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F-16 Fighting Falcon

in action

Aircraft Number 196

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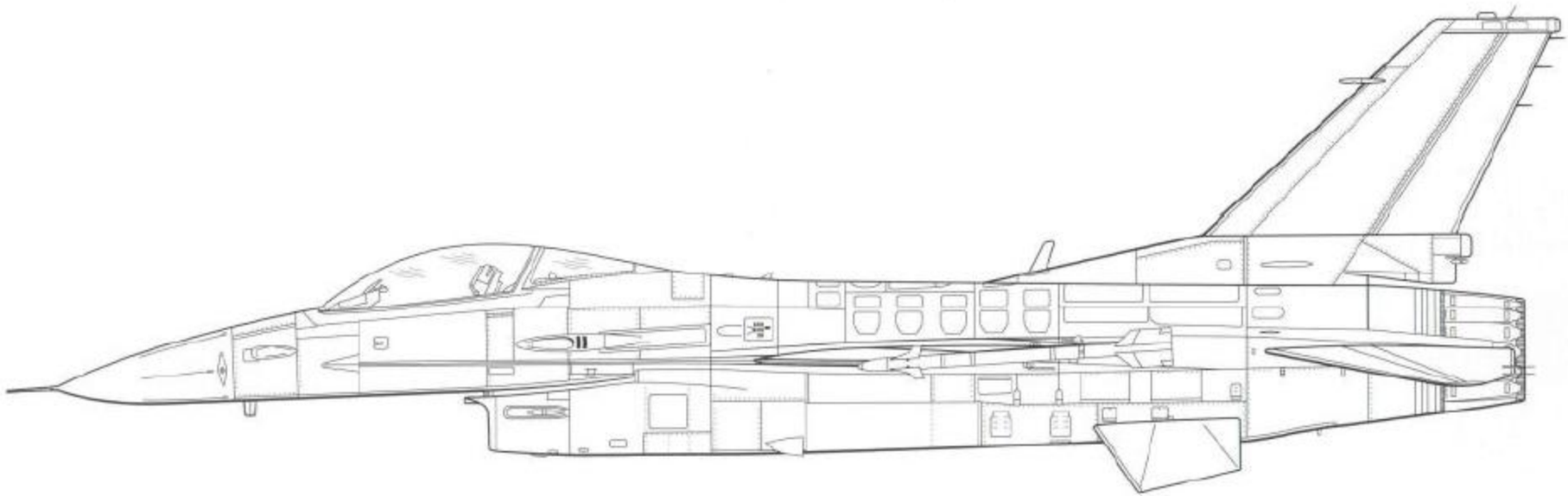
By Lou Drendel

Illustrated by David Gebhardt
Darren Glenn



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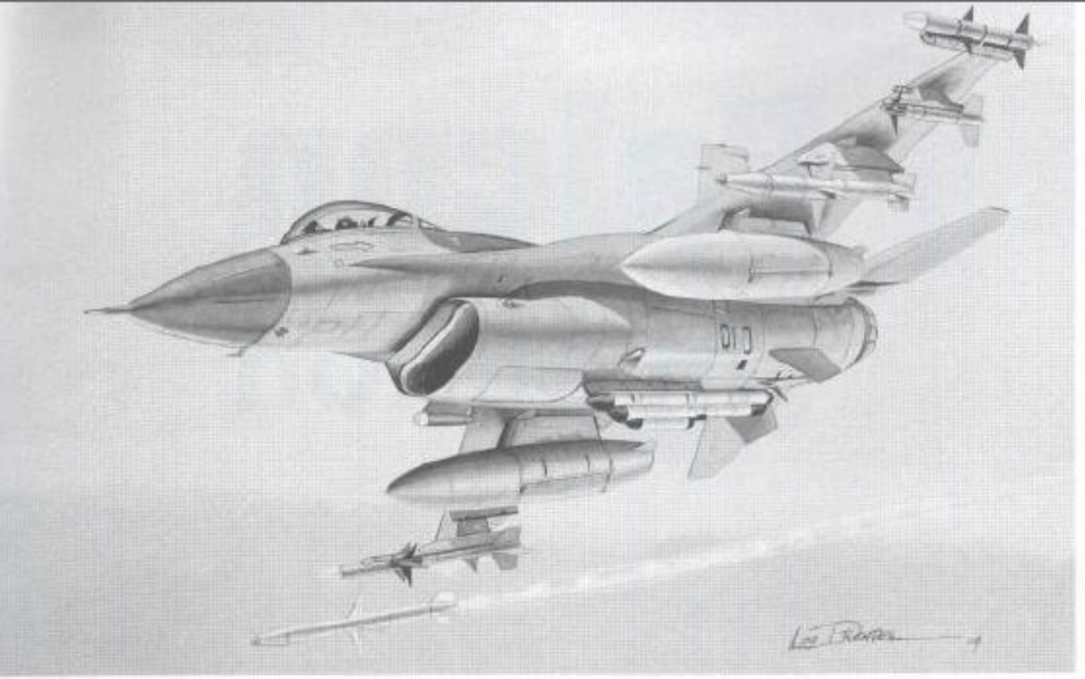

Cover: The Suppression of Enemy Air Defenses (SEAD) configured F-16C firing an AGM-88 High Speed Anti-Radiation (HARM) missile at an enemy radar site.

Acknowledgements

A number of very generous enthusiasts contributed to this book. I owe special thanks to Andre Jans and John Gourley, both of whom went out of their way to send me large digital files via CD. Other invaluable resources included the websites of Lockheed Martin (http://www.lmaeronautics.com/index.html), USAF (http://www.af.mil/), Code One Magazine (http://www.code one magazine.com/f16/), NASA (http://www.dfrc.nasa.gov/Gallery/Photo/F-16AFTI/), USAF Test Pilot School (http://www.edwards.af.mil/tps/vista.htm).

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(Left) The author (at right) with LtCol Bobby Armor after a low-level F-16D mission with the 363rd Fighter Wing out of Shaw AFB, S.C. LtCol Armor was a Gulf War veteran, with 119 hours of combat flight time. (USAF)

(Right) F-16As of the North Dakota Air National Guard fly combat air patrol (CAP) over Washington, D.C. shortly after the 11 September 2001 terrorist attacks on New York and Washington. The damaged Pentagon is in the left center of the picture, with Ronald Reagan National Airport at the lower right. ANG units have assumed most of the national air defense mission. Operation Noble Eagle is the ADC mission to protect the American homeland. (USAF)


Happy Hooligans
ND
AF 82 006
Happy Hooligans
ND
AF 82 992

The first flight of the YF-16 was 20 January 1974, at Edwards AFB, California. Test pilot Phil Oestricher was at the controls for the short trip around the pattern at Edwards after an inadvertent liftoff during high-speed taxi trials. (Lockheed Martin)

Foreword

This is the second F-16 In Action published by Squadron/Signal Publications. I authored the first edition over 20 years ago. Twenty years is a long time in the operational life of an airplane, even a modern airplane. In that time, the F-16 has undergone six major block changes incorporating four generations of core avionics, five engine versions, five radar versions, five electronic warfare suites and two generations of most other subsystems.

Because of the excellent aerodynamic and structural design of the original F-16, the external lines remain essentially unchanged. The F-16's growth potential, however, has been fully utilized. The growth in avionics processing capability has been exponential: the latest F-16's core computer suite has over 2,000 times the memory and over 260 times the throughput of the original production F-16. These improvements have been accompanied by dramatic improvements in reliability and maintainability.

More than 4,000 F-16s have been produced, in over 110 different versions in it's long and eventful life. It is currently flown by 22 different nations, worldwide, and there is reason to believe that production will continue, and that even more air forces will fly the lightweight fighter spawned by General Dynamics and now manufactured by Lockheed Martin.

Introduction

The United States went to war in Southeast Asia with airplanes which had been designed to accommodate a Cold War strategy that envisioned waves of Soviet nuclear bombers threatening the North American continent. The Century Series of fighters and all Navy attack and fighter aircraft were either designed for point defense or delivery of nuclear weapons. Most were less than ideal to fight the air war which evolved in Vietnam, and it didn't take the services long to realize this.

Early in the Viet Nam war, USAF planners proposed a new fighter, designed from the outset to be capable of long-range shoot-downs or for superiority in close-in dog fighting. It would be a large, complex fighter with powerful radar, multiple missiles, and an internal gun. It was designated as the Fighter Experimental (FX) and would eventually emerge as the McDonnell Douglas F-15 Eagle. On a parallel development track, USAF also proposed a new lightweight, advanced day fighter (ADF).

In spite of the fact that the United States was in a shooting war in Southeast Asia, the real enemy remained the Soviet Union, and most new weapons systems were planned around countering the Soviets. USAF tactical planners may have wanted the lightweight fighter more than the FX, but when the Soviets unveiled the MIG-25, there was no question about which fighter would get funded first and foremost.

Despite this, a "Fighter Mafia" of aerial tacticians within the Pentagon, led by Major John Boyd and Pentagon System Analyst Pierre Sprey, continued to champion the lightweight fighter concept. Their efforts were rewarded when on 16 January 1971, a Request For Proposals (RFP) was issued to the industry. The RFP called for a high thrust-to-weight ratio, a gross weight of less than 20,000 pounds, and high maneuverability. No attempt would be made to equal the performance of the MiG-25 Foxbat, the emphasis being placed instead on the most-likely conditions of future air combat -- altitudes of 30,000-40,000 feet and speeds of Mach 0.6 to Mach 1.6.

The emphasis was on turn rate, acceleration, and range rather than on high speed. Hearkening to one of the lessons of air-to-air combat in Vietnam, where the diminutive size of the adversary MIGs had given them advantages over the larger U.S. fighters, small size was specified for the new fighter. The RFP specified three main objectives. The aircraft should fully explore the advantages of emerging technologies, reduce the risk and uncertainties involved in full-scale development and production, and provide a variety of technological options to meet future military hardware needs.

Five manufacturers submitted proposals in response to the RFP --- Boeing, Northrop, General Dynamics, Ling-Temco-Vought, and Lockheed. In March of 1972, the Air Staff concluded that the competing Boeing Model 908-909 was the first choice, with the General

YF-16 number two (72-1568) was flown for the first time on 9 March 1974 with test pilot Neil Anderson at the controls. An experimental camouflage scheme of "air superiority blue" and cream was applied for testing purposes. YF-16s were configured as pure VFR day air superiority fighters, armed with short-range AIM-9 missiles and 20mm internal cannon. (General Dynamics)

Dynamics Model 401 and the Northrop Model P-600 next. The Vought V-1100 and Lockheed CL-1200 Lancer were eliminated.

But the Source Selection Authority rated the General Dynamics and Northrop proposals ahead of the Boeing submission. The General Dynamics Model 401-16B and the Northrop P-600 were chosen for further development on 13 April 1972, and contracts for two YF-16's (#72-1567 and #72-1568) and two YF-17's (# 72-1569 and # 72-1570) were awarded. Rather than the "X" (experimental) prefix being used, the "Y" (development) prefix was used. The YF-16 was to be powered by a single Pratt & Whitney F100 turbofan, whereas the YF-17 was to be powered by a pair of General Electric YJ101 engines.

The "cost plus fixed fee" contracts covered the design, construction, and testing of two prototypes, plus a year of flight testing. At the same time, contracts were let to Pratt & Whitney for a version of the F100 turbofan specially adapted for single-engined aircraft and to General Electric for the new and smaller YJ101 engine.

The YF-16

When the Lightweight Fighter competition was completed early in 1973, both the YF-16 and the YF-17 showed great promise. On 13 January 1973 the Air Force announced that the YF-16's performance had made it the winner of its Air Combat Fighter (ACF) competition. General Dynamics' YF-16 had generally shown superior performance over its rival from Northrop. It was also judged to have production costs lower than expected, both for initial procurement and over the life cycle of the plane. The YF-16 had also proved the usefulness of fly-by-wire flight controls, and innovative reclined seat backs and transparent head-up display (HUD) panels to facilitate high-G maneuvering, and the use of high profile, one-piece canopies to give pilots greater visibility.

The first of the two YF-16 prototypes, designed by a GD team under Harry Hillaker, was rolled out on 13 December 1973, only 21 months after award of the contract. Initial flight of the YF-16 was from Edwards Air Force Base (AFB) in California on 20 January 1974, flown

The first regular Air Force unit to get the F-16A was the 388th Tactical Fighter Wing (TFW), Hill AFB, Utah. The first flight of a Block 1 F-16A (78-0001) took place on 7 August 1978. The first aircraft in this block entered service with the 388th TFW on 6 January 1979, with initial operational capability (IOC) achieved on 1 October 1980. All block 1 F-16A/Bs were retrofitted with minor equipment changes and brought up to Block 10 standards in 1982-84.

In May of 1975, YF-16 #1 made its first transatlantic flight for a sales tour to potential NATO customers, culminating with an appearance at the Paris Air Show. On 7 June 1975, armed with the assurance of a USAF commitment to the type, Belgium, Netherlands, Denmark, and Norway announced that they had agreed to acquire the F-16 as a replacement for the F-104G. Seen here during the European tour. (Michel Klaver)

by GD test pilot Phil Oestricher. It was an inadvertent first flight, launched during a high-speed taxi test that exceeded the stall speed by a few knots. Once airborne, Oestricher felt he had no option other than continuation of the flight which, in spite of over-sensitive fly-by-wire controls, was successfully concluded. (Control inputs were adjusted accordingly for later flights.)

F-16A/B

The F-16A/B was the first production version of the Fighting Falcon. The A is the single-seat version and the B the two-seat version. Aside from the second seat, the A and B versions are essentially identical and have the same performance envelope, and carry the same weapons.

The USAF decided to use a new series of designators for describing minor changes to the Fighting Falcon that are introduced on the production line. F-16s are referred to by a set of Block Numbers and Multinational Staged Improvement Program (MSIP) stages. MSIPs are programs in which changes are incorporated in the F-16s as they come off the production line. The F-16A/B was built in Blocks 1, 5, 10 and 15. They were initially powered by the F100-PW-200 turbofan, rated at 12,240 lbs static test (ST) dry, 14,670 lbs ST full military, and 23,830 lbs ST with afterburning. Block 1 F-16A/Bs were the first 43 early production aircraft immediately following the two YF-16s and the eight FSD F-16As. They can be distinguished from all subsequent Fighting Falcons by having a black radome. There were 21 Block 1 F-16As and 22 Block 1 F-16Bs.

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Pilots flying the early Block 1 F-16As complained that the black radome made it too easy for adversaries to acquire the F-16 during simulated air-to-air combat. On Block 5, the gray radome was introduced. This became standard for all later F-16s. There were 99 F-16As and 27 F-16Bs built to Block 5 standards, which were ordered in Fiscal year 1978-79. Surviving Block 5 F-16A/Bs were brought up to Block 10 standards in 1982-84.

Block 5 F-16A/Bs destined for Israel had minor (but unspecified) modifications which are unique to Israel.

Block 10 consisted of 169 aircraft (145 F-16As and 24 F-16Bs), ordered in fiscal year 1979-1980. Block 10 aircraft incorporated some minor internal changes. Beginning with the Block 10 series, the USAF introduced a letter suffix within each block, with the letter initially signifying the order in which batches of aircraft were produced. This letter suffix took on greater significance in later standards, which included the graying of the radomes. Aircraft of the original four NATO users were also brought up to the Block 10 standard. These aircraft were deemed unsuitable for future upgrading. 24 Block 10 F-16s were modified for close-air support duties with the 138th Fighter Squadron of the New York Air National Guard. They were equipped with a General Electric GPU-5/A Pave Claw centerline pod, which housed the GAU-13/A four-barreled derivative of the seven-barreled GAU-8/A cannon used by the A-10A. This gun was intended for use against a variety of battlefield threats, including armor. However, the gun was never satisfactorily integrated with the F-16, and when Desert Storm came along, the 138th Fighter Squadron deployed its F-16s to the Gulf with traditional F-16 weaponry. The New York ANG's "Pave Claw" F-16A/Bs were replaced by F-16C/Ds in 1994. The 24 gun-pod-capable F-16s are now in storage at Davis-Monthan AFB .

General Electric reworked the F-101 engine, originally built for the B-1, optimizing it for fighters under the Derivative Fighter Engine (DFE) program, a joint USAF/Navy program to explore alternative powerplants to the Pratt & Whitney F100 turbofan in the F-16 and for the TF30 turbofan in the F-14 Tomcat. The new engine was designated F101X, and featured some components derived from the F404 engine used on the F/A-18 Hornet. These included a scaled-up fan and a modified nozzle and afterburner. The first FSD F-16A (75-0745) was fitted with the new F101X DFE engine and flew for the first time on December 19, 1980. There were some obvious visual differences between the F-101 exhaust and that of the F-100 engines used in production F-16s. (General Dynamics)

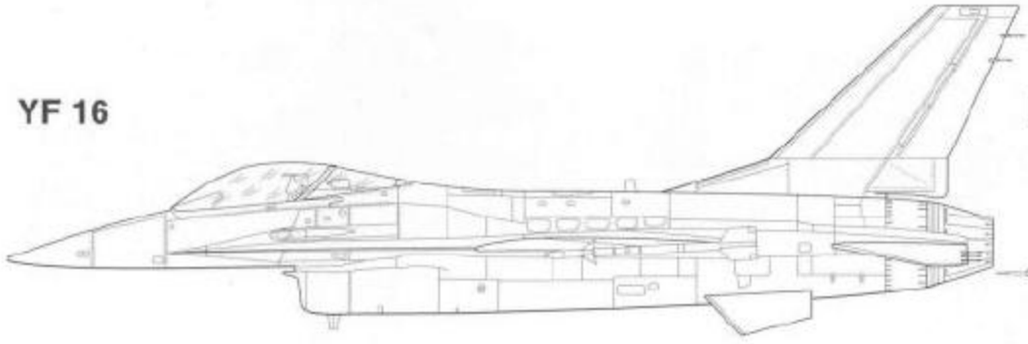
(Below) The so-called "Big Tail" horizontal stabilator enhancement was implemented in MSIP Stage I on Block 15 F-16s. It has remained through the current F-16C/D blocks.

Beginning in 1993, some Block 10 F-16A/Bs (including many which began life as Blocks 1 and 5 but were upgraded to Block 10) were turned over to the 82nd Training Wing at Sheppard AFB in Texas for use as non-flying instructional airframes for the training of crew chiefs. These planes were redesignated GF-16A. The G prefix designates the aircraft as a non-flying instructional airframe.

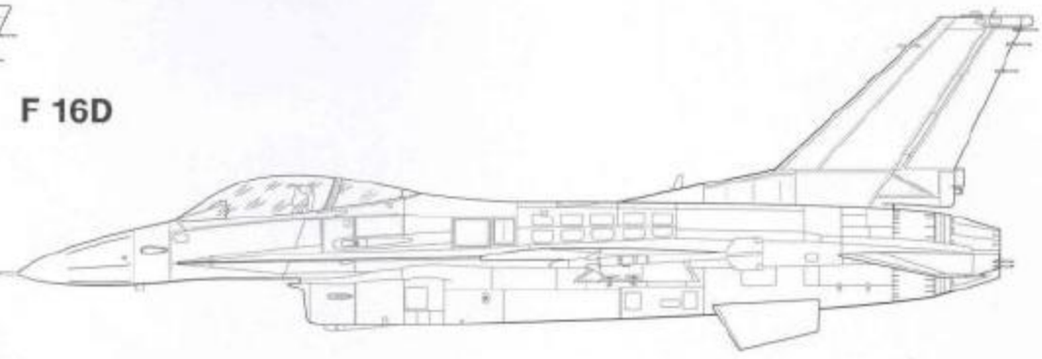
All earlier F-16s in Block 1, 5 and 10 can be identified by a black bulge and a blade UHF antenna underneath the radome. They also feature the small square-tipped horizontal tailplane.

The first major changes to the F-16A/B were introduced on Block 15 in MSIP Stage I. Among these were the introduction of the extended horizontal stabi-

YF 16



F 16D



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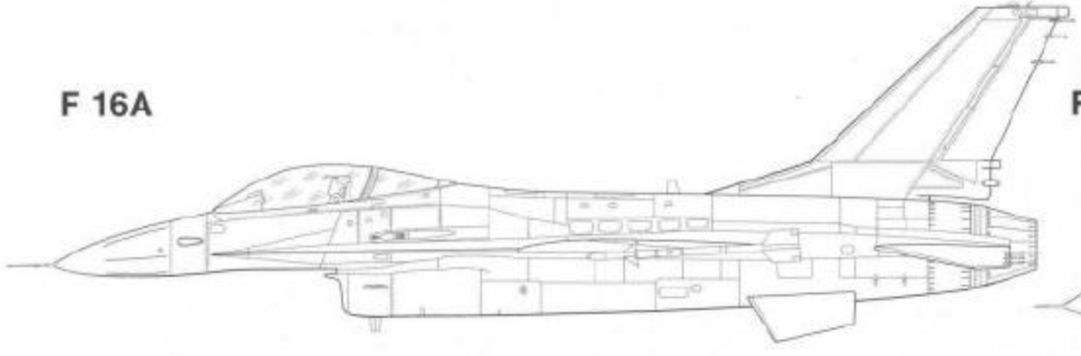
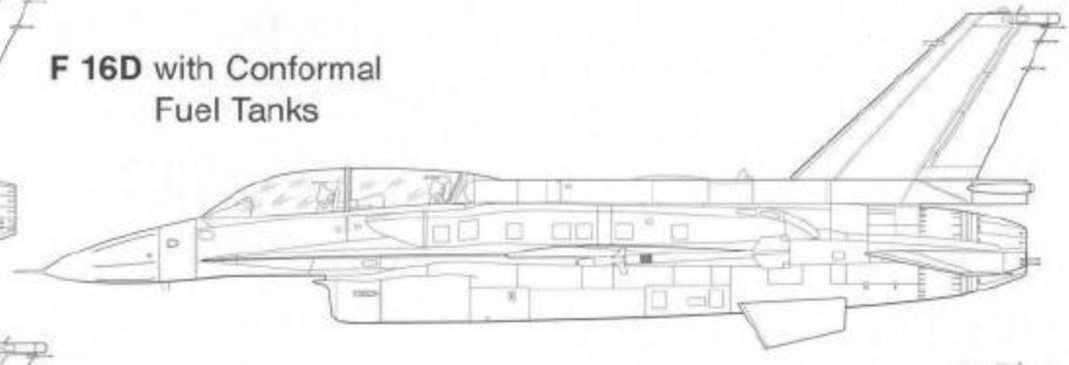
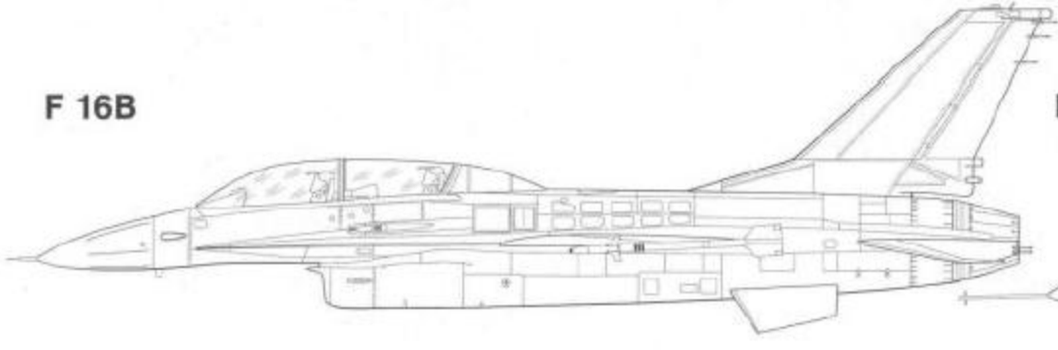


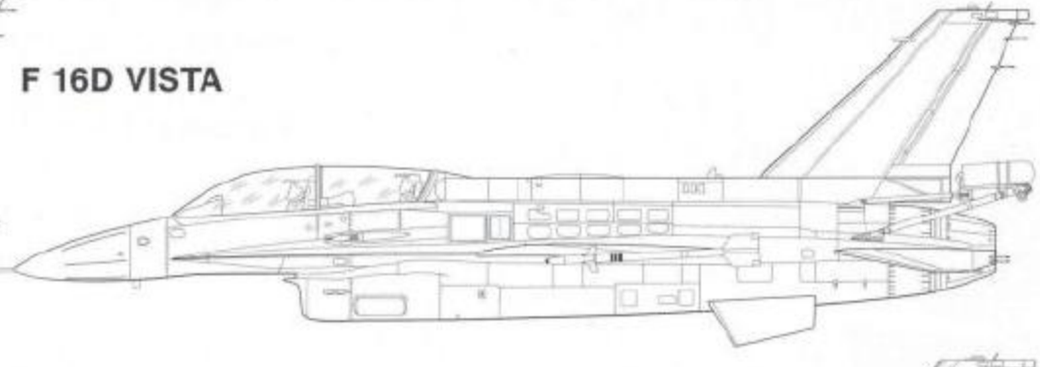
F 16D with Conformal Fuel Tanks



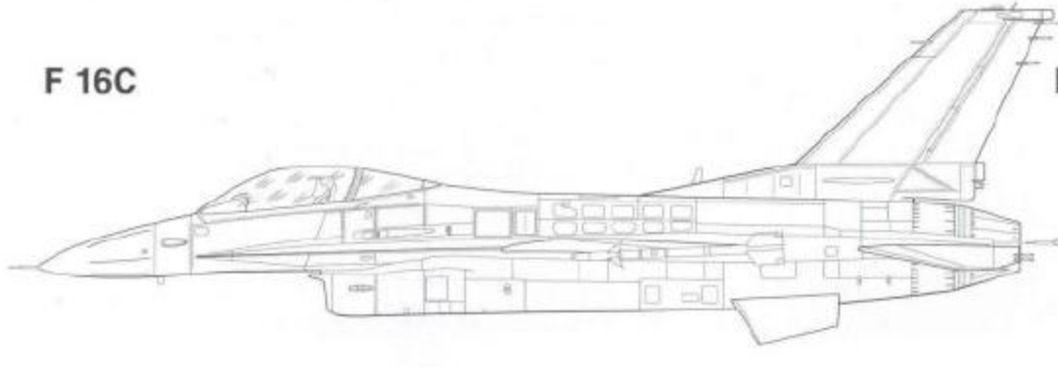
F 16B



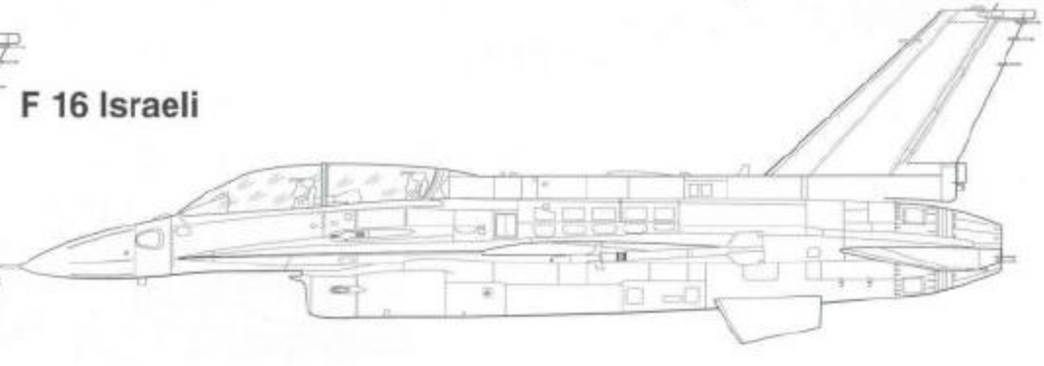
F 16D VISTA

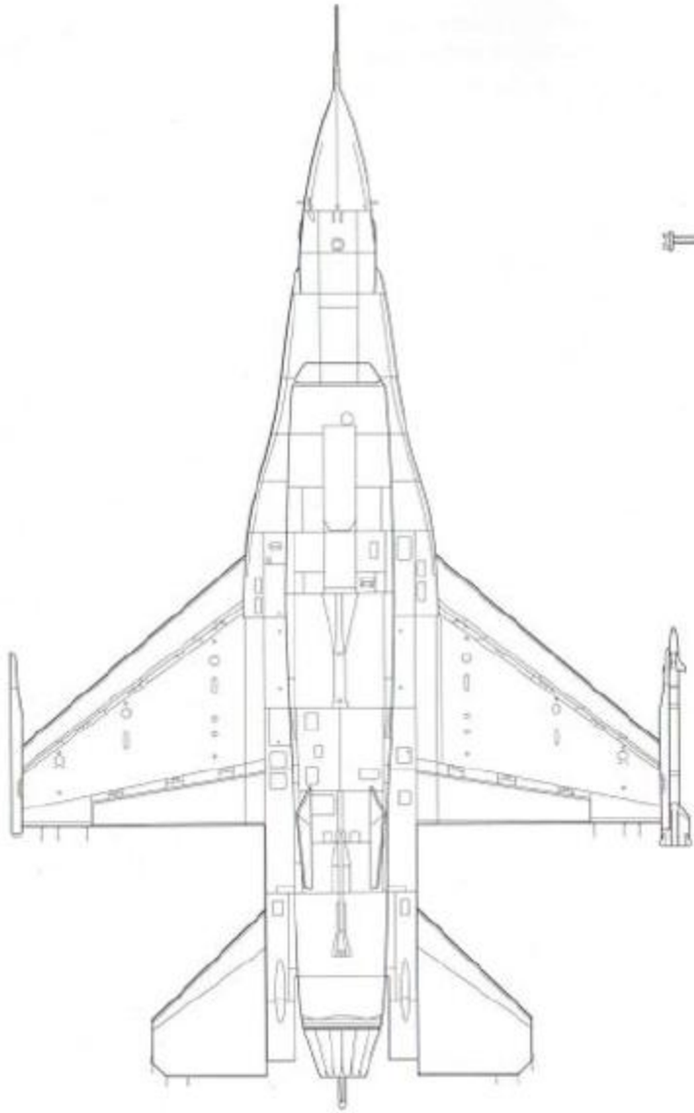


F 16C



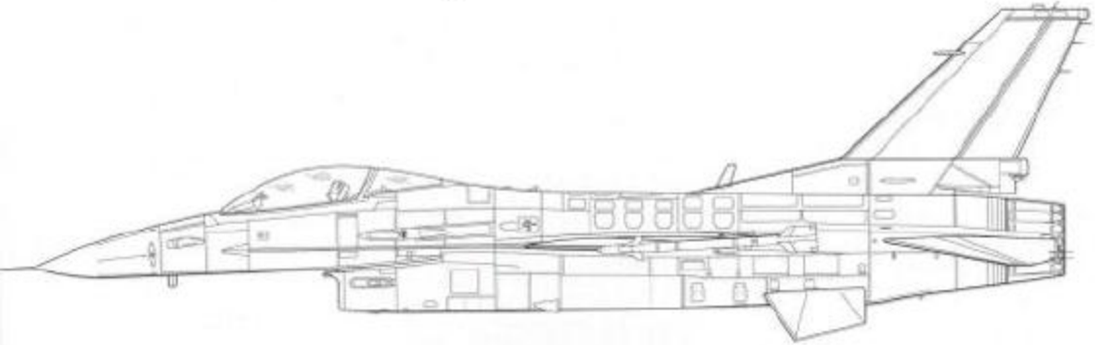
F 16 Israeli

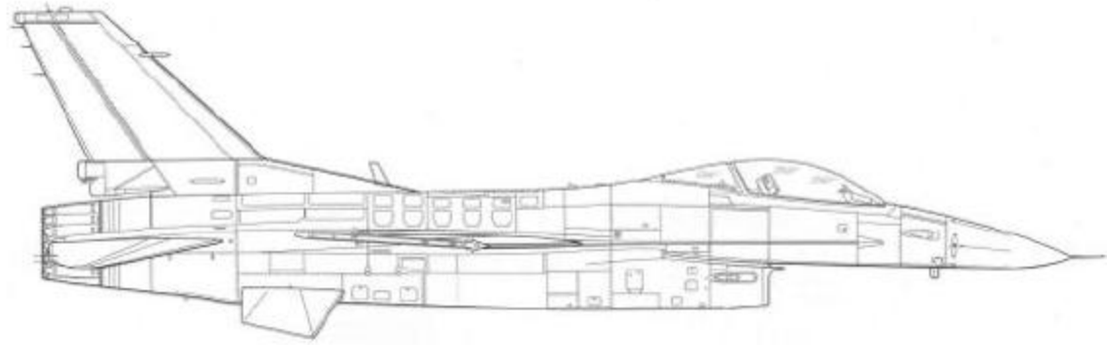




F 16C Fighting Falcon

Engine P&W F100-PW-200 Turbofan
Maximum Speed Mach 2 (1333 mph)
Tactical Radius 360 miles
Length 49 feet 4 inches
Height 16 feet 81/2 inches
Weight 18,238 lbs empty
Weight 26,463 lbs normal load
Weight 42,300 lbs Max load at take off
Armament One 20mm M61A1 Rotary cannon, two Aim-9 Sidewinder missiles on wing tip rails





(Above) The last of 17 Block 5 F-16Bs (78-099/115) on the ramp at Hill AFB, Utah. The 388th TFW was the first USAF unit to become operational in the Fighting Falcon.

(Right) An F-16 Fighting Falcon from the Minnesota Air National Guard's 179th Fighter Squadron Wing stands alert in support of Operation Noble Eagle on 11 December 2001. North American Aerospace Defense Command had more than 100 ANG and Air Force Reserve fighters from 26 locations providing homeland defense, with 100 additional fighters backing them up. Additionally, more than 20 ANG and AFRES tankers were airborne every day to keep fighters on station. (U.S. A.F. photo by Master Sgt. Daniel J. Schlies)

(Below) This F-16A Block 15H of the Vermont Air National Guard was eventually converted to the full air defense version. F-16As are distinguished by the smaller RHAW antenna at the base of the rudder. Flaps are set for take off as the pilot taxies with centerline fuel tank and no other external stores.

lator (the so-called "big tail"), which provided better stability and more authority for departure recover situations. It also changed takeoff rotation speed and allowed stable flight at higher angles of attack.

Block 15 aircraft also have two dogtooth radar warning antennas parallel to each other on the bottom of the radome. The blade antenna beneath the air intake was deleted.

The AN/APG-66 radar on the Block 15 F-16A/B was provided with an early version of a track-while-scan mode for greater air defense capability. Also included were "Have Quick I" secure UHF voice radios. Additional structural strengthening was added to allow an extra 1000 pounds of ordnance to be carried on the underwing hard points.

A program to upgrade systems and avionics of all Block 1/5 F-16A/Bs, code named Pacer Loft I, was announced in 1982. A second Pacer Loft upgrade program was started in December of 1983.

There were 457 Block 15 F-16A/Bs built in the U.S., 410 As and 47 Bs. They were ordered over fiscal years 1980-83 and delivered between November 1981 and March 1985. Also included in the batch were 40 aircraft for Egypt, 40 for Pakistan, 24 for Venezuela, and 60 add-on aircraft for the Netherlands. The Block 15 Operational Capability Upgrade (OCU) refers to F-16A/Bs powered by the more reliable F100-PW-220 turbofan. These aircraft also had structural strengthening and were provided with the enlarged HUD that was first introduced on the F-16C/D. The OCU included updates for radar and software, and upgrades for the fire control and stores management computers. A data transfer unit was added, and a radar altimeter was provided. Provision was made for the carrying of AN/ALQ-131 jamming pods, and installation of a ring laser inertial navigation system. F-16A/Bs manufactured since 1988 were built to OCU standards (starting with Block 15Y), with earlier Block 15 aircraft later being brought up to OCU status. The OCU program makes these F-16A/Bs comparable in many respects to F-16C/D models. Block 15OCU F-16A/Bs were delivered as add-ons for Belgium (44), Denmark (12), the Netherlands (51), and Norway (2). Also included were planes delivered in the late 1980s and early 1990s to Indonesia (12), Pakistan (11), Portugal (20), Singapore (8) and Thailand (18).

Production for the USAF totaled 675 F-16As and 120 F-16Bs. Of these, two F-16As (82-0966, 82-0974) were built by Fokker and three F-16As were built by SABCA. The remainder were built by Fort Worth. Fort Worth built 67 F-16As for Israel, 39 for Egypt, 28 for Pakistan, 18 for Venezuela, eight for Thailand, eight for Indonesia, 12 for Singapore, and 6 for Malaysia.

F-16A of the 159th Fighter Interceptor Squadron (FIS) of the Florida Air National Guard. ADF versions of the A model are recognizable by the bulges at the base of the vertical fin. The bulges are caused by the relocation of the Bendix-King AN/ARC-200 high frequency single-sideband radio to the leading edge of the fin, which necessitated the flight control accumulators to be relocated to either side of the tail fin. The bulges provide sufficient room for these accumulators.

The cockpit and its bubble canopy give the pilot unobstructed forward and upward vision, as well as improved vision over the side and to the rear. The F-16 canopy is tinted to ease eye strain and enhance visual acquisition of targets. The seat-back angle was expanded from the usual 13 degrees to 30 degrees, increasing pilot comfort and G-tolerance. (Blood drains from the brain more quickly in an upright posture.) (Andre Jans)

Another signature identifier of ADF F-16s are the "bird slicer" antennas in front of the canopy. Specific modifications for ADF versions include Allied Signal AN/ARC-200HF/SSB radios with Have Quick II Secure Speech Module and the Teledyne/E Systems Mk.XII Advanced IFF system (APX-109). The APG-66 radar was modified (designated APG-66A) to provide look down/shoot-down capability, enhanced small target detection, and CW (Continuous Wave) illumination for AIM-7 guidance. (John Gourley)

Fort Worth built 8 F-16Bs for Israel, 9 for Egypt, twelve for Pakistan (including four built by Fokker), six for Venezuela, four for Singapore, four for Thailand, four for Indonesia and two for Malaysia. In the initial European order, SABCA built 96 F-16As for the Belgian Air Force (serials FA-01/96) at Gosselies. The last was delivered on 28 April 1985, the final aircraft on the original NATO F-16 order for 348 planes. A second order for 40 (FA-97/136) was completed in 1991. Forty-six were built for Denmark (serials E-174/203). SABCA built 24 F-16Bs for Belgium (serials FB-01/24) and 16 for Denmark (serials ET-204/211, ET-0197/199, ET-022). Fokker built an initial batch of 40 F-16As for the Netherlands Air Force (serials J-212/258, J-616/648). Orders have since been increased to a total of 167 (serials J-864/881, J-358/367, J-136/146, J-054/063, J-508/514, J-001/012, J-013/021). The last 20 on the order were designated F-16A(R) and were capable of carrying an Oude Delft Orpheus sensor pod on the fuselage centerline station. This variant was first flown on January 27, 1983. Fokker also built two F-16As for the USAF, and built sixty for Norway. Fokker built an initial batch of 22 F-16Bs for the Netherlands (serials J-259/271, J-649/657) plus at least fourteen more (serials J-882, J-884/885, J-208/211, J368/369, J-064/065, J-515/516). One example was delivered to Egypt and 12 F-16Bs were delivered to Norway. Two of the original batch for the Netherlands were completed as F-16B(R) and were capable of carrying the Orpheus reconnaissance pod on the fuselage centerline. Block 15 aircraft represent the most numerous version of the more than 3,600 F-16s manufactured to date. The transition from Block 10 to Block 15 resulted in two hardpoints added to the chin of the inlet. The larger horizontal tails, which grew in area by about thirty percent are the most noticeable difference between Block 15 and previous F-16 versions.

Block 20 aircraft incorporate significant avionic and structural enhancements. Many of these enhancements are supported by a modular mission computer that replaces three other computers and has faster processing and a large growth capacity. The aircraft's improved version of the APG-66 radar, called the APG-66(V3), has many new features, such as increased detection and tracking ranges and the ability to track more targets simultaneously. These F-16s also have an improved data modem, a ring laser inertial navigation system, a digital terrain system, an advanced interrogator for identifying friendly aircraft, wide-angle head-up display, color multifunction cockpit displays, up-front controls (a set of programmable push buttons placed just

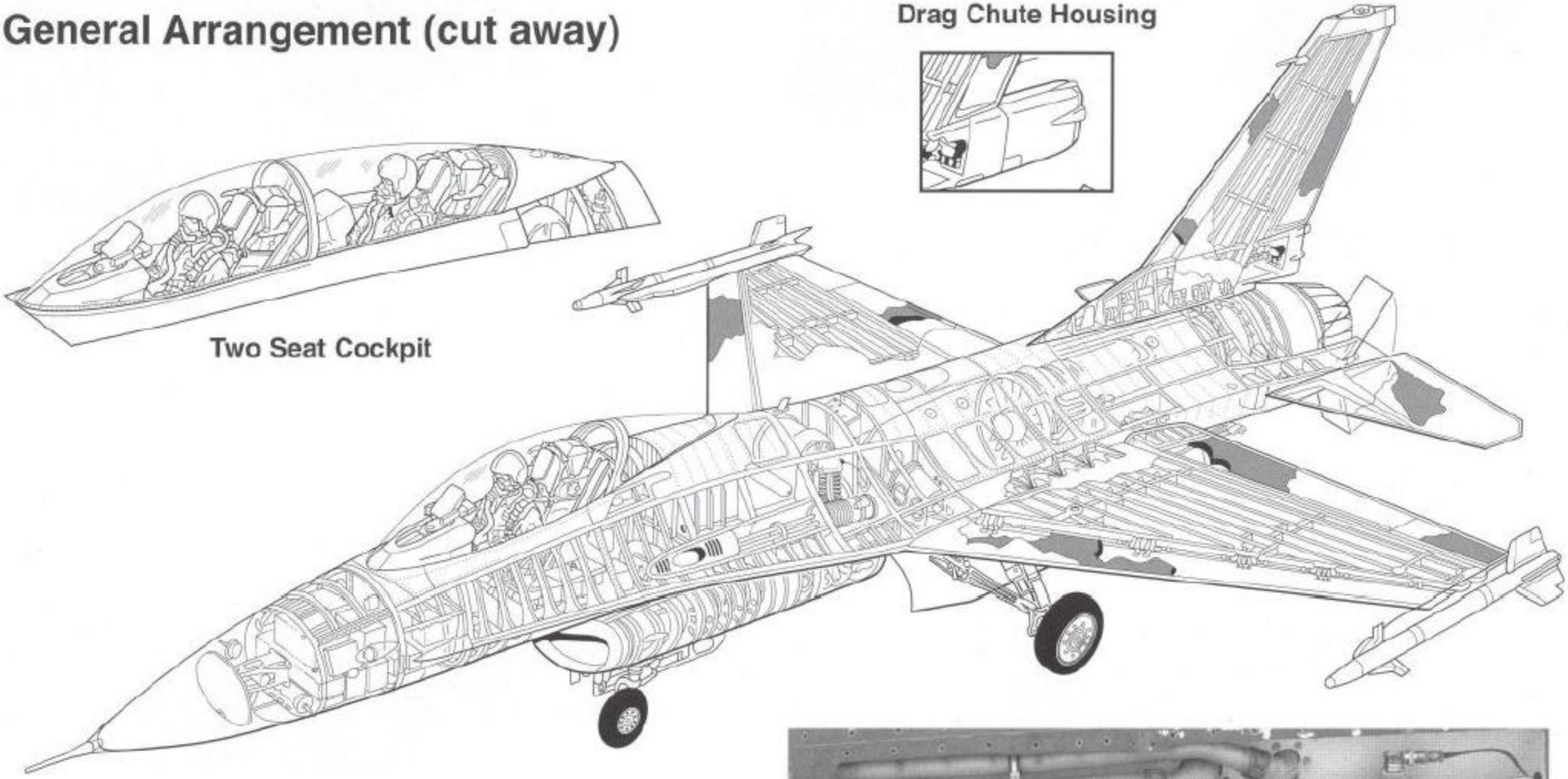
F-16A Block 15 of the California ANG after conversion to ADF configuration. A 150,000 candlepower night identification spotlight is installed on the port side of the nose (below and in front of the cockpit) to aid in visual ID of night intercepts. The aircraft are equipped to carry 600 (US) gallon (2,271 liter) external drop tanks, and to carry 6 BVR missiles such as the AIM-7 Sparrow or AIM-120 AMRAAM.

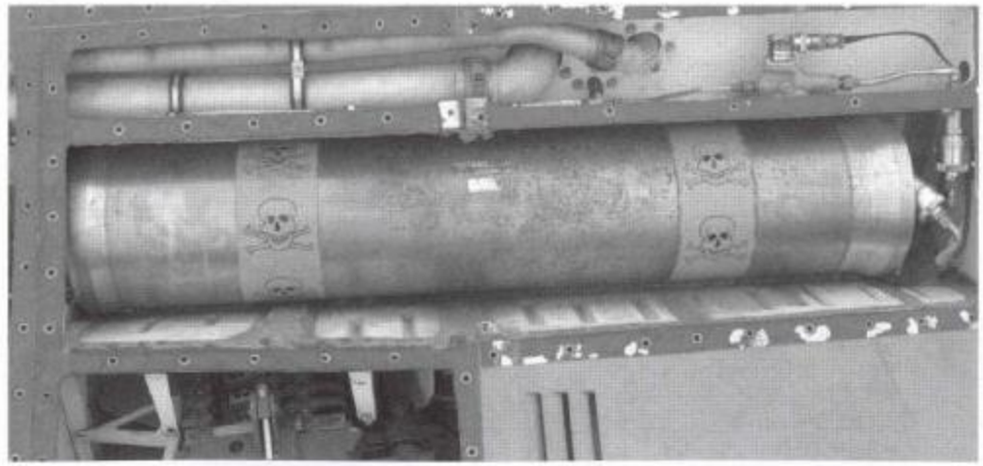
below the head-up display), and Block 50-style side stick and throttle controllers. Cockpit lighting is compatible with night-vision systems.

The first Block 20 rolled off the production line in Fort Worth in July 1996. The first two aircraft were fitted with flight instrumentation and assigned to Edwards AFB for developmental testing. While the airframe is similar to that of other F-16s (the wings and tail are F-16C Block 50 and most of the fuselage is Block 15), the avionics suite is completely different. The design of the Mission Modular Computer (MMC) supports two-level maintenance as technicians work with modules that slide into the MMC instead of larger line replaceable units located at various places within the airframe. What formerly amounted to entire LRUs now fit on one of these modules. The MMC contains redundant modules, so technicians can troubleshoot by swapping modules within an MMC or between MMCs.

F-16 Fighting Falcon

General Arrangement (cut away)

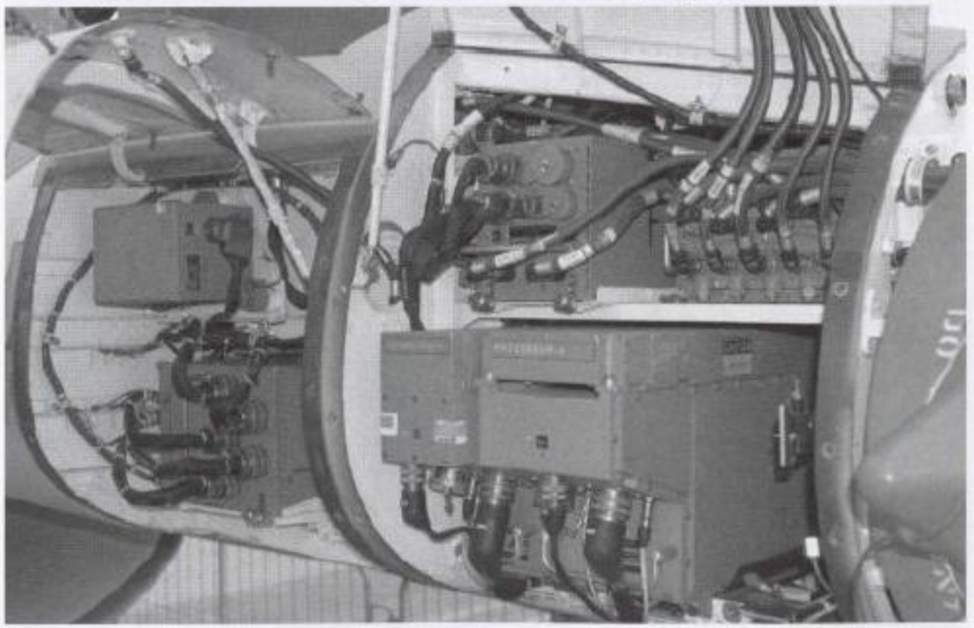




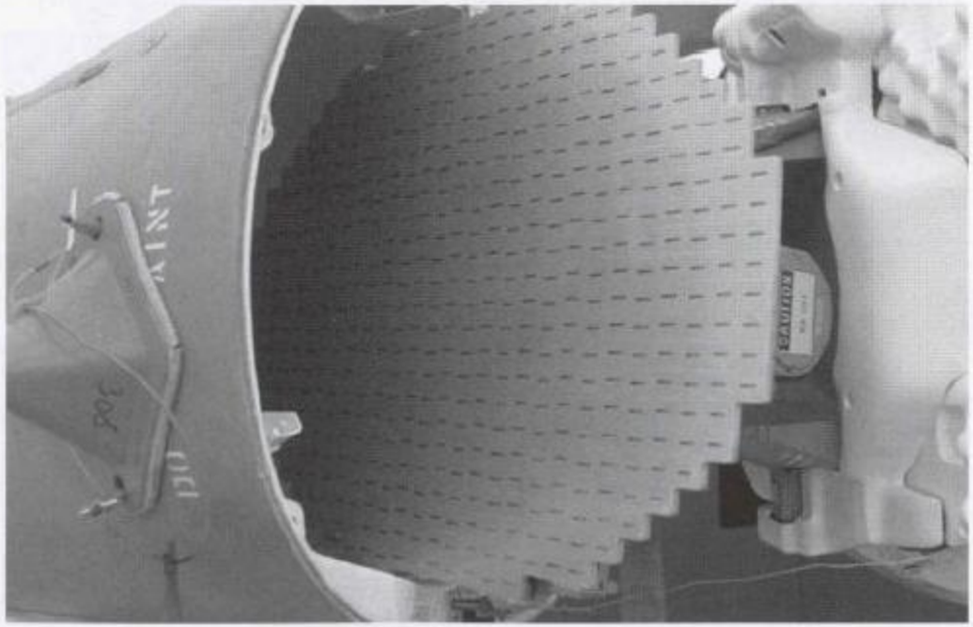
The Garret hydrazine turbine emergency power unit (EPU) on the starboard side of the fuselage, just aft of the canopy. (Andre Jans)

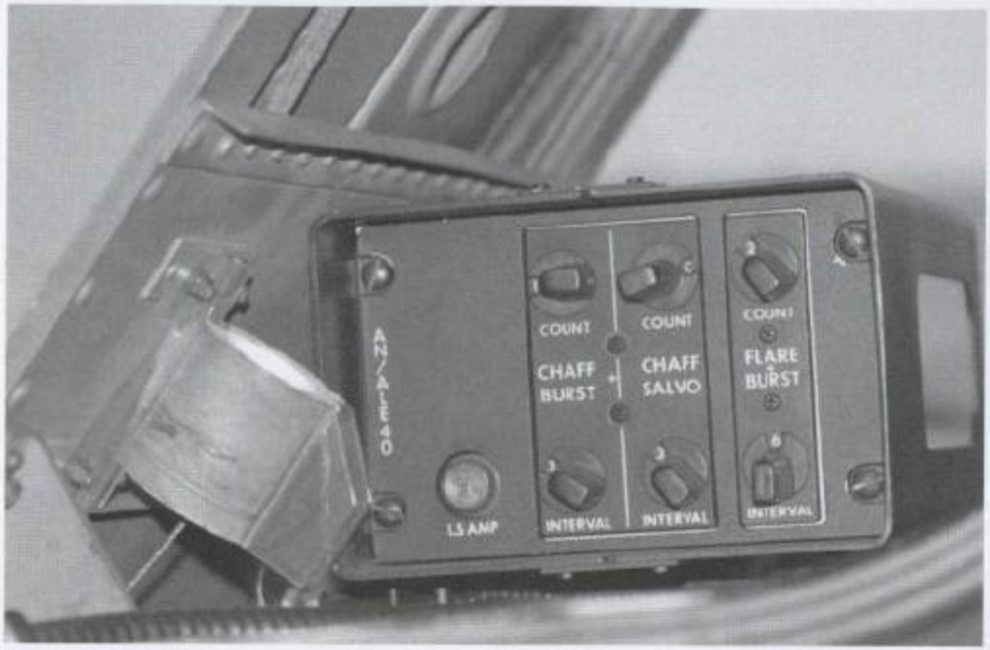
USAF contracted for kits to update and modify a total of 270 F-16A/B's to ADF at the Ogden Air Logistics Center in Utah, with the first F-16A ADF conversion completed in February 1989. The Block 15 airframes used for the ADF program were all meant to be upgraded to Block 15OCU standard with both programs running concurrently. Aircraft entering the Ogden ALC for ADF upgrade also received the Block 15OCU avionics installation. All ADF aircraft are Block 15OCU airframes. The upgrade program was concluded in 1992. (USAF)

The F-16 is equipped with either the APG-66 (F-16A) or APG-68 (F-16C) Westinghouse multimode radar. Frequently updated, both radars exhibit the latest in radar technology, including a very high-speed integrated circuit signal processor. These radars provide long-range detection and tracking and high-resolution mapping. (Andre Jans)



The radar antenna can be serviced by opening the radome, which is hinged on the starboard side of the nose. (Andre Jans)

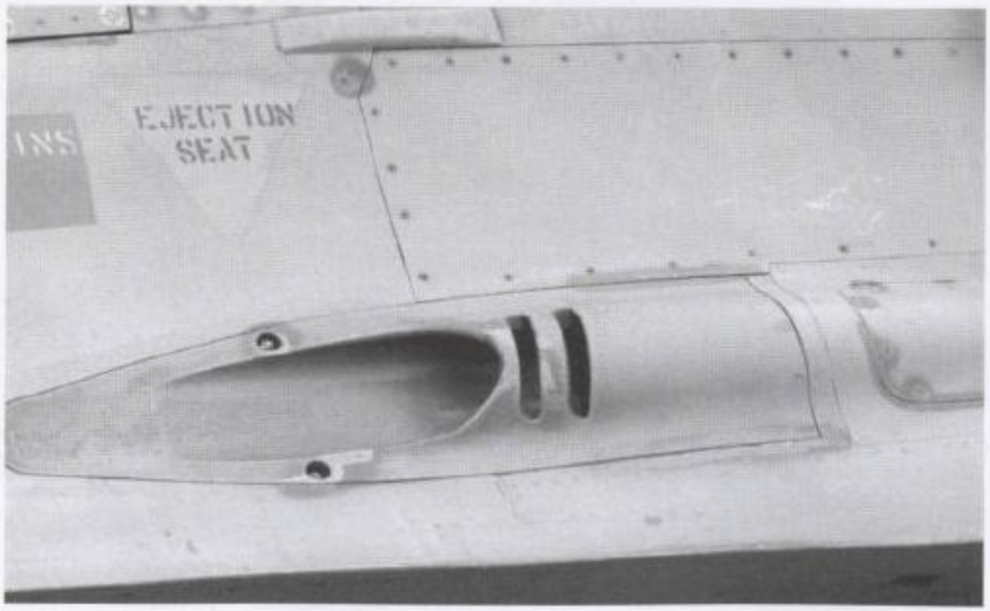


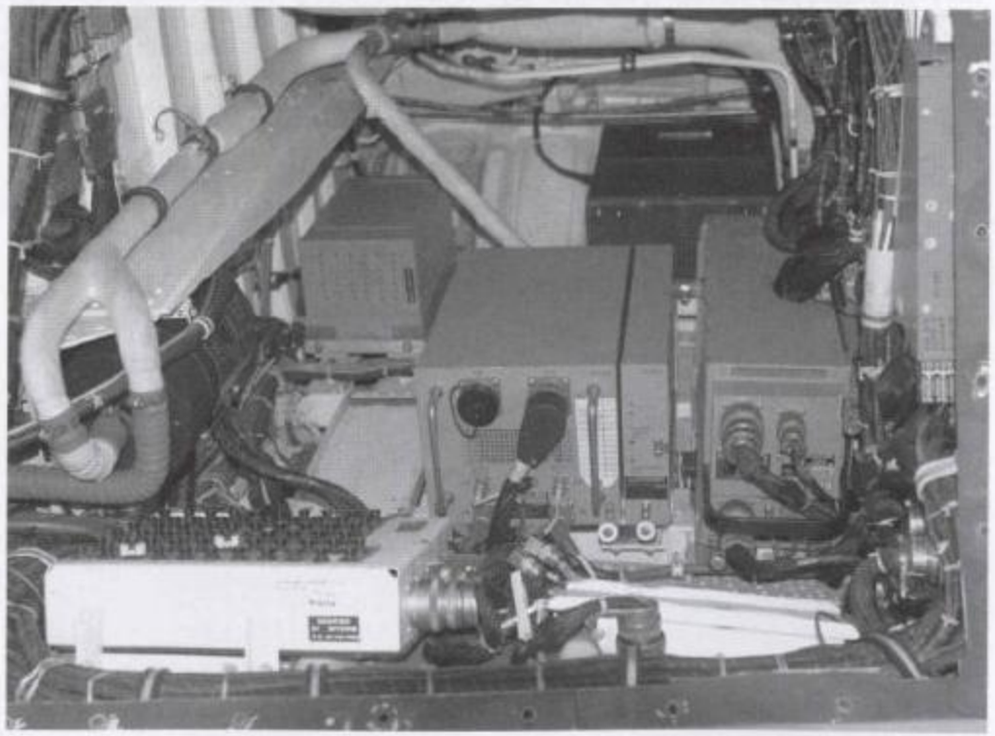


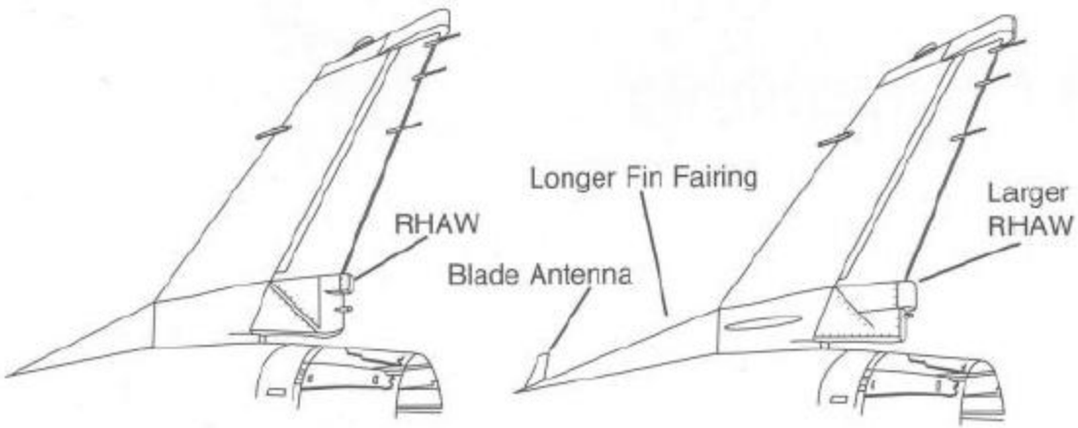
The AN/ALE-40 Chaff and Flare dispenser control module. Dispensers are located in the aft fuselage on port and starboard sides, just forward of the horizontal stabilator leading edge. (Andre Jans)

(Above and Below) Open access panels just forward of the Hydrazine tank reveal the ease of maintaining avionics and hydraulics in the F-16A. (Andre Jans)

The General Electric M-61A1 Vulcan 20mm cannon fairing on the port forward fuselage. All models of the F-16 carry this cannon with 511 rounds of ammunition. (Andre Jans)



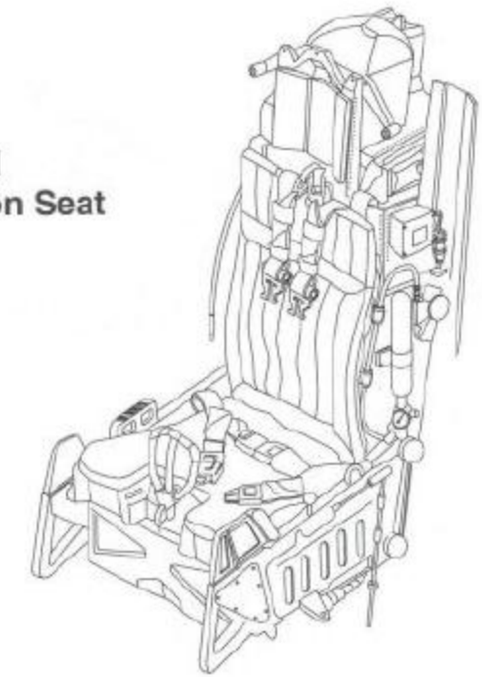


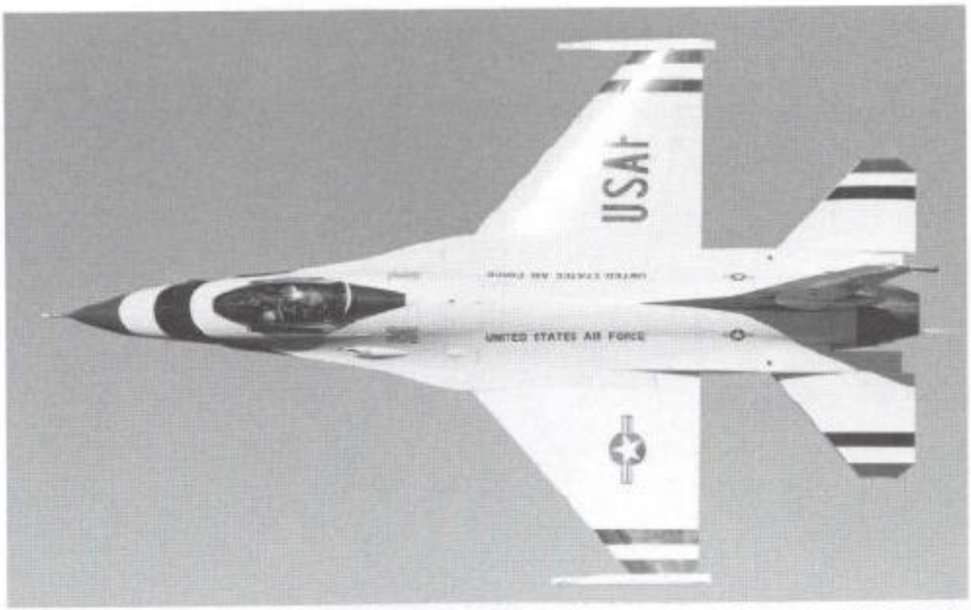


F-16A

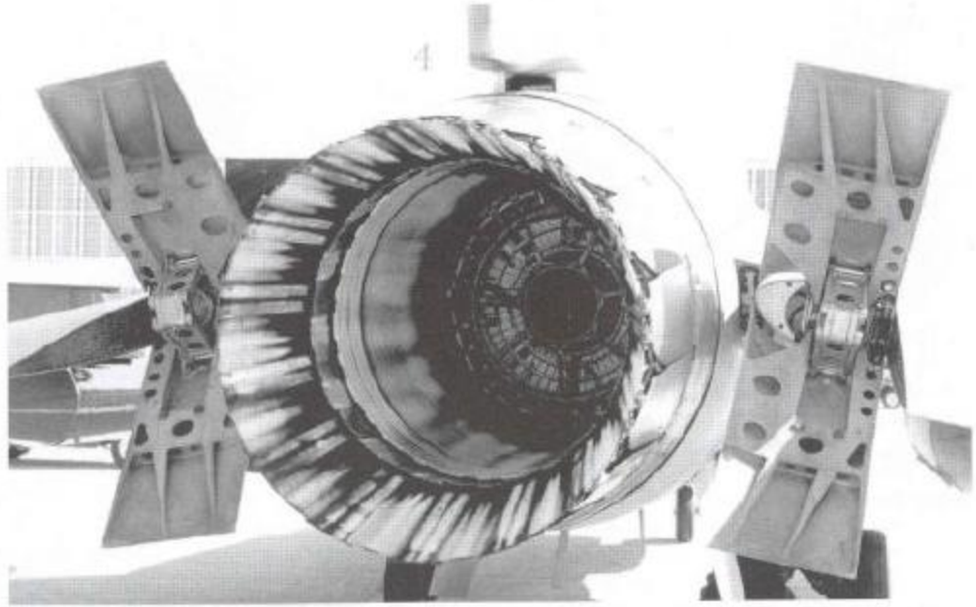
F-16C

Aces II Ejection Seat





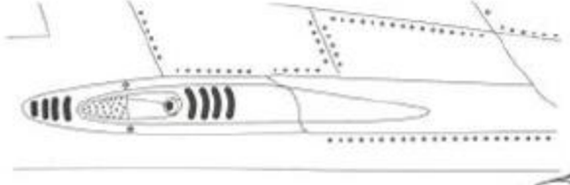
Early in 1983, the Thunderbirds reinstituted their traditional role of demonstrating the Air Force's frontline fighter capabilities by transitioning to the F-16A Fighting Falcon from the T-38 Talon. The F-16 has proven to be the most long-lived of any Thunderbird aircraft. (21 years and counting at this writing.) Further testament to the ability of the F-16 airframe to keep up with technological change. (Shinichi Ohtaki)

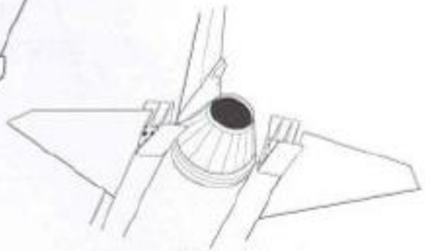


Most F-16s rely on a pair of very effective speed brakes for decelerating during landing. They are also deployed on approach to maintain high engine RPM and responsiveness in the event a go-around is necessary. (John Gourley)

Panel Components

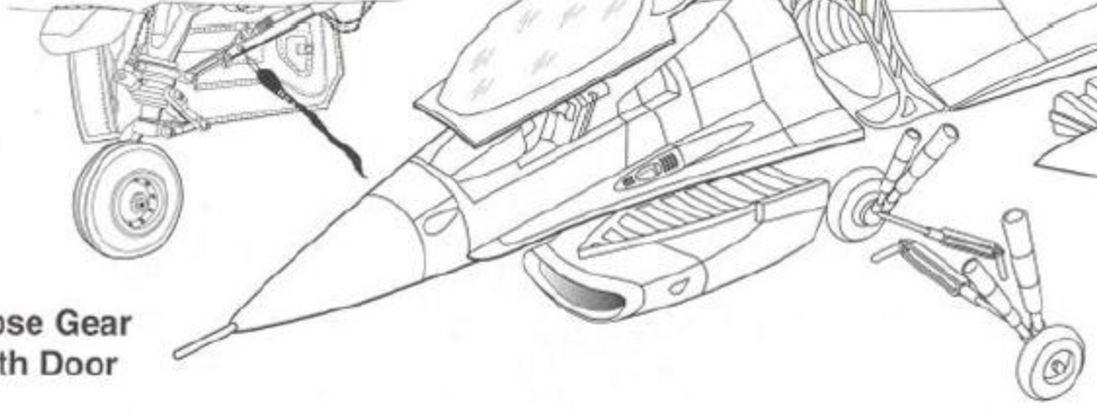
20mm gun aperture



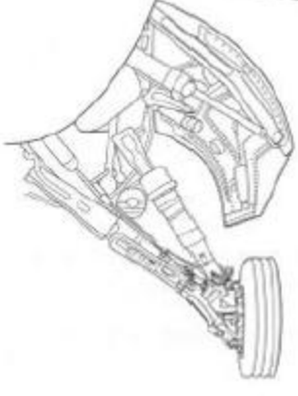


Air Brakes Operation

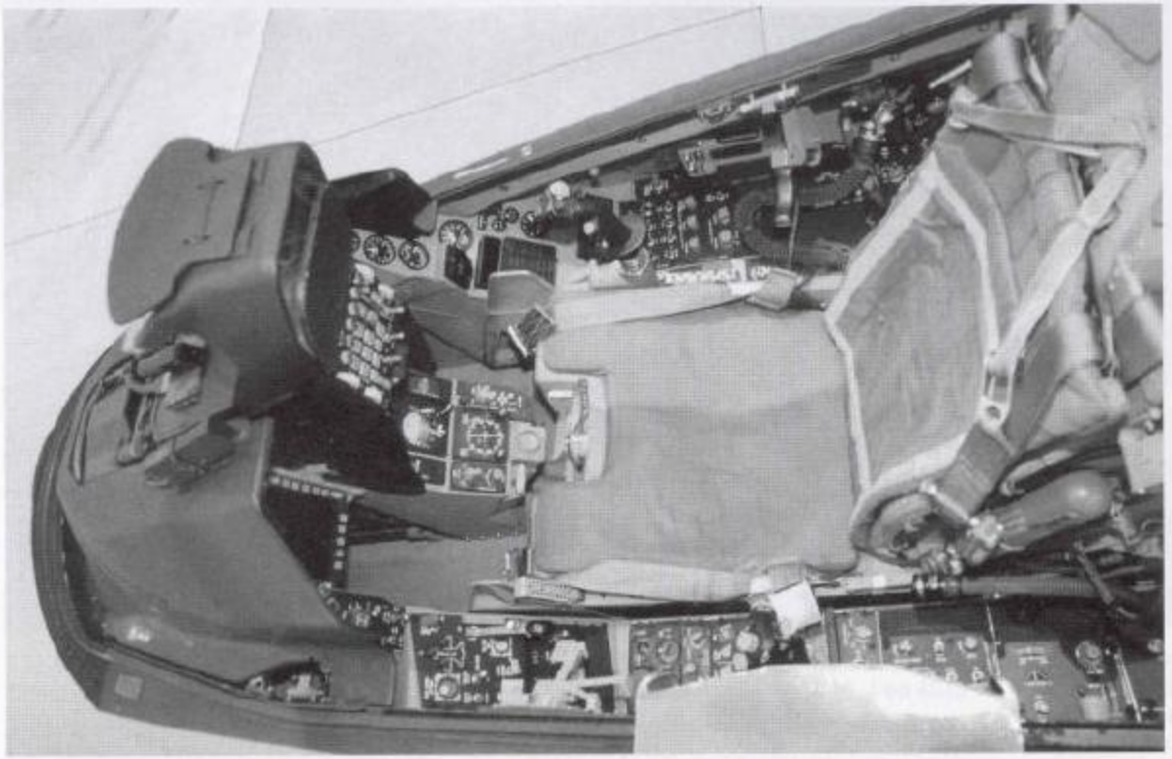
Air Brake

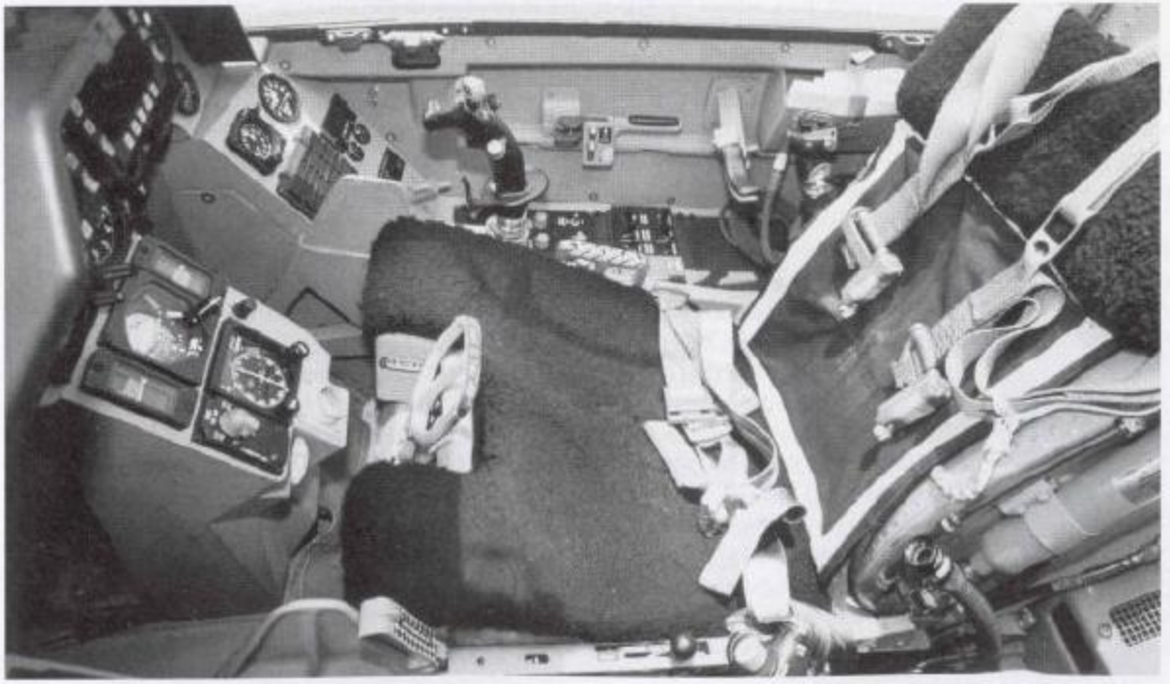


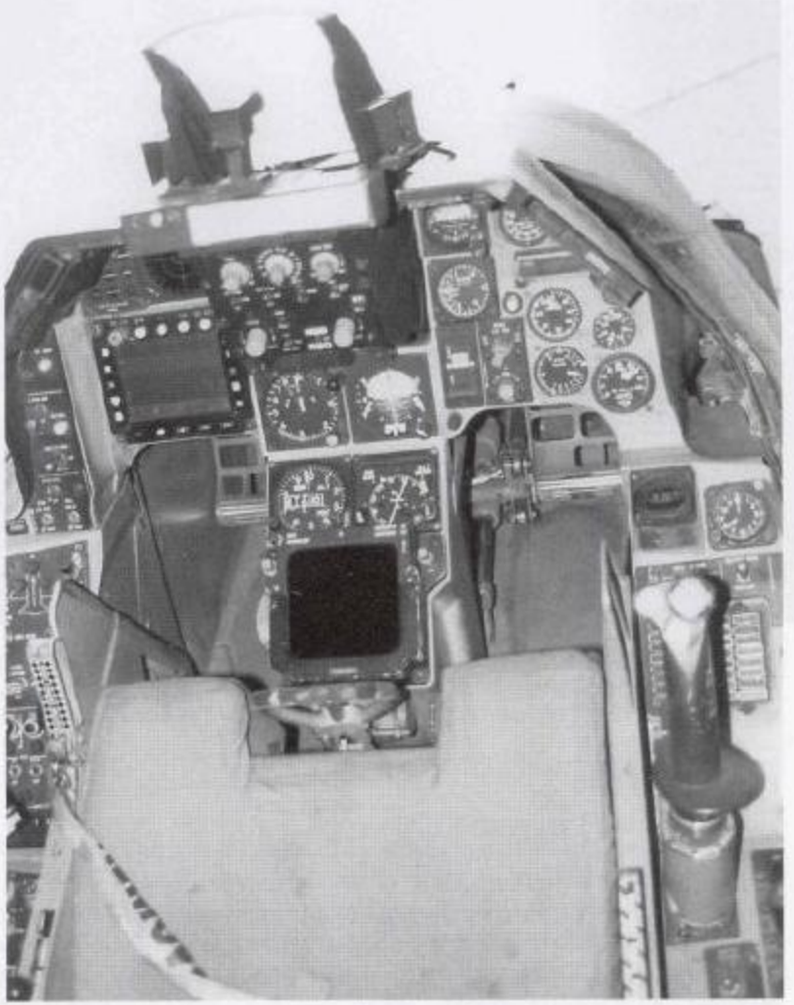
Nose Gear with Door



Main Landing Gear With Door







One of the areas in which the F-16 advanced aircraft design dramatically was the ergonomics of how pilots deal with the sustained high-G environment common in modern fighters. The F-16 cockpit seat is reclined at 30 degrees, and the pilot uses a side-stick controller which has no mechanical linkages to the controls. The fly-by-wire control system senses pressure on the stick and provides control inputs that are appropriate.....with the concurrence of the flight control computer which does not allow departures from controlled flight. An adjustable arm rest behind the side-stick controller helps to reduce fatigue in high-G maneuvering. Traditional "steam gages" (analog instruments) assume a secondary position on the F-16 instrument panel. The head-up display (HUD) provides all the information the pilot needs to fly and fight. Multifunction allows the pilot to control the various systems, including sophisticated weapons and navigation/targeting controls. The photos on this page are of an F-16D, circa 1994.

An F-16C Fighting Falcon, with moon in the background, flies a local training mission. This F-16 is the flagship aircraft of the 20th Fighter Wing, Shaw AFB, S.C. Except for wingtip AIM-120 missiles it is devoid of armament, but is configured for the SEAD mission with HARM launch rails and ASQ-213 HTS pod. The centerline store is the AN/ALQ-184 ECM pod. (U.S. Air Force photo by Airman 1st Class Greg Davis)

F-16C/D

The transition of the F-16 from Block 15 to Block 25 marks the evolution from the F-16A/B to the F-16C/D models. Block 25 added the ability to carry AMRAAM as well as night/precision ground-attack capabilities. An improved fire control computer, an improved stores management computer, and a USAF-standard inertial navigation system was added as well as multifunction displays, a data transfer unit, radar altimeter, anti-jam UHF radio, and provisions for future electronic warfare systems.

The Block 25 F-16 also received an improved radar, the Westinghouse (now Northrop-Grumman) AN/APG-68, with increased range, better resolution, and more operating modes. Block 25 got a larger head-up display, two head-down multifunction displays, and new up-front controls. All Block 25s were originally powered by the Pratt & Whitney F100-PW-200, but they have since been upgraded to the -220E configuration.

The first of 244 Block 25 F-16s flew in June 1984 and was delivered to the Air Force in July. Block 25 is the only F-16 to be employed exclusively by USAF. An F-16 Block 25 aircraft is distinguishable by its larger tail root with a small blade antenna on the leading surface. The extra space in the tail root was intended for an airborne self-protection jamming system. The space is being used for electronic countermeasure systems by some subsequent F-16 blocks.

Block 30/32 F-16s added two new engines; the Pratt & Whitney F100-PW-220 and the General Electric F110-GE-100. Block 30 designates a GE engine, and Block 32 designates a Pratt & Whitney engine. A larger inlet was introduced at Block 30D for the GE-powered F-16s, which are often called "big-mouth" F-16s. The larger inlet, formally called the modular common inlet duct, allows the GE engine to produce its full thrust potential at lower airspeeds. The smaller inlet is called a normal shock inlet and has not changed for the -220 and subsequent Pratt & Whitney engines. A Pratt & Whitney F100-PW-229 engine now powers the VISTA/F-16, which has the larger inlet. This is the only F-16 with a large inlet and a Pratt & Whitney engine. The engine bays are common to both engines.

Block 30/32 can carry the AGM45 Shrike and the AGM-88A high-speed anti-radiation missiles or HARM. Like the Block 25, it can carry the AGM-65 Maverick air-to-ground missile. Changes at Block 30D allowed the aircraft to carry twice as many chaff/flare dispensers. The aircraft has provisions for the ALR-56M advanced radar warning receiver. Forward radar warning receiver antennas were relocated to the leading edge flap at Block 30D. These "beer can" antennas have since been retrofitted onto all previous F-16C/D aircraft. Block 30/32 has a crash-survivable flight data recorder, voice message unit, and expanded memory for the multifunction displays. The first of 733 Block 30/32 F-16s was delivered in July 1987; the airplane was manufactured through 1989.

The F-16N manufactured for the US Navy is a variation of the Block 30. It is powered by the GE F110-GE-100 engine and has the small inlet associated with early Block 30 production. The F-16N also has the APG-66 radar of the F-16A models and minor structural differences for meeting Navy requirements. The aircraft has no cannon. Twenty-two F-16Ns and four TF-16Ns (two-seaters) were built from 1987 to 1988. They were used for dissimilar air-to-air training at three Navy adversary squadrons and at the Navy's Fighter Weapons School (Top Gun). The F-16Ns were grounded from Naval service in 1994 for budget reasons.

With the Block 40/42, the F-16 gained capabilities for navigation and precision attack in all

weather conditions and at night. The F-16 traded its analog flight controls for a digital system and new core avionics.

The landing gear of the Block 40/42 was beefed up and extended to handle the LANTIRN pods and more extensive air-to-ground loads. The landing gear bay doors bulge slightly by design to handle the larger wheels and tires. The LANTIRN pods also forced the landing lights to move forward from the struts of the main landing gear to the leading inside edge of the nose landing gear door. A larger head-up display accompanied the LANTIRN system as well.

The precision weapons incorporated by the Block 40/42 include the GBU-10, GBU-12, GBU-24 Paveway family of laser-guided bombs as well as the GBU-15 glide bomb.

Block 40/42 also saw the addition of the APG-68(V) radar, automatic terrain following (part of the LANTIRN system), global positioning system, a new positive-pressure breathing system to improve g tolerance for the pilot, full provisions for internal electronic counter measures, an enhanced envelope gun sight, and a capability for bombing moving ground targets. Some foreign versions of the aircraft can carry the AIM-7 Sparrow missile.

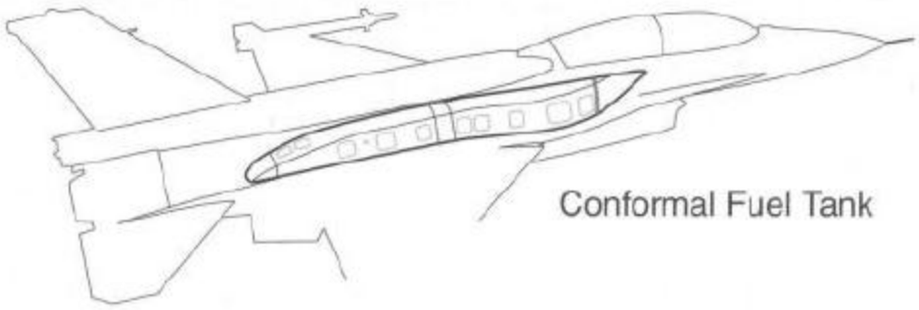
Block 40/42 production began in 1988 and ran through 1995. Twenty-one more Block 40s were built for Egypt from 1999 to 2000. Bahrain is considering more Block 40s to equip a second squadron. The 744 Block 40/42 aircraft produced to date can be distinguished externally from previous F-16 blocks by their landing lights and by the bulged landing gear doors. Any USAF F-16 carrying a LANTIRN pod is a Block 40/42.

Some USAF Block 40 aircraft are now equipped and flying missions with night vision goggles and with a data link system called Sure Strike. This system receives highly accurate position information from a forward air controller on the ground. The system then inputs the data into the weapon system computer and displays it as a way point on the head-up display. Sure Strike was integrated into the F-16 in about two months with off-the-shelf equipment. The data link is also used on the Apache helicopter. An upgrade program to Sure Strike, called Gold Strike, is adding two-way imagery transmission.

Block 50/52 F-16s are equipped with a Northrop Grumman APG-68(V)7 radar and a General Electric F110-GE-129 Increased Performance Engine, the aircraft are also capable of using the Lockheed Martin low-altitude navigation and targeting for night (LANTIRN) system. Technology enhancements include color multifunctional displays and programmable display generator, a new Modular Mission Computer, a Digital Terrain System, a new color video camera and color triple-deck video recorder to record the pilot's head-up display view, and an upgraded data transfer unit. By mid-1999 Block 50/52 [aka Block 50 Plus] F-16s will carry the CBU-103/104/105 Wind-Corrected Munitions Dispenser, the AGM-154 Joint Stand-Off Weapon, and the GBU-31/32 Joint Direct Attack Munition.

Block 50D/52D Wild Weasel F-16CJ variants include C-Model and D-Models. It is best recognized for its ability to carry the AGM-88 HARM and the AN/ASQ-213 HARM Targeting System (HTS) in the Suppression of Enemy Air Defenses [SEAD] mission. The HTS allows HARM to be employed in the range-known mode providing longer range shots with greater target specificity. This specialized version of the F-16, which can also carry the ALQ-119 Electronic Jamming Pod for self protection, became the sole provider for Air Force SEAD missions when the F-4G Wild Weasel was retired from the Air Force inventory. The lethal SEAD mission now rests solely on the shoulders of the F-16 HARM Targeting System. Although F-18s and EA-6Bs are HARM capable, the F-16 provides the ability to use the HARM in its most effective mode. The original concept called for teaming the F-15 Precision Direction Finding (PDF) and the F-16 HTS. Because this teaming concept is no longer feasible, the current approach calls for the improvement of the HTS capability. The improvement will come from

F-16D on a 1994 training mission out of Shaw AFB, S.C. It carries a LANTIRN (FLIR/TFR) navigation pod on the port intake, 5L stores adapter and an inert AGM-65 Maverick missile on the port intermediate wing station. (Lou Drendel)



The first Advanced Block 52 F-16s were handed over to the Greek Air Force as part of the Peace Xenia III FMS program in October of 2002. At the customer's request, the two-seat F-16Ds were delivered first in order to support the training effort. Deliveries continued until 2004. They were assigned to 340 Moira and 343 Moira, each equipped with 20 F-16Cs and ten F-16Ds. (Lockheed Martin)

the Joint Emitter Targeting System (JETS), which facilitates the use of HARM's most effective mode when launched from any JETS capable aircraft.

Advanced Block 50/52 aircraft have a common engine bay that allows customers a choice of engines in the 29,000-pound thrust class. The Block 50s are powered by the General Electric F110-GE-129 and have the Modular Common Inlet Duct (known as the large mouth inlet). Block 60 aircraft (for the UAE) are fitted with GE F-110-GE-132 engine, a derivative of the F-110-GE-129 that is rated at 32,500 pounds of thrust. The Block 52s are powered by the Pratt & Whitney F100-PW-229 Improved Performance Engine (IPE) which also has 29,000 pounds of thrust. The engine is configured with the Normal Shock Inlet (also known as the small mouth inlet).

The advanced Block 50/52 and Block 60 production series represent the largest configuration change in the F-16 history, offering additional fuel (via conformal fuel tanks) and payload capacity, new or improved avionics and sensors, color cockpit displays with enhanced pilot/vehicle interfaces. Nine countries have ordered Advanced Block 50/52/60 F-16s, including the USA, Greece, Israel, UAE, Chile and Poland, The lead customer for Block 52 was the Hellenic Air Force which will receive all its 50 new F-16s in 2004. The Israeli Air Force received its first F-16Is in 2003 and the last of the 102 aircraft is scheduled for delivery by 2008. The lead customer for 80 Block 60 aircraft was the Air Force of the United Arab Emirates. Initial deliveries were in 2004.

Advanced versions of the Block 50/52 F-16s are difficult to tell from previous F-16s, as most changes are internal. However, the two-seat models of the Advanced Block 50/52 and Block 60 are equipped with a dorsal avionics compartment that accommodates all of the systems of the single-seat model as well as some special mission equipment and additional chaff/flare dispensers. Most aircraft are procured with Conformal Fuel Tanks (CFT) for extended range and mission endurance. The rear cockpit can be configured for either a weapon system operator or an instructor pilot and can be converted with a single switch in the cockpit.

The F-16I made it's first flight on 23 December 2003. Israel's Peace Marble V foreign military sales program will supply the Israel Air Force (IAF) with 102 two-seat aircraft and is the largest Israeli F-16 acquisition yet. The F-16I is specially designed for Israel, and has been named "Soufa," or "Storm" in Hebrew, by the IAF. Production deliveries are scheduled through 2008.

The F-16I incorporates the latest technology and capabilities in an air combat fighter, such as modern core avionics, color cockpits featuring moving maps, Conformal Fuel Tanks and advanced electronic warfare displays. The aircraft also features the APG-68(V)9 multimode radar, Pratt and Whitney F100 Improved Performance Engine, "smart" weapons compatibility and sophisticated navigation and targeting system.

SOUTHWEST ASIA - An F-16 Fighting Falcon flies a combat sortie supporting Operation Iraqi Freedom on 7 May 2003. The aircraft and pilot are assigned to Balad Air Base, Iraq. It carries a tactical reconnaissance pod on the centerline. The Air Force contracted in May 1995 with what is now called the Quick Reaction Capability Organization of Lockheed Martin's Systems Development Center in Fort Worth to design, build, and test an F-16 reconnaissance pod. The first two pods were delivered within five months. (U.S. Air Force photo by Staff Sgt. Aaron Allmon II)

OPERATION SOUTHERN WATCH – A New Mexico Air National Guard F-16C Fighting Falcon taxis out for an Operation Southern Watch patrol mission. The 188th Fighter Squadron joined their active duty counterparts from the 523rd Fighter Squadron, 27th Fighter Wing, to support air operations over the No-Fly, No-Drive Zone in Southern Iraq prior to Operation Iraqi Freedom. It carries both LANTIRN (FLIR) targeting pod (starboard side) and LANTIRN navigation TFR pod (port side). (U.S. Air Force photo by Airman 1st Class Greg Davis)

(Below) OVER TYNDALL AIR FORCE BASE, Fla. – Major Pete Davey flies in formation with an MQM-107E Streaker sub-scale aerial target drone on April 20 during a Combat Archer exercise. MQM-107E sub-scale aerial target drones are assigned to the 82nd Aerial Targets Squadron and are used as targets during Combat Archer missions. Major Davey is an F-16C Fighting Falcon pilot with the 428th Fighter Squadron at Cannon Air Force Base, N.M. (U.S. Air Force photo by Master Sgt. Michael Ammons)

SOUTHWEST ASIA -- An F-16 Fighting Falcon from the 555th Fighter Squadron at Aviano Air Base, Italy, banks right after refueling from a KC-135 Stratotanker on 21 April 2003 following an aerial refueling. The F-16 received the 1 billionth pound of fuel from Combined Forces Air Component Command refuelers since Jan. 30, 2003. It is armed with JDAM (GPS-guided) and LGB (Laser guided bombs.) (U.S. Air Force photo by Master Sgt. Michael Ammons)

An F-16C of the 555th TFS, out of Aviano AB, Italy moves into refueling position during Operation Iraqi Freedom. During the second Gulf War, most munitions carried by the F-16 were precision-guided, either JDAM or LGB as on this Viper, which carries two 1,000 pound LGBs and one 2,000 pound JDAM. (USAF)

(Below) OVER IRAQ -- An F-16 Fighting Falcon on a 28 April 2003 mission in support of Operation Iraqi Freedom. The F-16 is assigned to the Michigan Air National Guard's 107th Fighter Squadron at Selfridge Air National Guard Base. It carries LGBs, but no target pod, and is also loaded with a tactical reconnaissance pod on the centerline. With the retirement of the RF-4 Phantom II, USAF no longer had a dedicated tactical reconnaissance aircraft, which necessitated development of the AN/ASD-11 Theatre Airborne Reconnaissance System (TARS), which uses a digital camera with a maximum imaging rate of 2.5 frames per second and a tape capacity of forty-eight gigabytes. The system can store over an hour's worth of continuous flight time (about 12,000 images). These images can then be downloaded to a computer and viewed almost instantly, thereby sidestepping the time and extensive equipment involved in chemically processing film. (U.S. Air Force photo by Master Sgt. Glenn Wilkewitz)

OPERATION IRAQI FREEDOM – Spangdahlem F-16s fly observation formation off the wing of a KC-10. KC-10 Extenders from the 305th/514th Air Mobility Wing, McGuire AFB, N.J., are deployed to Burgas Airport and nearby Camp Sarafovo, Bulgaria, to support tanker operations. Members from various Air Force units world-wide are currently deployed with the 409th AEG in support of Operation Iraqi Freedom. (U.S. Air Force photo by Master Sgt. Dave Ahlschwede)

A Spangdahlem F-16C, configured for the SEAD mission, flies past a castle on the Rhine. It carries AGM-88 HARM missiles on the intermediate wing stations. The AGM-88 HARM (high-speed anti-radiation missile) is a supersonic air-to-surface tactical missile designed to seek and destroy enemy radar-equipped air defense systems. The AGM-88 can detect, attack and destroy a target with minimum aircrew input. Guidance is provided through reception of signals emitted from a ground-based threat radar. (USAF)

The SEAD mission got more precise with the addition of the AN/ASQ-213 HARM Targeting Systems (HTS) pod, which is carried on the starboard chin station (5L). Originally developed by Texas Instruments under a program to provide new modular targeting systems for USAF aircraft, it is the key to USAF's effort in SAM hunting now and in the 21st century. The pod is 8 inches in diameter, 56 inches long and weighs 85 pounds. Most important of the HTS' capabilities is the ability to rapidly generate ranges to target radars, as well as to provide greater discretion between different types of enemy radars. (USAF)

OPERATION ENDURING FREEDOM -- An F-16 Fighting Falcon from the 174th Fighter Wing, Syracuse, New York, soars over Afghanistan in support of Operation Enduring Freedom. (U.S. Air Force photo by Staff Sgt. Suzanne M. Jenkins)

The flagship F-16C of Indiana ANG 122nd Fighter Squadron taxies at it's home base of Fort Wayne, Indiana. (Andre Jans)

Twenty-six F-16N adversary aircraft were built for the US Navy in 1987/88. (22 Single seat and 4 two seaters). The F-16N was based on the standard Block 30 F-16C/D and was powered by the General Electric F110-GE-100 engine. However, the F-16N had a strengthened wing and was capable of carrying an Air Combat Maneuvering Instrumentation (ACMI) pod on the starboard wingtip. The ACMI pod allows details of air-to-air engagements to be transmitted to a ground station. Although the F-16N was based on the small-inlet Block 30 F-16C/D airframe, it carried the APG-66 radar of the F-16A/B which was lighter in weight but less capable than the APG-68 of the F-16C/D. In order to save even more weight, the F-16N carried no internal cannon and could not be fitted with air-to-air missiles. The electronic warfare fit consisted of an ALR-69 radar warning receiver rather than the ALR-65 fitted to the USAF version, plus an ALE-40 chaff/flare dispenser. The TF-16N was a two-seat version of the F-16N, being based on an F-16D Block 30E aircraft, but Apart from the second seat, the TF-16N was identical to the F-16N. They were all grounded in 1995. (Andre Jans)

(Above) On 25 June 2003, the U.S. Air Force exercised a contract option associated with Phase III of the F-16 Common Configuration Implementation Program (CCIP) by awarding Lockheed Martin $26.6 million for retrofit kits to modify 22 Block 40/42 aircraft. The F-16 CCIP is designed to provide the latest capabilities to approximately 650 Block 40/42/50/52 F-16s operated by the active USAF and Air National Guard. The resulting configuration provides a high degree of commonality in hardware and software, with attendant benefits in logistics support costs, training, operational flexibility and future upgrades. The upgrades also provide a high degree of commonality with new production F-16s for international customers and with the F-16 Mid-Life Update being performed on 400 F-16A/Bs operated by five European NATO partners. This F-16C is armed with AIM-9 and AIM-120 missiles and 2,000 pound LGBs. (Lockheed Martin)

The ALQ-131 ECM Pod is modular in design containing various electronic receivers, antennas, and powerful transmitters designed to alter the flight path of an incoming enemy missile. This modular pod-mounted system can be configured to cope with a range of threats, spread over one to five frequency bands, by selecting individual modules for inclusion in the pod. Both noise and deception-jamming modes are available, and the pod can be reprogrammed to match the expected threat. The ALQ-131 ECM pod is controlled from the cockpit by both automatic and manual means.

F-16A of Royal Netherlands Air Force 323 Squadron in special 50th Anniversary markings which depict the Goddess Diana, patroness of the hunt and mascot of 323 Squadron. (See the Saga of Diana on page 37).

Venezuela: FAV F-16B #2337 in a special "20th Anniversary" color scheme. This special color scheme (the first ever for FAV aircraft) was designed by Jose "Jaws" Lugo and celebrates the 20th anniversary of Grupo Aereo de Caza N° 16.

USAF F-16A ADF #80-0548 from 169 FS of the Illinois ANG, based at Peoria ANGB in 1994.

F-16C Block 30 of Knights of the North Squadron, Israeli Air Force 2004.

Block 50 F-16C of the 111th Combat Wing, Nea Anhialos AB, Hellenic Air Force, equipped with Conformal Fuel Tanks.

Block 52 F-16D of the Republic of Singapore Air Force. (RSAF)

F-16C Block 32 "By Request II" of the 302nd FS, Arizona Reserve. Painted to celebrate the 50th anniversary of the 302nd, which traces it's lineage to the famous Tuskegee Airmen. The jet was adorned with the red tail and striped nose of the Tuskegee P-51s. "By Request" was the mount of Tuskegee commander Benjamin O. Davis.

Pods, Pylons, and Weapons

While the basic aerodynamic shape of the F-16 has remained constant from prototype to the latest blocks, quantum leaps in technology have enhanced it's mission exponentially. This has resulted in the addition of offensive and defensive systems which are often manifested by the addition of various lumps, bumps, antennae, and pods.

The most visually significant addition to the F-16 is the LANTIRN pods. LANTIRN is a system consisting of two pods which allow aircrew to fly their aircraft by day or night and in adverse meteorological conditions. It provides Terrain-Following Radar (TFR), Forward-Looking Infra-Red (FLIR), targeting information for the aircraft's on-board fire control system and target laser illumination. Over 1,400 pods are currently in service with 10 countries.

The LANTIRN system comprises two pods; one AN/AAQ Navigation Pod ("To Fly"), and one AN/AAQ-14 Targeting Pod ("To Fight"). The pods were conceived in a way that allows them to operate autonomously, so either pod can be used without the other should the need arise.

The main sub-systems of the navigation pod are a Texas Instruments Ku-band terrain-following radar (AN/APN-237A), a wide field-of-view (WFOV) forward-looking infra-red sensor, and the necessary computers and power supplies.

The TFR uses advanced signal processing to provide a wide azimuth coverage, which in turn allows more violent maneuvering of the carrier aircraft. The system can provide directional inputs to the pilot or the flight control computer, whereas older systems only provided pitch-up commands.

The TFR significantly enhances the aircraft's chances to survive on the modern battlefield, since it not only allows the pilot to automatically avoid the terrain but also enables him to evade air defense systems by maneuvering horizontally. The radar can be linked directly to the F-16's autopilot to automatically maintain a preset altitude down to 100 feet while flying over virtually any kind of terrain. Five modes are available: Normal, Weather, ECCM, Low Probability of Intercept (LPI), and Very Low Clearance (VLC).

The FLIR has a 28 degree field-of-view horizontally and 21 degrees vertically. The resulting images are superimposed on the outside scenery by projecting them on the HUD. The image is grainy, but the sense of depth is good enough to fly in total darkness or the smoke of a battlefield. Rain, fog, or smoke however, degrade the performance of the system, since infra-red energy is greatly absorbed by aerosols or water vapor. For an expanded perspective beyond normal HUD viewing limits, the pilot can hands-on-throttle-and-stick (HOTAS)-select snap looks left or right 11 degrees from the center. Another switch allows the pilot to select either a negative "white hot" or a positive "black hot" image, both green and white rather than black and white.

Main sub-systems of the targeting pod are another forward-looking infrared (FLIR) and a laser designator/range finder. Both are housed in the movable nose section of the AN/AAQ-14, and are stabilized by a stabilization system which compensates for aircraft movemeat and vibration. The FLIR that is installed in a two-axis turret operates in two modes: a wide field-of-view for target acquisition or a narrow one for zooming in. When LANTIRN is not in operation, the turret is rotated to protect the sensors from the elements.

The FLIR can be aimed independently for zooming in on the selected target. Data from the FLIR is fed into one of the multi-function head-down displays in the cockpit and is used to identify terrain features and/or targets at long range.

LACKLAND AIR FORCE BASE, Texas -- Tech. Sgt. Marcos Farias attaches a Low-Altitude Navigation and Targeting Infrared for Night targeting pod to a 149th Fighter Wing F-16 Fighting Falcon. The 149th FW was the first unit in the Air Force to graduate pilots from the F-16 basic course with targeting-pod training. (U.S. Air Force photo by Senior Master Sgt. Mike Arellano)

The AN/AAQ-14 targeting pod contains a high-resolution, forward-looking infrared sensor (which displays an infrared image of the target to the pilot), a laser designator-range finder for precise delivery of laser-guided munitions, a missile bore sight correlator for automatic lock-on of AGM-65D imaging infrared Maverick missiles, and software for automatic target tracking. For a Maverick missile, the pod automatically hands the target off to the missile for launch with pilot consent. For a laser-guided bomb, the pilot aims the laser designator, and the bomb guides to the target. For a conventional bomb, the pilot can use the laser to determine range, then the pod feeds the range data to the aircraft's fire control system. (John Gourley)

The pod also houses Environmental Control Systems and a bore-sight correlator ("look where I look") hands-off system which passes targeting data to the aircraft's Fire Control Computer (FCC) and the weapon systems.

The laser designator can "illuminate" targets for laser-guided bombs. It can also be used to automatically track moving targets on the ground as well as to designate them for AGM-65 Maverick missiles. It is even possible to designate targets for multiple Maverick shots in a single pass. Another use for the laser is determining the exact distance of a landmark to update the aircraft's inertial navigation system. This is critical to accurate delivery of both guided and unguided ordnance without visual references.

With the arrival of Block 50, the F-16 assumed the role of Suppression of Enemy Air Defense (SEAD) for the Air Force. The SEAD mission, which involves shutting down or destroying enemy surface-to-air missile sites, was formerly performed by the F-4G Phantom. The primary missile used in these missions is called the High-Speed Anti-radiation Missile (HARM). The latest version of the F-16 carries a special pod, the HARM Targeting System, that makes this missile even more effective. F-16s with HARM and HTS were used in the August-September 1995 Operation Deliberate Force in Bosnia and have been used since then in Operations Northern Watch, Southern Watch, and Iraqi Freedom to destroy Iraqi surface-to-air missile sites.

The AGM-88 HARM (high-speed anti-radiation missile) is a supersonic air-to-surface tactical missile designed to seek and destroy enemy radar-equipped air defense systems. The AGM-88 can detect, attack and destroy a target with minimum aircrew input. Guidance is provided through reception of signals emitted from a ground-based threat radar. It has the capability of discriminating a single target from a number of emitters in the environment. The proportional guidance system that homes in on enemy radar emissions has a fixed antenna and seeker head in the missile nose. A smokeless, solid-propellant, dual-thrust rocket motor propels the missile.

Recently improved electronic jamming systems carried on the F-16 have increased survivability. Threat warning receivers and radar sensors that can distinguish the type of enemy radar illuminating the aircraft give the pilot more information.

Counter measures, such as chaff and flares, have been improved. Towed decoys have been introduced into the F-16 fleet. Dispensers for these defensive systems are incorporated in some of the pylons. Miniature air-launched decoys are being demonstrated as well. Engine improvements have increased survivability of the F-16 by giving pilots more thrust to evade threats. Engine improvements also allow the F-16 to cruise at higher and, thus, safer altitudes for longer periods of time while carrying increased payloads.

The Air Defense F-16 is a variant of the Block 15 OCU F-16 equipped with some additional systems for the air-to-air role. It has an improved APG-66A radar, an APX-109 identification friend or foe interrogator, ARC-200 high-frequency radio, standard flight data recorder, and a 150,000-candlepower spotlight mounted on the left side of the forward fuselage. The Air Defense F-16 can fire the AIM-7 Sparrow air-to-air radar-guided missile using continuous wave illumination from the radar. Like later F-16 versions, the air defense version can fire the AIM-120 AMRAAM radar-guided missile. The Air Defense F-16 is distinguishable by its four-bladed "bird-slicer" antennas just forward of the canopy and under the engine inlet and by the blistered tail root. The blisters were required to make room for the high-frequency radio equipment.

Two-hundred and seventy Block 15 airframes were converted to the air defense configuration in the late 1980s and early 1990s. All of the aircraft went to the Air National Guard. The first air defense variant was delivered in early 1989. An Air Defense F-16 unit from Fargo, North Dakota, proved the airplane's prowess when it won the William Tell air-to-air competition in 1994.

The F-16 was conceived as a lightweight, day VFR, air-to-air point defense fighter. It has morphed into a very capable all-weather fighter/bomber. The original and most basic armament consisted of the AIM-9 Sidewinder and internal M-61 Vulcan 20mm cannon. Both are retained on current versions of the F-16. They have been augmented by beyond-visual-range (BVR) missiles and practically all of the dumb and smart bombs in the U.S. inventory.

The most venerable missile in the U.S. inventory is the AIM-9 Sidewinder. The AIM-9 Sidewinder is a supersonic, heat-seeking, air-to-air missile. It has a high-explosive warhead and an active infrared guidance system. The Sidewinder was developed by the US Navy for fleet air defense and was adapted by the U.S. Air Force for fighter aircraft use. Early versions of the missile were extensively used in the Southeast Asian conflict. In September 1958

The SUU-20 practice bomb and rocket dispenser can be carried by the F-15, F-16, F/A-18, and F-117. The SUU-20 rack uses pyrotechnic charges to eject bombs, such as the BDU-33 practice bomb. (John Gourley)

The AN/AAQ-13 navigation pod provides high-speed penetration and precision attack on tactical targets at night and in adverse weather. The navigation pod also contains a terrain-following radar (TFR) and a fixed infrared (IR) sensor, which provides a visual cue and input to the aircraft's flight control system, enabling it to maintain a preselected altitude above the terrain and avoid obstacles. This sensor displays an infrared image of the terrain in front of the aircraft on the head-up display (HUD). The navigation pod enables the pilot to fly along the general contour of the terrain at high speed, using mountains, valleys and the cover of darkness to avoid detection. The pod houses the first wide-field, forward-looking infrared navigation system for Air Force air-superiority fighters.

Chinese Nationalist F-86s fired the first Sidewinder air-to-air missiles to down 11 communist Chinese MiG-17s over the Formosa Straits.

The AIM-9 has a cylindrical body with a roll-stabilizing rear wing/rolleron assembly. Also, it has detachable, double-delta control surfaces behind the nose that improve the missile's maneuverability. Both rollerons and control surfaces are in a cross-like arrangement.

The infrared guidance head enables the missile to home on target aircraft engine exhaust. An infrared unit costs less than other types of guidance systems, and can be used in day/night and electronic counter measures conditions. The infrared seeker also permits the pilot to launch the missile, then leave the area or take evasive action while the missile guides itself to the target.

The AIM-9L added a more powerful solid-propellant rocket motor as well as tracking maneuvering ability. Improvements in heat sensor and control systems provided the AIM-9L missile with an all-aspect attack capability and improved guidance characteristics. The L model was the first Sidewinder with the ability to attack from all angles, including head-on. An improved active optical fuse increased the missile's lethality and resistance to electronic counter measures. A conical scan seeker increased seeker sensitivity and improved tracking stability. The AIM-9L is configured with an annular blast fragmentation warhead. Production and delivery of the AIM-9L began in 1976. The all aspect heat seeking Lima model of the established AIM-9 Sidewinder missile was one of the most significant air combat weapons of its time. The AIM-9L did not require a tail chase position to lock on to a tailpipe, and could lock on from any angle including head-on. Soon after deployment the AIM-9L proved that existing air combat tactics were obsolete, since instantaneous turning performance became far more important than sustained turning performance. The ability to point the aircraft's nose at an opponent and quickly fire a missile became far more important than the ability to follow through multiple turning maneuvers to acquire a tail aspect gun/heat seeker firing position.

The AIM-9M, currently the only operational variant, has the all-aspect capability of the L model, but provides all-around higher performance. The M model has improved defense against infrared counter measures, enhanced background discrimination capability, and a reduced-smoke rocket motor. These modifications increase ability to locate and lock-on a target and decrease the missile's chances for detection. Deliveries of the M model began in 1983. The Sidewinder has a range of 10 to 18 miles, depending on altitude, and a max speed of Mach 2.5. It has a launch weight of 190 pounds and a per-unit cost of approximately $84,000.

While some ADF F-16s have been modified to allow firing of the AIM-7 Sparrow radar-guided missile, the primary BVR radar missile in use by all F-16s is the AIM-120. The AIM-120 advanced medium-range air-to-air missile (AMRAAM) is a new generation air-to-air missile. It has an all-weather, beyond-visual-range capability. AMRAAM is a supersonic, air launched, aerial intercept, guided missile employing active radar target tracking, proportional navigation guidance, and active Radio Frequency (RF) target detection. It employs active, semi-active, and inertial navigational methods of guidance to provide an autonomous launch and leave capability against single and multiple targets in all environments.

The AMRAAM weighs 340 pounds and uses an advanced solid-fuel rocket motor to achieve a speed of Mach 4 and a range in excess of 30 miles. In long-range engagements AMRAAM heads for the target using inertial guidance and receives updated target information via data link from the launch aircraft. It transitions to a self-guiding terminal mode when the target is within range of its own monopulse radar set. The AIM-120 also has a "home-on-jam" guidance mode to counter electronic jamming. With its sophisticated avionics, high closing speed, and excellent end-game maneuverability, chances of escape from AMRAAM are minimal. Upon intercept an active-radar proximity fuse detonates the 40-pound high-explosive warhead

The AGM-65 Maverick is a tactical, air-to-surface guided missile designed for close air support, interdiction and defense suppression mission. It provides stand-off capability and high probability of strike against a wide range of tactical targets, including armor, air defenses, ships, transportation equipment and fuel storage facilities. Maverick was used during Operation Desert Storm and, according to the Air Force, hit 85 percent of its targets. The Maverick has either a rounded glass nose for electro-optical imaging, or a zinc sulfide nose for imaging infrared. The warhead is in the missile's center section. A cone-shaped warhead, one of two types carried by the Maverick missile, is fired by a contact fuse in the nose. The other is a delayed-fuse penetrator, a heavyweight warhead that penetrates the target with its kinetic energy before firing. The latter is very effective against large, hard targets. The propulsion system for both types is a solid-rocket motor behind the warhead.

The venerable AIM-9 Sidewinder is still one of the most effective fighter weapons in the world. The AIM-9M, currently the only operational variant, has the all-aspect capability of the L model, but provides all-around higher performance. The M model has improved defense against infrared counter measures, enhanced background discrimination capability, and a reduced-smoke rocket motor. These modifications increase ability to locate and lock-on a target and decrease the missile's chances for detection. Deliveries of the M model began in 1983. (USAF)

to destroy the target. At closer ranges AMRAAM guides itself all the way using its own radar, freeing the launch aircraft to engage other targets. It has a per-unit cost of $386,000.

Because of the Vietnam experience, no new fighter aircraft designed in the wake of that experience have been without a gun. The F-16 has one M-61A1 20mm multi-barrel cannon with 500 rounds of ammunition.

F-16s also carry the AN/AAQ-28 LITENING Advanced Airborne Targeting and Navigation Pod. LITENING is under contract with the United States Air Force Reserve and the Air National Guard, as well as six international air forces. Northrop Grumman's Electronic Sensors and Systems Sector, located in Rolling Meadows, Illinois partnered with RAFAEL of Israel to produce these systems.

LITENING pods are currently fielded with Air National Guard (ANG) F-16s. The LITENING II system, with a 256 FLIR, is also operational on ANG and Air Force Reserve Command F-16s and on AV-8Bs owned and operated by the USMC, as well as Italy and Spain.

One of the primary lessons learned from the Gulf War was that modern air forces need the ability to operate 24 hours a day in adverse weather conditions and to deliver precision guided weapons. In Desert Storm, aircraft using precision weapons typically destroyed with just two bombs targets which in World War II required 9,000 bombs and in Vietnam 300. The pods used in Desert Storm were expensive, single purpose systems which required multiple pods to perform various missions. Until LITENING, no system incorporated in a single pod all the features required by a modern air force. LITENING, however, combines multiple sensors for maximum flexibility in a single pod at low cost.

Active-duty aircraft have a precision-strike capability, thanks to the advanced Low Altitude Navigation and Targeting Infrared Night System. Air Force Reserve Command is providing a similar capability for its fleet of F-16 Fighting Falcons by acquiring the new LITENING II Precision Attack Targeting System. The LITENING II system being purchased is similar to LANTIRN in size, appearance and system interface. However, it provides improved reliability and maintainability, along with state-of-the-art additional capability. The additional capability includes laser spot tracking, laser marking, ranging, and dual sensor input from both a forward-looking infrared camera and a state-of-the-art daytime video camera for greater flexibility under varying environmental conditions.

"Smart" bombs carried by the F-16 include the GBU-10, 12, 16, and 24 laser-guided bombs (LGB) and GBU-24E/B, 29, 30, 31, 32 GPS Guided Joint Direct Attack Munitions (JDAM).

The AGM-65 Maverick is a tactical, air-to-surface guided missile designed for close air support, interdiction and defense suppression mission. It provides stand-off capability and high probability of strike against a wide range of tactical targets, including armor, air defenses, ships, transportation equipment and fuel storage facilities. Maverick was used during Operation Desert Storm and, according to the Air Force, hit 85 percent of its targets.

The Maverick variants include electro-optical/television (A and B), imaging infrared (D, F, and G), or laser guidance (E). The Air Force developed the Maverick, and the Navy procured the imaging infrared and the laser guided versions. The AGM-65 has two types of warheads, one with a contact fuse in the nose, the other a heavyweight warhead with a delayed fuse, which penetrates the target with its kinetic energy before firing. The latter is very effective against large, hard targets. The propulsion system for both types is a solid-rocket motor behind the warhead.

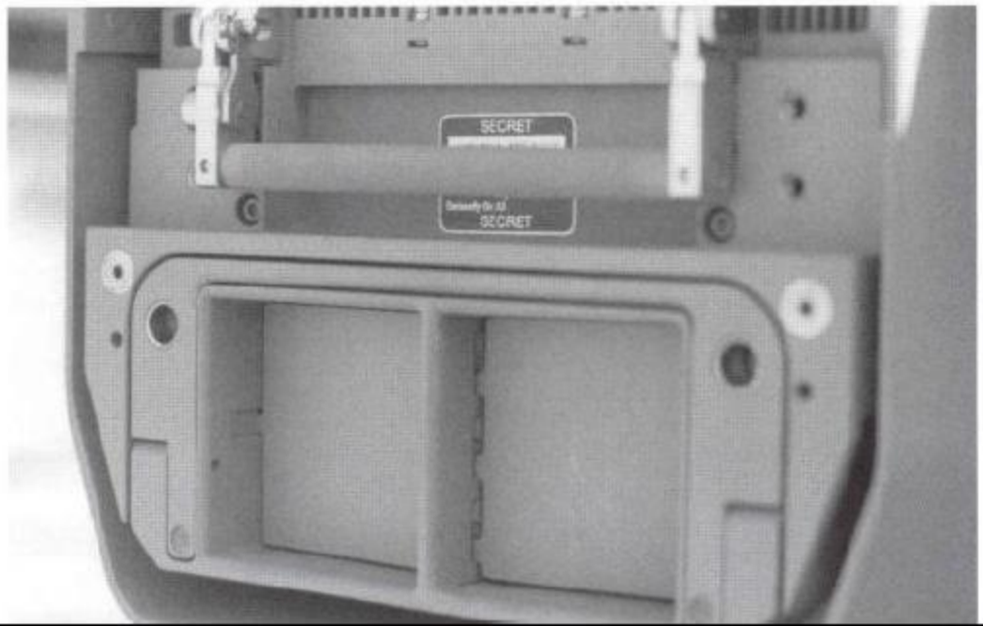
Air Force versions of the Maverick weigh 462 pounds at launch with a 125 pound warhead. They have a max speed of .95 Mach and a range of 17 miles. Production unit cost is $125,000.

The "smart weapon" capacity of the F-16 has been doubled with the certification of the new BRU-57 multiple weapon rack.The BRU-57 has two stations, each with MIL-STD-1760 interfaces for smart weapons so flight and targeting data can be transferred to the weapon immediately prior to release. The F-16 now will be able to carry four, instead of two, 1,000-pound class smart weapons.

The U.S. Air Force certified use of the Lockheed Martin CBU-103/104/105/107 Wind Corrected Munitions Dispenser series using the BRU-57 on its fleet of Block 40/42/50/52 F-16 aircraft. Certification of the AGM-154 Joint Standoff Weapon (JSOW) was expected to be

The ALE-50 Advanced Airborne Expendable Decoy (AAED) is a towed expendable intended to provide a radar target decoy to an incoming missile. The ALE-50 can be manually operated as a stand-alone device, or it can be integrated and controlled by the ALE-50.

Detail of the launch end of the ALE-50. It is mounted on the outboard wing station in conjunction with the AIM-9 launch rail. (John Gourley)



completed in 2004. The rack is also compatible with 500-pound and 1,000-pound Joint Direct Attack Munitions (JDAMs). All these weapons are integrated with only a software change to the F-16.

The BRU-57 is a vertical ejection rack using the latest technology. Compared to the previously used TER-3 triple ejector rack, it has advantages of interfacing with smart weapons, higher reliability and maintainability, and greater safety with lower potential for collision of weapons during release.

The F-16 was the first aircraft to use the BRU-57. The BRU-57 contains two BRU-46 ejector units already used in the U.S. Air Force inventory.

Defensive systems include chaff and flare dispensers, (the former to confuse radar-guided missiles, the latter to decoy heat-seekers), and electronic jammers, most commonly carried in pods on the centerline.

The AN/ALE-40 Counter Measure Dispenser System (CMDS) provides expendable counter measures stores. It allows the pilot to release chaff or flare, depending on the threat type, to counter any homing of a missile to the plane. This is a very simple yet effective system. Chaff looks like millions of tiny strands of aluminum foil and each strip is cut to length to match the various wavelengths of the radar. Using chaff to combat radar was used as early as WW II and still proves very effective against nearly all radar threats. Flares are white hot magnesium that are designed to defeat a missile's infra-red (IR) tracking mechanisms.

The AN/ALE-47 Counter Measures Dispenser System provides an integrated, reprogrammable, computer controlled system to dispense expendables/decoys to enhance aircraft survivability. It is designed to employ electronic and infrared counter measures according to a program developed and implemented by the aircrew. ALE-47 provides the aircrew with a "smart" counter measures dispensing system, allowing the aircrew to optimize the counter measures employed against anti-aircraft threats. The ALE-47 system is an upgraded version of the ALE-40, which is more automatic and is programmable to better enhance its capabilities depending on aircraft mission.

The most commonly carried ECM pods are the AN/ALQ-119, AN/ALQ-131 and the AN/ALQ-184.

The Westinghouse AN/ALQ-119 jammer pod is currently carried on the F-16 and A-10, and previously carried on the F-4 prior to that aircraft's retirement. During the Vietnam War the ALQ-119 was carried on the F-4, Phantom II frequently mounted on the inboard station, though subsequently it was frequently mounted on the Left Forward Aim-7 missile station.

This noise/deception jammer covered three frequency bands. Current AN/ALQ-119 maintenance activities include programming of new threats and techniques to the system, system performance laboratory testing, threat and weapon systems analysis and technique development, and field support for various range testing of the system.

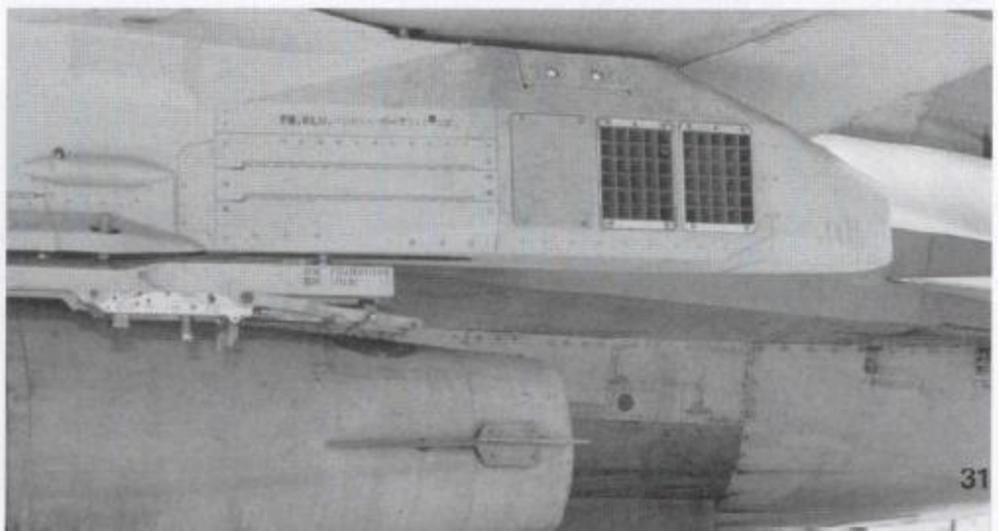
The AN/ALQ-131 Electronic Counter Measures Pod provides electronic counter measures protection for USAF, ANG, AFRES, and FMS country aircraft. The AN/ALQ-131 is certified on the F-16, F-111, A-10, F-4, F-15, F-5 and C-130 aircraft. The ALQ-131 ECM Pod is modular in design containing various electronic receivers, antennas, and powerful transmitters designed to alter the flight path of an incoming enemy missile. This modular pod-mounted system can be configured to cope with a range of threats, spread over one to five frequency bands.

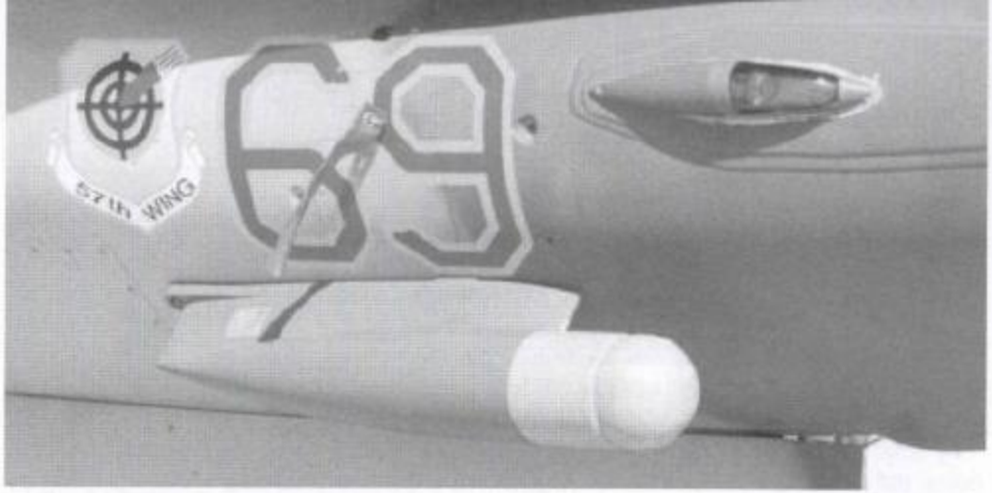
By selecting individual modules for inclusion in the pod, the user can program the pod to defeat threats. Both noise and deception-jamming modes are available, and the pod can be reprogrammed to match the expected threat. The pod is controlled from the cockpit by both automatic and manual means. The cockpit control indicator is used to turn the system on, enable threat response actions, and display system status. ECM pods are pre-programmed on the ground for specific threats that may be encountered.

The AN/ALQ-184 Electronic Attack Pod provides self-protection for the F-16 combat aircraft and crew in a complex radar guided threat environment. Built by Raytheon E-Systems for the Air Force, the AN/ALQ-184 protects aircraft against radio frequency threats by selectively directing high power jamming against multiple emitter. In 1995 Raytheon's Goleta, California, electronic warfare operation, which builds the AN-ALQ-184, was combined with the company's E-Systems division.

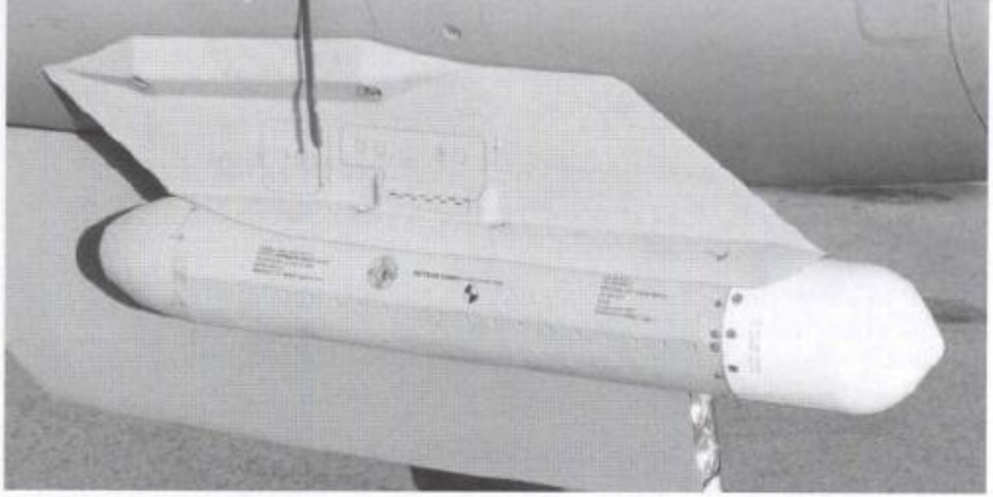
The "Pylon Integrated Dispenser System (PIDS)" fits chaff-flare dispensers to the rear of the outboard stores pylon on each wing. PIDS is in service with a number of foreign user as well as the USANG and USAF Reserve. Also shown is the latest aerodynamically efficient triple ejector rack (TER) and the AIM-9 launch rail on the outboard wing station. (John Gourley)

The PIDS integrates the ALE-47 Chaff/Flare dispenser. ALE-47 provides the aircrew with a "smart" counter measures dispensing system, allowing the aircrew to optimize the counter measures employed against anti-aircraft threats. The ALE-47 system is an upgraded version of the ALE-40, which is more automatic and is programmable to better enhance its capabilities depending on aircraft mission. (John Gourley)





The AN/ASQ-213 HARM Targeting Systems (HTS) Pod is carried on the right intake chin (5R) station. It is integral to the Suppression of Enemy Air Defenses (SEAD) mission which uses the AGM-88 HARM (high-speed anti-radiation missile) as the primary weapons to attack enemy air defense radar sites. (John Gourley)

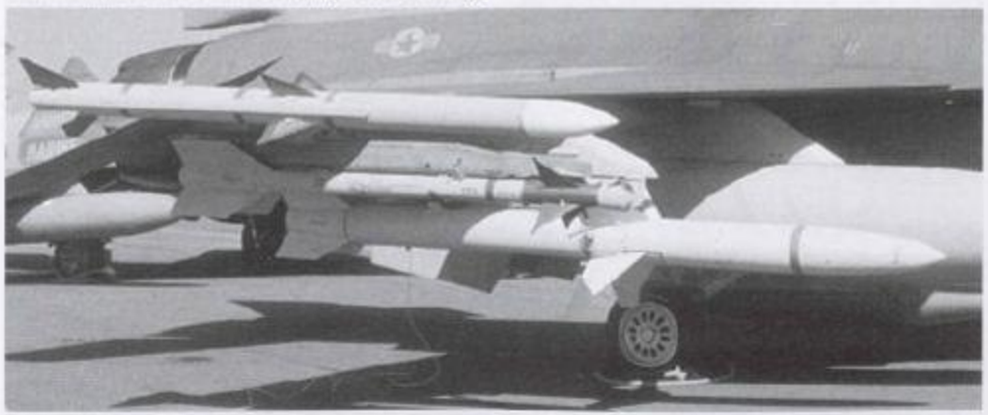


F-16Ns carried this emitter to record air combat maneuvering sorties by Top Gun instructors and students. (John Gourley)

An F-16C Fighting Falcon assigned to the 522nd Fighter Squadron, Cannon Air Force Base, N.M., releases an AGM-154 Joint Standoff Weapon (JSOW) over the Utah Test and Training Range. The mission was part of an air-to-ground weapons system evaluation program mission commonly referred to as Combat Hammer. The squadron is deployed to Hill AFB, Utah. The AGM-154A (Formerly Advanced Interdiction Weapon System) is intended to provide a low cost, highly lethal glide weapon with a standoff capability. JSOW family of kinematically efficient, air-to-surface glide weapons, in the 1,000-lb class, provides standoff capabilities from 15 nautical miles (low altitude launch) to 40 nautical miles (high altitude launch). The JSOW is a launch and leave weapon that employs a tightly coupled Global Positioning System (GPS)/Inertial Navigation System (INS), and is capable of day/night and adverse weather operations. The JSOW uses inertial and global positioning system for midcourse navigation and imaging infra-red and datalink for terminal homing. The JSOW is just over 13 feet in length and weighs between 1000-1500 pounds. (U.S. Air Force photo by Master Sgt. Michael Ammons)

An F-16C Fighting Falcon assigned to the 522nd Fighter Squadron at Cannon Air Force Base, N.M., fires an AGM-65H Maverick air-to-ground missile at a target located over the Utah Test and Training Range. The mission was part of an air-to-ground weapons system evaluation program mission commonly referred to as Combat Hammer. The squadron is deployed to Hill AFB, Utah. The Maverick missile family provides day, night, and limited adverse weather capability and is currently USAF's primary discriminatory antitank weapon. Maverick is a primary weapon for LANTIRN equipped aircraft. (U.S. Air Force photo by Master Sgt. Michael Ammons)

An F-16CJ with typical SEAD mission armament of AIM-120 and AIM-9 air-to-air missiles and AGM-88 HARM missiles. (John Gourley)



(Below) OPERATION IRAQI FREEDOM -- Tech. Sgt Daniel Gilbert, an F-16 Fighting Falcon crew chief, checks the underside of an F-16 launching at a forward deployed air base. (U.S. Air Force photo by Master Sgt. Terry L. Blevins)

(Above) In 2002 the U.S. Air Force began using a software update developed by Lockheed Martin Aeronautics Co. that added new "smart" weapons capability to its 400-aircraft fleet of Block 40/42 F-16C/Ds. The weapons included the GBU-31 Joint Direct Attack Munition (JDAM) – INS/GPS (Inertial Navigation System/Global Positioning System [satellite]) guidance, the AGM-154 Joint Stand-Off Weapon (JSOW) – INS/GPS guidance, the CBU-103/104/105 Wind-Corrected Munitions Dispenser (WCMD) – INS guidance, EGBU-27 enhanced laser-guided bomb – laser seeker plus INS/GPS guidance. (Lockheed Martin)

AVIANO AIR BASE, Italy -- An F-16C Fighting Falcon of the 52nd Fighter Wing returns from flying a mission against targets in Yugoslavia, 2 April 1999. Members of the 52nd from Spangdahlem Air Base, Germany, were deployed at Aviano to support NATO Operation Allied Force. It is armed with 4 AIM-120 AAMs and 2 AGM-88 HARMs. (USAF)

(Below) A look-down view of a Tiger-striped F-16C belonging to the 140th Fighter Wing, 120th Fighter Squadron, Colorado Air National Guard, as the aircraft flies over eastern Utah while returning from the Utah Test and Training Range. The aircraft has tiger-stripes applied to the upper surfaces and represented the Colorado ANG as their official Tiger jet as the unit hosted the Inaugural Tiger Meet of the Americas in mid-August. The inaugural meet closely mirrors the NATO Tiger Meet and brings together military units that have large cats as their mascots. (U.S. Air Force photo by Staff Sgt. Greg L. Davis)

F-16C 90-0700 of the 112th Fighter Squadron, Ohio ANG. (Andre Jans)

F-16C 83-1155 of the 174th Fighter Squadron, NY ANG is the flagship of the Syracuse-based Viper unit. (Andre Jans)

F-16C 89-2040 of the 125th FS, 138th FW "Tulsa Vipers" of the Oklahoma ANG marked to reflect the "Native America" theme of Oklahoma. (Andre Jans)

An F-16 Fighting Falcon flies near China Lake Naval Air Weapons Center, Calif., during a successful AIM-9X test. The aircraft and pilot are from the 416th Flight Test Squadron at Edwards Air Force Base, Calif. The AIM-9X utilizes the existing AIM-9M AOTD, warhead, and rocket motor, but incorporates a new Guidance Section (GS), new hangars, a new mid-body connector, new harness and harness cover, new titanium wings and fins, and a new CAS. The missile is propelled by the AIM-9M solid-propellant rocket motor, but uses a new Arm and Fire Device (AFD) handle design. Also, the AIM-9M rocket motor is modified to mount the CAS on its aft end. Aerodynamic lift and stability for the missile are provided by four forward-mounted , fixed titanium wings. Airframe maneuvering is accomplished by four titanium control fins mounted in line with the fixed wings and activated by the CAS, which includes a thrust vector control system that uses four jet vanes to direct the flow of the rocket motor exhaust. (Photo by Tom Reynolds)

(Below) An F-16 Fighting Falcon from the 555th Fighter Squadron at Aviano Air Base, Italy, banks away from a KC-135 Stratotanker on April 21 following an aerial refueling. The F-16 received the 1 billionth pound of fuel distributed from Combined Forces Air Component Command refuelers since Jan. 30, 2003. The F-16 is armed with a GBU-32 Joint Direct Attack Munition (JDAM). (U.S. Air Force photo by Staff Sgt. Aaron Allmon II)

Foreign F-16 Operators

Belgium

Belgium was one of four European members of the NATO F-16 partnership, and one of two responsible for the European production of F-16s. The primary Belgian contractor in the F-16 program was the Societe Anonyme Belge de Constructions Aeronautiques (SABCA), which was responsible for the final assembly of F-16s intended for both Belgian and Danish service. Fabrique National manufactured the F100 engines for the F-16s of all four nations in the European consortium.

In early 1978, the first European F-16 assembly line opened at SABCA, followed by the first flight of a Belgian-built F-16 in December 1978. The aircraft was accepted by the Belgian Air Force in January 1979. This was the first locally built F-16 to be delivered to a European operator.

The original Belgian order was for 116 F-16 aircraft. Beginning in September 1981, 35 early-production Belgian F-16s were rotated back through the SABCA factory for cockpit modifications and avionics updates. The modifications effectively brought the aircraft to Block 10 standards. Delivery of these first 116 aircraft to the Belgian Air Force was completed in May 1985. A follow-on order of 44 Block 15 Operations Capability Upgrade (OCU) aircraft was placed in February 1983 and delivered between 1987 and 1991.

Denmark

Denmark was a member of the four-nation consortium that first brought the Fighting Falcon to Europe. The initial Royal Danish Air Force order was for 58 aircraft. These planes went through final assembly in the Belgian Societe Anonyme Belge de Constructions Aeronautiques (SABCA) plant. All were built to the initial Block 1 standards. Deliveries to the Royal Danish Air Force began in January 1980. A follow-on order of 12 Block 15 F-16 aircraft was placed in August 1984. Intended as attrition replacements, these latter aircraft were built by Fokker in the Netherlands.

The Netherlands

The Netherlands was one of the four start-up European NATO F-16 customers, along with Belgium, Denmark, and Norway. The initial Dutch order included 102 aircraft to be assembled at Fokker. This line first opened for business in April 1978, and was the second of the European F-16 final assembly lines to open. (SABCA in Belgium was the first.) The first Dutch-built F-16 took off on its maiden flight on May 3, 1979. Initial delivery of the F-16A/B to the Dutch Air Force took place in June 1979.

In December 1983, the Dutch Parliament approved plans to increase its purchase of F-16s from 102 to 213 aircraft. In 1989, the Netherlands ordered an attrition replacement of 10 F-16As. The last F-16 rolled off the line at Fokker's Schiphol plant in February 1990.

Norway

In 1970, Norway started looking for a replacement for its aging fleet of F-104 Starfighters. On July 21, 1975, Norway, Belgium, the Netherlands, and Denmark ordered the F-16. Together, they formed the European consortium that was to build the F-16 under license. Norway acquired 72 F-16s from the Netherlands' Fokker production line between January 1980 and June 1984. The first Fighting Falcon for the Royal Norwegian Air Force took off on its maiden flight on December 12, 1979.

Israel

In August of 1978, the government of Israel announced plans to acquire 75 F-16s. The first F-16 deliveries to Israel occurred under the Peace Marble I Foreign Military Sales program. The first four F-16s arrived in Israel in July 1980. Under Peace Marble II, the Israel Defense Force was supplied with 75 Block 30 F-16s. The first Block 30 F-16 arrived in October 1987.

An early (and more modest) version of Diana. (Andre Jans)

The Saga of Diana

by Andre Jans

In 1992, Dutch commercial artist Peter van Stigt designed a T shirt for 323 Squadron, featuring a pin-up of the goddess Diana which is related to the squadron insignia. His Diana was much more attractive than the squadron insignia.

In 1998, when 323 started thinking of celebrating its 50th anniversary, a pair 323 mechanics "borrowed" the t-shirt design for one of their F-16s (J-877). This design was evidently considered too racy by Air Force HQ and was removed shortly thereafter.

A 2nd design was painted on F-16 J-230, which depicted Diana in a blue background. J-230 couldn't make it to the annual air show at Leeuwarden AB in July 1998 due to operational commitments at Goose Bay, Canada. It was later modified officially with more clothes. This design was applied, on vinyl, to J-642, which was available for display. This was removed after the show as the F-16 was not airworthy with the vinyl decal applied.

J-248 was introduced during the Fall of 1998 when 323 Squadron officially celebrated its 50th anniversary during November. It flew a few years with 323 Squadron before it was handed over to Volkel AB when 323 started receiving the new MLU type F-16's. As far as is known, this J-248 never was rated with extra clothes. It probably escaped the attention from our Air Force generals as they already had rated 3 earlier designs and probably lost sight of number four. J-248 was never updated to MLU standard and was put in storage. Its current status is unknown, but was probably scrapped.

Designer Peter van Stigt was able to clear the violating of copyright with our Air Force as his design was used without permission on all 4 F-16's. Two years earlier he was given the opportunity to design the 45 year anniversary tail of 312 Squadron, based at Volkel AB. This is the "Bonzo" Dog painting on F-16A J-879. In this period Peter was the volunteer 312 'house artist'. All copyright details were given attention and the design was accepted without hesitation by the AF HQ. The 'Bonzo' tail flew for almost two years.

The fourth and final version of Diana. The goddess Diana, maiden huntress, protector of all that is wild and free is the mascot of RoNAF 323 Squadron. (Andre Jans)

A Dutch F-16 armed with AIM-120 AAMs and LGBs on takeoff. Lockheed Martin Aeronautics Company was awarded a contract on 18 January 2002 for delivery of F-16 modification kits that will significantly upgrade the capability of F-16s used by air forces in several European countries. The contract is for delivery of 306 modification kits, an option for 39 additional kits, plus spares, support equipment and technical manual changes. These kits will be used to upgrade F-16s previously modified with the F-16A/B Mid-Life Update (MLU), and operated by the air forces of Belgium, Denmark, the Netherlands and Norway. Portugal is planning to incorporate this modification on its F-16s as well, but under a separate contract at a later date. The upgrade enables these F-16s to employ advanced weapons such as the AIM-120 missile and the family of "smart" bombs associated with the LANTIRN system. (Lockheed Martin)

In May 1988, a follow-on order was placed for 60 Block 40 F-16s, plus an option for 15 more. The first of these Peace Marble III Fighting Falcons arrived in Israel in August 1991. The first of 50 surplus U.S. Air Force Block 10 F-16s was delivered on August 1, 1994, under the Peace Marble IV program. Delivery was completed in late 1994.

In July 1999, Israel selected the F-16I over other competing aircraft, which led to a contract for 50 F-16D Block 52+ signed in January 2000, and an option for up to 60 more aircraft to be exercised in 2001. The Peace Marble V aircraft will deliver during 2003 through 2006. The optional aircraft would be delivered in 2006 through 2008.

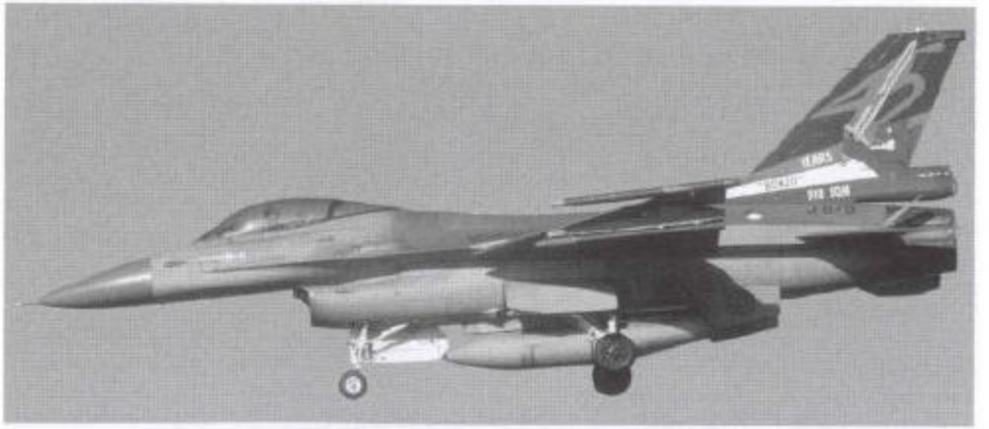
Israeli F-16s have extensive local modifications, with different avionics fits and higher gross weights, which require changes in the landing gear and the use of new wheels. Israeli F-16Cs have been fitted with a number of locally-produced avionics items including Elta EL/L-8240 electronics counter measures equipment to replace the Loral Rapport III, and AN/ALE-40 chaff/flare dispensers (or an indigenous equivalent) in place of the newer AN/ALE-47s found on C models used elsewhere. Israeli F-16Cs can be equipped with a locally produced ACM debriefing system which is packaged into an inert AIM-9 airframe and uses a differential GPS to record the exact tracks of aircraft for replay during post-mission debriefings. Some Israeli F-16Cs may use an indigenous radar such as the Elta 2021B or 2032 in place of the APG-68. Israel Military Industries (IMI) has produced a special 600 US gallon underwing drop tank to replace the standard 370 US underwing drop tanks, which extends the combat radius of the F-16 by 50 percent. The maximum all-up weight of an Israeli F-16C is reportedly 48,000 pounds, as compared to 42,300 pounds for a USAF Block 40 F-16C.

Egypt

Egypt signed a letter of agreement in June 1980 to acquire 42 Block 15 F-16 fighters under the Peace Vector Foreign Military Sales program. The first aircraft was accepted by the Egyptian Air Force in January 1982. The first six planes arrived in Egypt in March 1982. In the Peace Vector II program, Egypt ordered 40 additional Block 32 F-16s. In October 1986, the first of these aircraft arrived in Egypt. The 242nd Regiment at Beni Suef began operating F-16Cs in October 1986.

In June 1990, Egypt signed an order for 47 Block 40 F-16s, powered by the General Electric F110 turbofan engine. The first of these Peace Vector III F-16s was delivered to Egypt in

The "Bonzo" scheme designed by Peter van Stigt for RoNAF 312 Squadron for their 45th Anniversary was applied to J-879. (Andre Jans)



October 1991.

A contract to produce 46 Block 40 F-16C/Ds for the Egyptian Air Force was placed with TUSAS Aerospace Industries (TAI) of Turkey in 1993. Carried out under the Peace Vector IV program, this contract marked the first sale of a foreign-built Fighting Falcon to a third-party nation. The first aircraft was delivered in early 1994, and deliveries continued into 1995. All but one of the earlier F-16s for Egypt had originated on the Lockheed Martin Aeronautics Company production line. Egypt received 175 Fighting Falcons by the time all the TAI planes were delivered.

In May 1996, Egypt signed a letter of agreement for 21 new F-16 Block 40 aircraft. This represented Egypt's fifth F-16 order in 15 years.

In June 1999, Egypt ordered 24 F-16 Block 40 aircraft under the Peace Vector VI program. These aircraft were delivered during 2001 and 2002. They were the last Block 40 aircraft produced.

Korea

In December 1981, the Republic of Korea signed a letter of agreement for the purchase of 36 F-16C/D Block 32 Fighting Falcons under the Peace Bridge Foreign Military Sales program. This made the Republic of Korea Air Force (ROKAF) the first foreign operator of the F-16C model of the Fighting Falcon. Funds remaining in the Peace Bridge program allowed the ROKAF to purchase four additional F-16 Block 32 aircraft in June 1988.

On December 2, 1994, Korea received the first of 120 F-16s under the Korea Fighter Program. All aircraft were manufactured to the Block 52 standard and had upgraded avionics and Pratt & Whitney F100-PW-229 engines. Under the terms of the agreement, Lockheed Martin Aeronautics Company manufactured the first 12 aircraft. The next 36 were then delivered in kit form and assembled in South Korea. Samsung Aerospace is building the last 72 aircraft in South Korea.

South Korea is the fifth country to produce the F-16, after the United States, Belgium, the Netherlands, and Turkey. The first Korean-built KF-16 was delivered in June 1997.

In July 2000, Korea ordered 20 additional Block 52 F-16 aircraft to be produced by Korea Aerospace Industry (KAI) under license. These aircraft comprise Korea Fighter Program II and were delivered during 2003 and 2004.

The Koreans are in the process of developing their own version of the F-16. The T-50 Golden Eagle is a supersonic, advanced jet trainer and lead-in fighter trainer being jointly developed and produced by Lockheed Martin Aeronautics Company and Korea Aerospace Industries (KAI) for the Republic of Korea Air Force. The T-50 will be used to train pilots to fly current and next-generation fighters; it will also be marketed for export.

Lockheed Martin is the principal subcontractor and responsible for the wings, flight controls and avionics, plus technical assistance in the development process.

The supersonic T-50 will have the maneuverability, endurance and advanced systems to prepare future pilots to fly next-generation fighters like the F-22 and the Joint Strike Fighter. These same characteristics give the T-50 an excellent light-combat potential.

The Full Scale Development (FSD) program began in 1997. The first of four FSD aircraft flew on 20 August 2002. First production aircraft is expected to be completed in 2005.

Pakistan

In December 1981, the government of Pakistan signed a letter of agreement for the purchase of 40 F-16A/B (28 F-16A and 12 F-16B) fighters for the Pakistan Air Force. The first aircraft were accepted in October 1982. The Pakistani F-16s are all Block 15 aircraft, the final version of the F-16A production run. They are powered by the Pratt & Whitney F100-PW-200 turbofan engine. All 40 aircraft were delivered between 1983 and 1987.

Pakistan ordered 71 additional Block 15 F-16 aircraft, 11 in December 1988 and 60 in November 1989. However, due to the U.S. embargo of military equipment, only 28 of these aircraft were built, and they were placed in storage at the U.S. Air Force Aircraft Maintenance and Regeneration Center in Tucson, Ariz.

Venezuela

In May 1982, the government of Venezuela signed an agreement to buy 24 Block 15 F-16 aircraft. This purchase was under the Peace Delta Foreign Military Sales program. The first aircraft was accepted for the Venezuelan Air Force in September 1983.

Turkey

In September 1983, the government of Turkey announced plans to buy 160 F-16s under the Peace Onyx I program, which operates under the Foreign Military Sales program. The first eight aircraft in the order were built at Lockheed Martin Aeronautics Company, with the remaining 152 aircraft assembled in Turkey at TUSAS Aerospace Industries (TAI) at Murted. TUSAS is an acronym for Tusas Ucak Sanayii AS, or Turkish Aircraft Industries, a company owned jointly by Turkish and American shareholders.

The Turkish Air Force received its first two F-16s as assembly kits in March 1987. Turkey officially received its first F-16D in July 1987. The first Turkish F-16s arrived at Murted Air Base in October 1987, followed by the first flight of a Turkish-built F-16 on October 20, 1987. Starting with the 44th aircraft, all Turkish Air Force F-16s from the first batch were manufactured to Block 40 standards. The first 43 F-16s were Block 30 versions.

TAI has also been awarded a contract to build wings, center fuselages, and aft fuselages for U.S. Air Force F-16s. They have also been awarded a contract to build 46 Block 40 F-16C/Ds for the Egyptian Air Force under the Peace Vector IV program.

In March of 1992, a follow-on order for 80 Block 50 F-16Ds was placed under the Peace Onyx II Foreign Military Sales program. TAI delivered these aircraft from 1996 to 1999.

Greece

In November 1984, Greece announced its decision to acquire 40 F-16 fighters to replace the country's F-5A Freedom Fighter. The formal agreement was signed in January 1987.

The first group of F-16C/Ds for Greece, acquired under the Peace Xenia I Foreign Military Sales program, were delivered between November 1988 and October 1989. They were Block 30 aircraft, powered by the General Electric F110-GE-100 turbofan engine. The first F-16D for the Hellenic Air Force was presented in November 1988. The first F-16C was delivered later that same month.

In April 1993, Greece placed an order for 40 additional F-16 Block 50 fighters under the Peace Xenia II program. The aircraft are powered by the General Electric F110-GE-129 engine. The first two F-16 Block 50 aircraft for Greece rolled out of the factory at Lockheed Martin Aeronautics Company on the same day in January 1997 – more than a month ahead of schedule.

In March 2000, Greece signed a letter of agreement for 50 Block 52+ F-16C/Ds under the Peace Xenia III program. These aircraft will deliver during 2002 and 2003. Greece has an option for 10 additional aircraft to be exercised in late 2001.

Singapore

In January 1985, Singapore ordered eight F-16/79 fighters with General Electric J79 engines. Later that year the order was changed to the F-16A/B OCU Foreign Military Sale (FMS) configuration with the F100-PW-220 engine. This was the Peace Carvin Foreign Military Sales program. The first aircraft was delivered in February 1988 and the rest were delivered during that year. These aircraft were used for training Singapore Air Force pilots at Luke Air Force Base, Ariz., until they were moved to Singapore in January 1990.

In July 1994, Singapore signed a letter of agreement for 18 Block 52 F-16C/D aircraft under the Peace Carvin II Foreign Military Sales program. The first aircraft was accepted in ceremonies on April 19, 1998. The rest of the aircraft were delivered during 1998.

In July 1996, Singapore signed a commercial contract for lease of 12 new Block 52 aircraft to be used for training in the United States. These aircraft were delivered in the second half of 1998, and are currently in operation at Cannon Air Force Base, N.M.

In September 1997, Singapore ordered 12 more Block 52 F-16C/D aircraft under a commercial contract. The first delivery was in November 1999 and the last in April 2000.

In November 2000, Singapore ordered 20 Block 52 aircraft under a commercial contract. These aircraft will be delivered between 2003 and 2005.

In addition to purchasing and leasing new aircraft, Singapore has leased U.S. Air Force F-16s for pilot and maintenance training in the United States. Singapore leased nine ex-Thunderbird F-16A/B aircraft from 1993 to 1996, and a dozen Block 42 aircraft from 1996 to1998. Singapore Air Force personnel are currently training at Luke and Cannon Air Force Bases using their own and leased Block 52 aircraft.

Thailand

In July 1987, Thailand obtained approval to order the F100-powered F-16. A letter of agreement was signed in December 1987 for the purchase of 18 F-16s under the Peace Narcsuan Foreign Military Sales program. Thailand took delivery of its first F-16A at Lockheed Martin Aeronautics Company. All of Thailand's first F-16 order is for Block 15 aircraft.

In September 1995, Thailand received the first aircraft of a second batch of 18 new F-16A/B Block 15 aircraft, including 12 A-models and six B-models. The last six of those F-16s were delivered to Thailand in February 1996. This event marked the end of production for all Block 15 F-16s. The Block 15 had been in continuous production for more than 14 years. At 983 aircraft, it is the F-16 block most produced.

In July 2000, Thailand signed a letter of agreement for purchase of 16 F-16A/B Block 15 Air Defense Fighter versions from the U.S. Air Force inventory. Thailand is the fifth country to acquire used F-16s. Two additional aircraft are being procured for spares generation.

Indonesia

In August 1986, Indonesia signed a letter of agreement for 12 F-16A/B Block 15 aircraft. The first F-16 was delivered to the Indonesian Air Force in December 1989, under the Peace Bima-Sena Foreign Military Sales program. Deliveries were completed in 1990.

Bahrain

In March 1987, Bahrain signed a letter of agreement for 12 Block 40 F-16C/Ds in the Peace Crown Foreign Military Sales program. The first aircraft was delivered in ceremonies at Lockheed Martin Aeronautics Company in March 1990. Bahrain signed a follow-on order in February 1998 providing for the purchase of 10 additional Block 40 F-16s, and these were delivered during 2000.

Portugal

In August 1990, the Portuguese Air Force signed a letter of agreement for 20 F-16A/B Block 15 aircraft in the Peace Atlantis Foreign Military Sales program. These aircraft were fitted with restored F100-PW-220E engines.

In a ceremony in February 1994, the first two aircraft were accepted. Those two aircraft and two additional aircraft were delivered to Portugal in July 1994.

Portugal became the fifth European Participating Air Force (EPAF) as it joined the United States and original four EPAFs in the F-16 Multinational Fighter Program. In November 1998, Portugal signed a letter of agreement for 25 Excess Defense Article F-16A/B Block 15s. Twenty are being upgraded with the F-16A/B Mid-Life Update in Portugal, and the rest are being used to generate spares.

In July 2000, Portugal announced its intention to upgrade its first 20 F-16s to the F-16A/B Mid-Life Update following the first batch of 20.

Jordan

In July 1996, an agreement was signed between the United States and Jordan authorizing the lease of 16 F-16A/B Block 15 Air Defense Fighter version aircraft. A Foreign Military Sales support/training agreement was signed and designated Peace Falcon. The official rollout of the first F-16 for the Peace Falcon program occurred in October 1997 at Hill Air Force Base in Utah.

United Arab Emirates

In May 1998, the United Arab Emirates announced it had selected the advanced version of the F-16, culminating an intense competition. The program would involve major development, testing and purchase of 80 Block 60 aircraft. A commercial contract was signed in March 2000, and go-ahead occurred in June 2000. The Block 60 "Desert Falcon" configuration will include an APG-80 Agile Beam Radar, an internalized forward-looking infrared targeting system, a new cockpit, internal electronic counter measures, enhanced-performance F110-GE-132 engine, and conformal fuel tanks. The aircraft will be delivered in 2004 through 2006.

Japan selected the F-16 as the basis for the design of its new support fighter in 1987. In mid-2000 the Japan Defense Agency's Technical Research and Development Institute completed extensive flight tests in Japan of four prototype aircraft, designated XF-2. MHI delivered the first production aircraft to the Japan Defense Agency (JDA) in September 2000. By the end of March 2002, 28 F-2s had been delivered to the JDA

Italy

In March 2001, Italy signed a letter of agreement for lease and support of 34 F-16A/B Air Defense Fighter aircraft from U.S. Air Force inventory. Italy is the 21st F-16 customer, the sixth country to purchase used F-16s, and the second country to lease used F-16s. Four additional aircraft were acquired for spares generation.

Mitsubishi Heavy Industries is the prime contractor for the F-2, with Lockheed Martin manufacturing the aft fuselages, wing leading-edge flaps and stores management systems; 80 percent of all left-hand wing boxes; and other avionics and avionics support equipment. Lockheed Martin components are shipped to MHI's Komaki-South facility in Nagoya, Japan, where they are assembled by MHI with other components to form the F-2. (Lockheed Martin)

(Right) GANCI AIR BASE, Kyrgyzstan -- Maj. Beau Rogers displays an American flag from his Dutch F-16 while refueling over Afghanistan on 11 September 2002. Rogers is an exchange pilot serving with the Royal Netherlands air force. He joins Dutch pilots to provide fighter support to ground forces in Afghanistan supporting Operation Enduring Freedom. "Bird Slicer" antennae in front of the canopy is for the advanced IFF system. (U.S. Air Force photo by Capt. Allen Herritage)

Dutch F-16AM J-063 was credited with a MIG kill during the the air war in the Balkans. (Andre Jans)

(Above) F-16D of the Valley Squadron of the Tsvah Haganah le Israel/Heyl Ha'Avir (Israel Defense Force/Air Force). All of the IDF/AF's F-16D two-seaters (both Block 30 and Block 40 aircraft) have been fitted with enlarged dorsal spines. Although the IDF/AF has not revealed exactly what is in these spines, they are believed to accommodate Wild Weasel electronic equipment which detects emissions from enemy radar sites and pinpoints their locations. Other speculation is that the "hump" on some of these aircraft is for a nuclear weapons delivery capability. Only the F-16D has the enlarged dorsal spine, the two-seat F-16B being similar to the USAF version. (Steven Drew via Andre Jans)

(Right) The proliferation of F-16s in the Middle East caused the IDF to add a large star of David to the tails of some of their Baraks to aid in identification. (Steven Drew via Andre Jans)

Below) F-16C of the "Scorpion Squadron" of the IDF/AF. This squadron traces their lineage to the birth of the IDF, when they flew Spitfires. Under Peace Marble II, the IDF was supplied with late-model F-16C/D's (Block 30). The first F-16C arrived in October 1987. The first F-16D was received by the IDF on 21 December 1987, and was seen in 'First Combat squadron' colors, carrying the tail number No 031'. A total of 75 Block 30 aircraft were delivered: 51 F-16C's (locally known as Barak or Lightning) and 24 F-16D's (Brakeet or Thunderbolt). (Steven Drew via Andre Jans)

(Above) Norway marked this F-16BM to celebrate the 50th anniversary of NATO. Royal Norwegian Air Force F-16s are equipped with the Northrop Grumman AN/ALQ-162 internally mounted deception jammer. In April 1998, Norway decided to acquire the Shadowbox II upgrade for the AN/ALQ-162. This will increase the capability of the baseline jammer to deny lock-on by pulse-Doppler (PD) and airborne intercept (AI) radar threats. RoNAF Vipers were the first to be fitted with drag chutes, in deference to their operations on slick and snowy runways. (Andre Jans)

(Below) The first group of F-16C/Ds for Greece, acquired under the Peace Xenia I Foreign Military Sales program, were delivered between November 1988 and October 1989. They were Block 30 aircraft, powered by the General Electric F110-GE-100 turbofan engine. The first F-16D for the Hellenic Air Force was presented in November 1988. The first F-16C was delivered later that same month. (Andre Jans)

F-16D 89-0044 of the Turk Hava Kuvvetleri (THK, or Turkish Air Force). The first F-16C/Ds to be operated by the THK were handed over to 141 Filo and 142 Filo stationed at No 4 Base at Murted. An OCU at Murted was also equipped with the F-16C/D. These F-16s replaced the F-104G Starfighter. F-16s were later issued to 161 Filo and 162 Filo at Bandirma and 191 Filo and 192 Filo at Balikesir. The Murted F-16 units are assigned to air defense duties only. The Bandirma's squadrons also have a secondary close air support role. (Andre Jans)

F-16AM, FA-112, at the 2003 Recce Meet. It carries the Theater Airborne Reconnaissance System (TARS) (Andre Jans)

(Below) The F-16I "Soufa" ("Storm" in Hebrew) made its first flight on 23 December 2003. The F-16I is an Advanced Block 52 two-seat variant for the Israeli Air Force that has significant enhancements over the four previous versions acquired by the IDF/AF. The aircraft is the first of 102 F-16Is being produced for Israel under the Peace Marble V program that continues through 2008. (Lockheed Martin)

The parachute braking system was originally designed for use by the Royal Norwegian Air Force. It has since been used on several other foreign F-16s. RHAW antennas are installed on either side of the chute housing. (John Gourley)

NATO planners fully expected to lose many airfields in the event of WWIII. Part of their contingency planning included use of highways as runways, and they practiced landing tactical aircraft on these roadways. (Michel Klaver)

(Above and Below) The new Lockheed Martin F-16F made its first flight on 6 December 2003, at Fort Worth, Texas. The F-16F is the two-seat model of the new Block 60 version, which has been designated F-16E/F. The F-16E/F is the newest, most advanced F-16 ever produced and contains new structure, avionics, cockpit, engine and airframe subsystems. It is pictured with conformal fuel tanks on the upper fuselage. The aircraft is in the markings of the United Arab Emirates Air Force, which is the lead customer for the F-16E/F and has ordered 80 aircraft. The first aircraft will initially be used for flight test purposes and is configured with a flight test air data boom on the nose and brackets on the aft fuselage for a flight test spin chute. The F-16E/F resembles earlier F-16 aircraft in appearance only. Internally, the Block 60 has an all-new cockpit that features all-digital instruments and three 5x7-inch color displays. It is powered by a General Electric F110-GE-132 engine that produces 32,500 pounds of thrust. Additionally, the F-16E/F features a new avionics suite, including a revolutionary Electronic Warfare (EW) system, the new APG-80 Agile Beam Radar (ABR) and a new Integrated FLIR Targeting System (IFTS), all provided by Northrop Grumman. (Lockheed Martin)

Japan (An F-16 by any other name is still an F-16)

The F-2 Support Fighter is a multi-role, single-engine fighter aircraft produced for the Japan Air Self Defense Force. It was co-developed and is now being co-produced by Mitsubishi Heavy Industries (MHI) of Japan and Lockheed Martin Aeronautics Company (principal U.S. subcontractor to MHI).

Based on the design of the F-16C/D Fighting Falcon, the F-2 is customized to the unique requirements of the Japan Defense Agency. Although capable of both air-to-air and air-to-surface roles, the F-2 emphasizes the air-to-surface role because its primary mission is sea-lane protection.

The F-2 has a wing area enlarged approximately 25 percent over the F-16 wing area. (The wingspan is 36 feet 0 inches, as compared with 32 feet 9 3/8 inches for the standard F-16C.) The new wing makes extensive use of co-cured composite technology to cut down on the weight and to reduce the radar signature. The larger wing allows more internal fuel storage

and two more weapon store stations than the F-16. In addition to the larger wing area, the F-2 fuselage has also been enlarged approximately 16 inches over that of the F-16. The horizontal tails are also larger.

Significant hallmarks of the program are the technology transfer and the workshare between the two countries. As agreed, Japan is responsible for producing approximately 60 percent of the aircraft and the United States is responsible for producing approximately 40 percent.

Republic of China (Taiwan)

Since the political rapprochement with The Peoples Republic of China (Mainland China) in 1972, supply of military hardware by the United States had been problematic. F-16s were not available for export, so the Taiwanese government decided to develop their own version of the F-16, and since technology was not embargoed, they were able to create a new fighter development program loosely based on the F-16.

The Taiwanese Aero Industry Development Center's (AIDC) "Ching Kuo", is essentially a new aircraft. The design was formalized in 1985, with major assistance from a team of General Dynamics engineers working under a $50 million USD contract. AIDC also received assistance from other US aerospace firms, including Menasco, Garrett, Westinghouse, Bendix/King, and Lear Astronics.

Four prototypes were built, including three single-seat machines and one tandem-seat machine. The first prototype performed its initial flight on 28 May 1989. The first prototype suffered an embarrassing landing accident on 29 October 1989, when its front landing gear collapsed in front of Taiwanese President Lee Tung Hui and the press. The damage was not critical and was quickly repaired.

The type received the formal name of "Ching Kuo" in honor of former Taiwanese president Chiang Ching Kuo. The tandem-seat version was intended for operational conversion and proficiency training, but is combat-capable.

From the side, the Ching Kuo has a certain general resemblance to the Northrop F-5, with some flavor of the F-5's descendant, the F/A-18 Hornet. From the top, the resemblance to the F-16 is obvious and it could be easily mistaken for an F-16 from such an angle. The arrangement of flight surfaces is very similar, with a wedge-style wing featuring LERXes and some wing-body blending, a single vertical tailfin, and all-moving horizontal tailplanes.

Taiwan continued to seek F-16s while this program got under way, and was eventually successful. Under a 1992 contract, 120 Lockheed Martin Block 20 F-16As and 30 two-seat f-16Bs were ordered by Taiwan.

The Republic of China (Taiwan) designed and built the Ching Kuo fighter with the aid of engineers from General Dynamics working under a $50 million USD contract. Taiwan also received assistance from other US aerospace firms, including Menasco, Garrett, Westinghouse, Bendix/King, and Lear Astronics. (H.J. Yen)

Although designated Block 20 F-16A/B, these planes are actually quite a bit more advanced. They have the AN/APG-66(V)3 radar, a wide angle HUD, an digital TRNS, GPS, a night-vision goggle compatible cockpit, and a new modular mission computer. However, requests by Taiwan to purchase the AMRAAM missile have so far been blocked.

Initial deliveries began in April of 1997. By the end of the year, the first F-16s had replaced the F-5Es serving with Nos. 21, 22, and 23 Squadrons of the 4th TFW at Chiayi. The next batch of planes were scheduled to equip the 8th TFW at Hualien. An RoCAF training unit has been formed at Luke AFB in Arizona to support this effort. A set of LANTIRN Pathfinder and Sharpshooter navigation and targeting pods will also be provided, but the customary laser target designators are not equipped.

The most recent derivative of the F-16 to fly is the Korean Aircraft Industries "Golden Eagle", which is basically an 80% scale version of the F-16. The Golden Eagle is being developed as the "T-50" tandem-seat trainer and the "A-50" fighter. (Lockheed Martin)

Experimental F-16s

F-16s have been used in a variety of test roles, from proving various new control configurations, to testing new avionics.

F-16CCV The first YF-16 (72-1567) was rebuilt in December 1975 to become the USAF Flight Dynamics Laboratory's Control Configured Vehicle (CCV). CCV aircraft have independent or "decoupled" flight control surfaces, which make it possible to maneuver in one plane without movement in another--for example, turning without having to bank.

The CCV YF-16 was fitted with twin vertical canards added underneath the air intake, and flight controls were modified to permit use of wing trailing edge flaperons acting in combination with the all moving stabilator.

The YF-16/CCV flew for the first time on 16 March 1976, piloted by David J. Thigpen. On 24 June 1976, it was seriously damaged in a crash landing after its engine failed during a landing approach. The aircraft was repaired and its flight test program was resumed. The YF-16/CCV was retired on 31 June 1977 after 87 sorties and 125 hours.

In February of 1977 President Jimmy Carter announced a new arms transfer policy. Attempting to reduce arms proliferation throughout the world, Carter decreed that American manufacturers could no longer sell to foreign air forces any combat aircraft that was the equal of those in the US inventory. There were exceptions to this rule. The four NATO users of the F-16 and, as a special exception, the nation of Israel. Exceptions were also made for arms deliveries to Iran so that the Shah could continue to act as a bulwark against Soviet expansion into the Persian Gulf region. At first, South Korea's request for F-16s was turned down under this new rule, but was later approved as a quid pro quo for pending US troop withdrawals from Korea. However, nations such as Jordan, Taiwan, and Venezuela were denied access to the F-16.

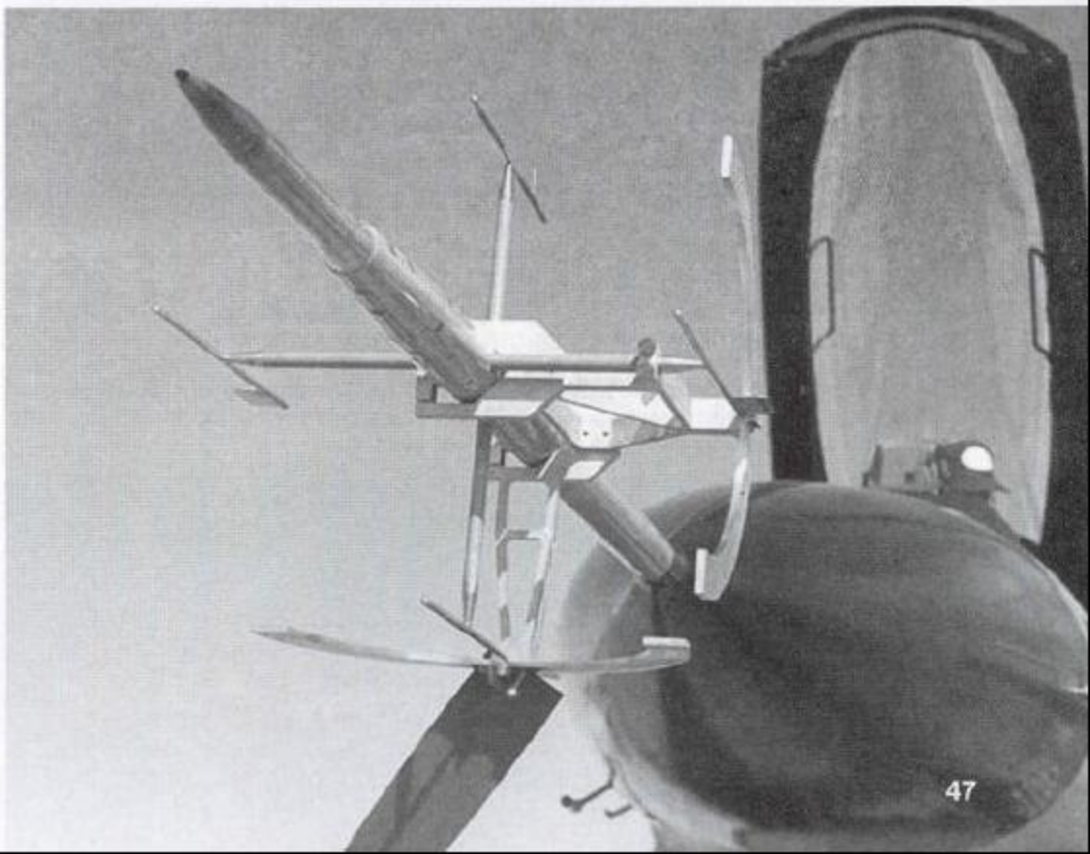
One of the side effects of this new policy was the teaming of General Dynamics with General Electric to produce a less-capable export version of the Fighting Falcon powered by the J79-GE-17X engine. This project was announced by General Dynamics in November of 1979. The J79 engine had powered the F-104 Starfighter and the F-4 Phantom, both of which were already in widespread service with large numbers of foreign air arms. As the J79-GE-119, this engine was installed in FSD F-16B serial number 75-0752. Since the J79 engine required a lower airflow than did the F100 turbofan used on all production F-16A/Bs, the shape of the air intake was altered, with the intake extending further forward than the standard shape and the splitter plate being enlarged. Since the J79 engine was 18 inches longer than the F100, the rear fuselage had to be extended aft of the stabilator pivot point. The J79 turbojet ran a lot hotter than the F100 turbofan, so a steel shield weighing about a ton had to be installed around most of the length of the new engine to provide protection from the extra heat. The aircraft came to be known as the F-16/79. It was projected that the F-16/79 would have a unit cost of a million dollars less than that of a standard F-16A.

The F-16/79 first flew on 29 October 1980 with company test pilot James A. McKinney at the controls. The J79-powered F-16 was initially offered to Venezuela as a substitute for the F-16A/Bs that had originally been ordered. An evaluation team from Venezuela flew the F-16/79 in February of 1981. It was considered by as many as 20 other air arms, and briefings on the F16/79 were given to Australia, Jordan, Malaysia, Nigeria, Singapore, Taiwan, and Thailand.

Most potential customers were less than enthusiastic about the F-16/79. Not only was the F-16/79 less powerful than the standard F-16A/B, it was also significantly heavier because of the

The first far-reaching technology configuration for the F-16 was appended to the first YF-16. The large canards installed under the intake allow the CCV F-16 to maneuver without benefit of coordinated control movements. (Lockheed Martin)

Experimental test versions of the F-16 employ a sophisticated nose probe which measures airframe movement in all axis. (General Dynamics)



(Above) Montgomery: F-16C SN 88-399 of the 187th Fighter Wing, Alabama Air National Guard, stationed at Montgomery ANGB. Assigned to Col. Scott Mayes.

Gamblers: F-16C Block 50 of the 77th Fighter Squadron (FS) of the 20th Fighter Wing (FW), home-based at Shaw AFB, SC as it appeared during an Operation Iraqi Freedom combat mission.

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