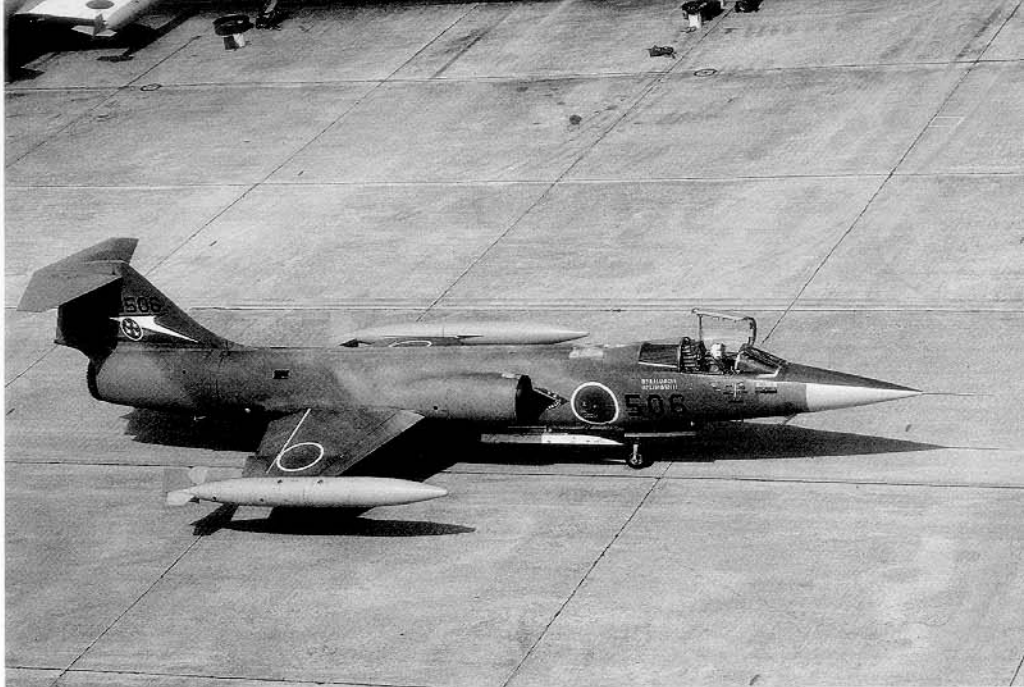
This F-104J (76-8700) of No 207 Squadron at Haha was painted Light Gray with White wings during 1979. Most of the stenciling on this F-104J was in Japanese, unlike NATO F-104Gs which carried at least a portion of their stenciling in English. (Toshiki Kudo via Rick Morgan)

A lineup of F-104Js of No 203 Squadron, Japan Air Self Defense Force being refueled on the ramp of their home base of Chitose in northern Japan. JASDF Starfighters spent most of their service lives in Natural Metal with White wings and Black anti-glare panels. (Toshiki Kudo via Rick Morgan)





During the early 1980s the Japanese tried a number of different camouflage schemes on their F-104s. This F-104DJ of No 207 Squadron at Naha was painted in a Tan, Light Green and Dark Green over Light Gray tactical scheme. All markings were full sized and in full color, somewhat negating the camouflage effect. (Toshiki Kudo via Rick Morgan)



This F-104J of No 207 Squadron was camouflaged in a two tone Gray scheme with the legend *Kuribayahi Kobiashi* under the rear portion of the canopy in Black. All markings were in full color, the numbers were in Black and the lower portion of the radome was in Light Gray. (Toshiki Kudo via Rick Morgan)

Another experimental camouflage scheme carried by F-104Js of No 207 Squadron was overall Dark Green. The Japanese national insignia was not outlined and all numbers were in black. This camouflaged tended to weather rapidly leaving the aircraft with a very streaky appearance. (Toshiki Kudo via Rick Morgan)



F-104S Super Starfighter

The F-104S is a third generation Starfighter resulting from a joint Lockheed/Italian study conducted at Lockheed Palmdale. Two late production Italian built F-104Gs were shipped to California for modification under the designation F-104S.

The F-104S differs from the earlier F-104G in that it has an advanced weapons system capable of using the AIM-7 radar homing air-to-air missile, deletion of the M61 cannon, uprated 11,870 lbst (17,900 lbst in afterburner) J79-GE-19 engine, strengthened airframe, installation of two small ventral fins on either side of the standard ventral fin and two additional underwing pylons wired for AIM-7 Sparrow missiles.

The first production F-104S rolled off the Aeritalia assembly line during December of 1968 and deliveries began to the Italian Air Force on 9 June 1969. Initial contracts called for production of 165 aircraft, but this was later increased to 205. Along with the Italian Air Force, the F-104S has been ordered by the Turkish Air Force which has placed a contract for forty aircraft.

The F-104S is the only Starfighter variant capable of using a beyond visual range missile, the AIM-7F Sparrow. Normally combat loads consist of four AIM-9 Sidewinders (two on the wingtips and two on under fuselage rails), two AIM-7s and two fuel tanks.

During 1983, authorization was given to update two-thirds of the F-104S fleet to the F-104S ASA configuration (ASA stands for *Aggiornamento Sistema d'Arma* or Updated Weapons System). The F-104S ASA has an improved radar with a look-down/shoot-down capability, Aspide 1A missiles (developed from the AIM-7), improved avionics and navigation system and reinstallation of the M61 cannon. The prototype F-104S ASA was completed and handed over to the Italian Air Force for trials on 12 December 1984.

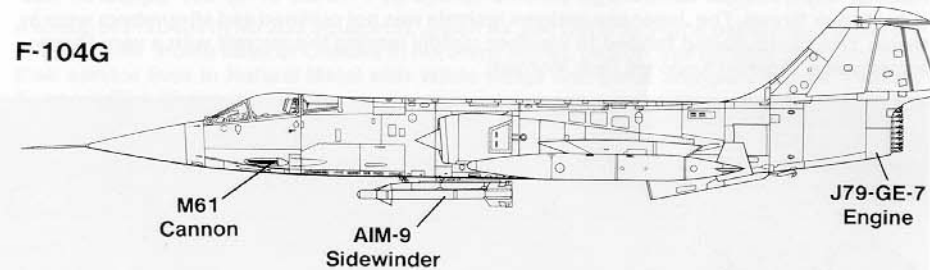
A pair of 36th Stormo F-104S Starfighters, configured for the air defense mission, fly formation near the unit's base at Gioia del Colle (Bari), Italy. The aircraft are armed with AIM-9 Sidewinders on the wingtip rails and AIM-7 Sparrows on the underwing pylons. An additional pair of AIM-9s could be carried on under fuselage rails for a total of six missiles. (Italian Air Force)



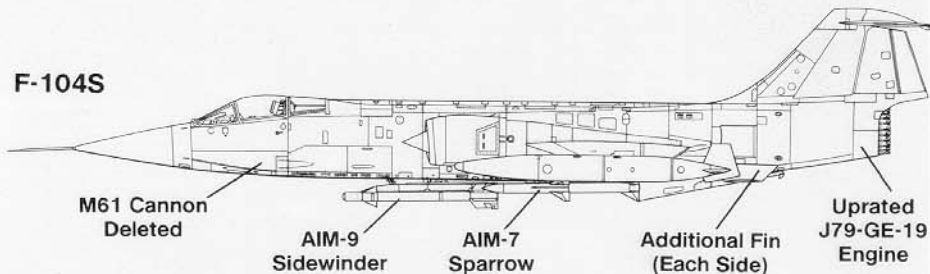
Italy's F-104S is, in many respects, the most potent of all the Starfighters variants and its mission comes closer to that of the original F-104 concept than other NATO operators. This F-104S of the 53rd Stormo was based at Cameri. One of the modifications done to the F-104S was the addition a pair of small fins located on either side of the ventral fin. (Italian Air Force)

F-104S

F-104G

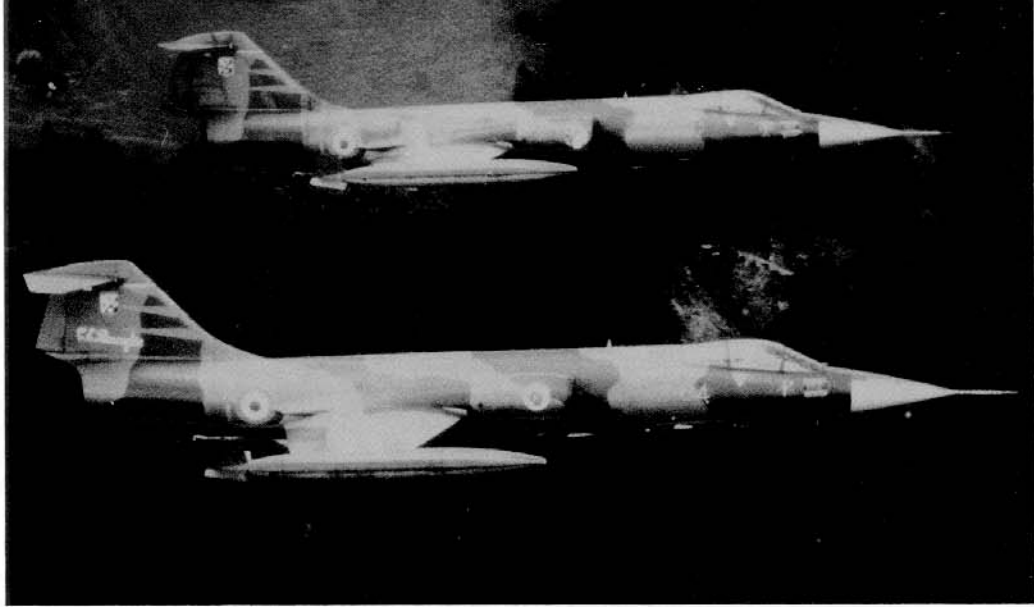


F-104S





An F-104S of the 5th Stormo carries underwing fuel tanks and no other stores. The Yellow tail stripe extends in front and behind the Stormo badge although it is barely noticeable unless the aircraft is seen directly from or slightly below a level position. The code numbers on the nose are in White. (Italian Air Force)



This pair of F-104S Starfighters of the 3rd Stormo, 132nd Gruppo carry three Red flashes in the fin along with the Gruppo marking. The 3rd Stormo has tactical reconnaissance as its primary mission and operates the RF-104G in that role, making it one of the very few Italian units still using the F-104G. These aircraft are based at Verona-Villafranca. (Italian Air Force)

These F-104S Starfighters of the 20th Gruppo carry the 5th Stormo *Diana the Hunter* badge on the vertical tail with Yellow stripes coming off the badge. The pitot tubes are striped in Red and White, with a break in the center of the tube. Camouflage patterns on Italian F-104s are standardized but are not exact from aircraft to aircraft. (Italian Air Force)

This F-104S carries the standard weapons load, a pair of AIM-9 Sidewinders and a pair of AIM-7F Sparrows, for Italian Air Force interceptors. The flaps and leading edge slats are fully deployed, indicating the aircraft is in slow speed flight. The smoke trail behind the F-104S is a trade mark of the J-79 engine. (Italian Air Force)





An F-104S/AS1 of the 5th Stormo, 102nd Squadron on the ramp outside a Hardened Aircraft Shelter (HAS). The 102nd Squadron is assigned the air-to-ground mission and the F-104S/AS1 is well suited to this role since the M61 cannon is reinstalled in this variant of the F-104S. (G. Beerens)



The F-104S was purchased by the Turkish Air Force to update its Starfighter fleet. Normal Turkish F-104S Starfighters do not carry the AIM-7, but use the underwing missile pylons carry a pair of AIM-9 Sidewinders. These aircraft belong to the 191st Squadron based Balıkesir. (Oguz Meric)

A Turkish F-104S of the 191st Squadron on alert armed with a pair of AIM-9 Sidewinders on the outboard missile rails. Turkish F-104S Starfighters carry reduced size national insignia, have the base/aircraft code number in Black outlined in White on the nose and the individual aircraft number repeated in Black just under the windscreen. (Oguz Meric)



Lancer

While the F-104 was providing the nations that were using it with a fighter of highly advanced capabilities and breathtaking performance, it was not the effective, easy to operate fighter needed for the Western European market. The F-104 had repeatedly proven itself to be a handful to fly even in the hands of a skilled pilot, much less in the hands of a less experienced pilot. That fact, plus the Starfighter's increasing age, led Lockheed to issue (in 1971) a proposal for a successor to the F-104 designated the CL-1200 Lancer.

The Lancer was proposed with the idea of using as many F-104 components as possible. This goal could be readily and quickly accomplished, since the type was still in production in both Germany and Italy. A ready market existed for the new fighter as well, with nine European and six other nations still operating the F-104 (1971).

The CL-1200 concept, on which the Lancer was based, was developed as a private venture by Lockheed and entailed what amounted to a major redesign of the existing F-104 structure. The changes involved were many and included a wing structure some fifty-three percent larger than the Starfighter's, an enlarged vertical tail, high-lift devices, additional hardpoints on the wings, an improved intake design, considerably increased fuel capacity and the installation of a Pratt & Whitney TF30-P-100 engine. The forward fuselage was to be an F-104S or TF-104G section, depending on whether the aircraft was to be a single or two-seater, mounted on a thirty inch fuselage extension.

The Lancer project at first appeared to promise an effective light weight fighter for the 1980s at a cost far below that of any new-design air superiority fighter. Unfortunately, and perhaps incorrectly, certain members of the Air Force's "Fighter Mafia" felt that the design had the potential to adversely impact development of the then new F-15 Eagle. As the result, political pressure was applied and the CL-1200 was assigned the experimental designation X-27. The Lancer offered only limited scope and technological advances when used as a research aircraft; so the Air Force agreed to the request that the type not be built. In the event, no metal was cut and the project died.

The Lancer's intended market had been in Europe from the beginning and the Air Force's unwillingness to work with Lockheed on the project had considerable basis in that fact. While the proposed fighter could have, on paper at least, offered a high performance aircraft at greatly reduced development costs, it failed to offer the "quantum leap" in technology that would justify extensive American financial involvement. In addition, several new European fighters offered similar performance. A full scale mockup of the aircraft was built and displayed, but no actual flight article was ever constructed and the program quietly faded away.

The full scale Lancer mockup used an F-104G forward fuselage and landing gear and had the wooden fuselage covered by metal skinning. The Lancer was to be an improvement over the F-104, but it could not effectively compete with the then-projected F-15 Eagle. It could, however, have outperformed most of the fighters then serving in the world's air forces. (Lockheed)



NASA Starfighters

The F-104 was a "hot" aircraft in the fullest meaning of the word and it was only logical that NASA would become interested in the type. Their involvement with the F-104 began during May of 1963, when three aircraft were purchased by the agency for a total of \$2,256,000, a small investment for a fighter of the Starfighter's performance capability. The original reason for buying the F-104 was to provide high performance test bed capabilities, as well as providing a simulator for the X-15 program, since a "dirty" approach in the Starfighter closely approximated the landing pattern of North American Aviation's X-15.

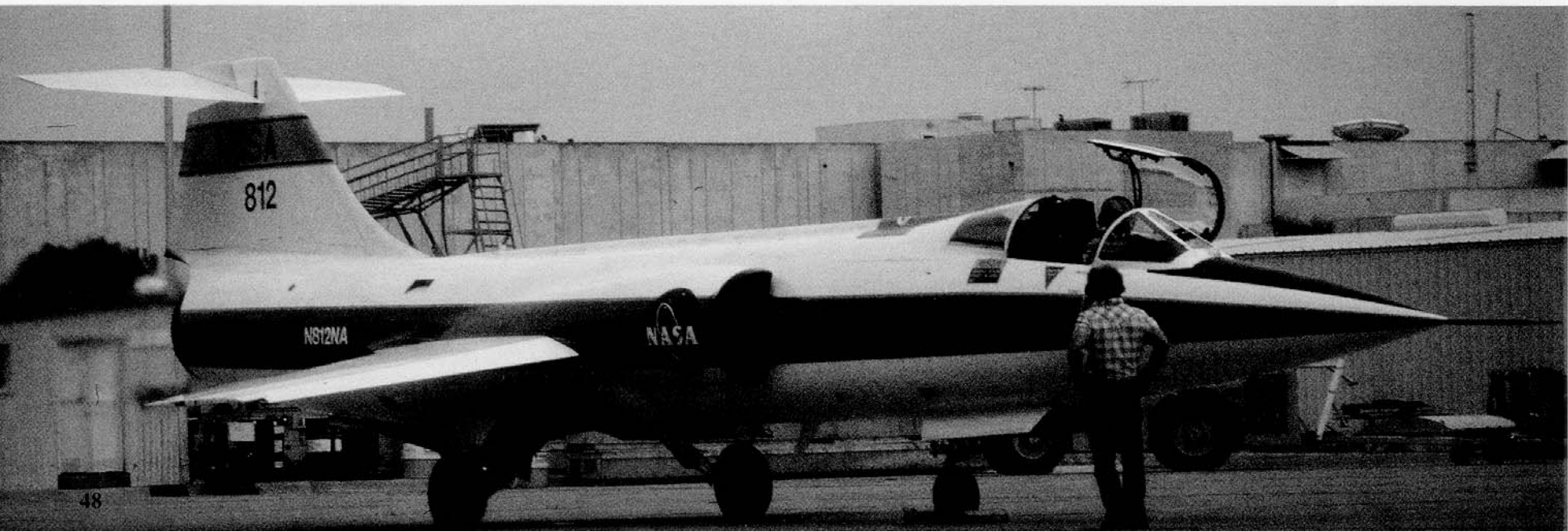
These first three NASA Starfighters were initially designated F-104Ns and were used primarily as supersonic chase aircraft for much of their careers. The Agency's Starfighter inventory received a tremendous boost in 1975, when three ex-Luftwaffe F-104s (two F-104Gs and a TF-104G) were delivered from Jever Air Base in West Germany to augment the F-104Ns then in use. The age of the NASA's existing Starfighters and the draw down of the Air Force's F-104 program had made support, particularly regarding spare parts, a difficult matter.

The early 1980s saw extensive STS (Space Shuttle) materials research conducted using the F-104s as a test platform. Utilizing an under-fuselage pod, the Starfighter was used to test both the tiles and the Advanced Flexible Reusable Surface Insulation (AFRSI) used in lieu of the tiles in some areas of the spacecraft. By 1985, however, it was determined that the NASA's fleet of F-104s were both too old and too difficult to support to be economically viable any longer. Consequently, an agreement was reached with the Navy to accept a number of F/A-18 Hornets to replace the Starfighters, ending their service with NASA.



Several of the NASA's Starfighter fleet came from West German stocks. This TF-104G still carried its Luftwaffe camouflage scheme with a NASA tail number (825) and a National Aeronautics and Space Administration badge on the fin. The aircraft was later repainted in the standard NASA White, Blue and Gold paint scheme. (Isham)

N812NA, on the ramp at NAS Moffett Field, California during May of 1983, was one of three F-104Ns (ex F-104As) assigned to NASA. NASA's Starfighters often operated without wing tanks, since their missions were generally of a very specific nature and of short duration. The casual attire of the ground handler is typical of civilian manned flight lines. (Bob Burns)



Civil F-104s

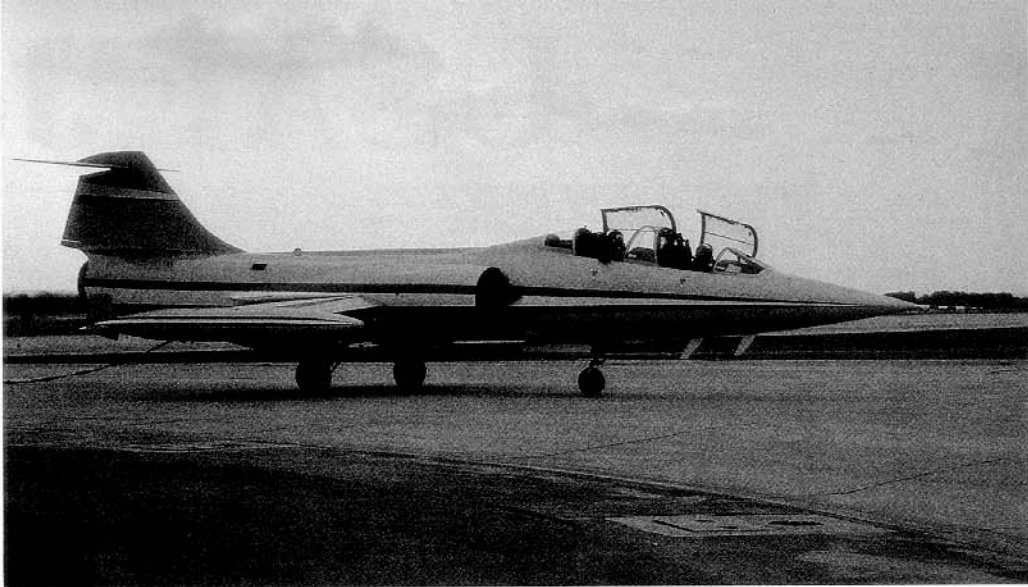
Military Starfighters have nearly disappeared from the skies of the world, but the aircraft has received somewhat of a new lease on life in the civil "Warbird" market. Civilians have operated ex-military aircraft since the conclusion of the First World War, sometimes for commercial purposes and sometimes just for the sheer exhilaration of flying a high performance military machine. A new direction was established in this "Warbird" market during the late 1970s and early 1980s, when enthusiasts began to acquire flying examples of first-generation jet fighter and training aircraft such as the T-33, F-86, and Hawker Hunter.

Since then, virtually every type of military aircraft short of the strategic bomber and air refueling tanker has appeared on the "Warbird" market. There seemed to be a limit, however; the Mach 2 fighter as typified by the USAF Century Series. These fighters seemed far too expensive for a private individual to own and operate and, it was thought, far too prone to governmental controls and regulations to ever be seen in the hands of a private individual.

Times change, and so do perspectives. While there are presently no privately owned (that is to say, non-corporate) F-101s, F-102s, F-105s or F-106s flying, there are a surprising number of F-100s and F-104s out there wearing the "N" number of the civil registry. Most are of foreign origin and some are rarely flown, but they are there, providing their owners with what was, until the recent importation of large numbers of ex-Warsaw Pact MiG jet fighters, the most exotic warbirds flying. Their existence provides just another chapter in the remarkable story of the Lockheed F-104.

The F-104 was, and is, a highly unforgiving aircraft, yet it has remained in service somewhere in the world for over thirty years. Italian and Turkish F-104s will likely continue in service into the 21st Century, vindicating the vision of Kelly Johnson. No one who has heard an F-104 on final will ever forget its banshee-like howl and no one who has ever seen a Starfighter in flight will ever forget its exotic shape. Although its final chapter has yet to be written, the F-104 has already entered the realm of the "legendary" aircraft. Few would argue that it did not earn this status.

N104NL, is an F-104D operated by Northern Lights Aircraft, Inc. The aircraft is used for contract work and carries an overall Blue scheme with White trim. Jet Warbird owners are faced with problems unknown to their fellow enthusiasts who operate the more conventional piston engined restorations, among which higher maintenance costs and a fuel bill that is awe-inspiring. (Mark Morgan)



This F-104D, N104JR operates out of Houston, Texas, under the auspices of a museum collection. Public displays, like this one at Kelly AFB in 1988, serve to introduce young aviation enthusiasts to the Starfighter and its characteristic shriek while on approach never fails to get the attention of the spectators. (Phillip Friddell)

The Starfighter is among the least likely candidates for conversion to a Warbird, but the type has achieved a degree of popularity with those enthusiasts wealthy enough to operate a Mach 2 fighter. These Starfighter hulks are ex-Belgian Air Force F-104Gs awaiting restoration at Mojave, California. (John Kerr)



A TF-104G Starfighter of No 726 Squadron, Royal Danish Air Force. The F-104 was replaced in Danish service by the F-16 Fighting Falcon during the 1980s.



On 10 December 1971, a Pakistani Air Force F-104A shot down an Indian Navy Alize anti-submarine aircraft over the Indian Ocean. This was one of five kills credited to F-104s during the 1971 India/Pakistan conflict.

