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Volume 1

by
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FOREWORD

This publication is the first of a multi-volume *Encyclopedia of U.S. Air Force Aircraft and Missile Systems.* Volume I deals with the development, deployment, and operations of fighter aircraft between 1945 and 1973, commencing with the F-80 *Shooting Star* and ending with the development of the F-15 *Eagle.* Many of these aircraft were employed during the Korean War, the war in Southeast Asia, and during cold war crises throughout the world. Additional volumes to be published in this series will cover Air Force bombers, transports, trainers, other military aircraft, and missile systems.

JOHN W. HUSTON
Major General, USAF
Chief, Office of Air Force History

PREFACE

This volume contains basic information on all Air Force fighters developed between World War II and 1973, including all configurations. It is based primarily on US Air Force sources. The origin of each aircraft is noted as well as its most troublesome development, production, and operational problems. Also covered are significant modifications, most of which can be attributed to ever-changing aeronautical technology. Production totals, delivery rates, unit costs, phaseout dates, and other important milestones are provided, as well as a brief description of each version's new features.

The book begins with the first postwar American jet fighter—the F–80 Shooting Star. It ends with Northrop's F–5 Freedom Fighter. Complete consistency of data on each fighter was not always available, but each section describes the aircraft's basic development, production decision dates, program changes, test results, procurement methods, and the like. Technical data and operational characteristics also are provided.

Many people contributed to this work, in particular members of the Historical Office, Aeronautical Systems Division, of the Air Force Systems Command (AFSC), and the Historical Office, Air Force Logistics Command (AFLC), both located at Wright-Patterson AFB, Ohio. The author also owes a special debt to Colonel Monte D. Montgomery, a former staff officer in the Allocations Division, Deputy Chief of Staff, Programs and Resources, Headquarters USAF; and to Dr. Thomas G. Belden, former Chief Historian of the Air Force, who strongly encouraged publication of such an encyclopedia. Finally, she is indebted to her office colleagues, Max Rosenberg, Deputy Chief Historian, Office of Air Force History; Carl Berger, Chief, Histories Division; Bernard C. Nalty, Clyde R. Littlefield; and several other colleagues; members of the Editorial Branch, particularly Eugene P. Sagstetter; and Eleanor C. Patterson, who typed the entire manuscript without faltering.

Marcelle Size Knaack

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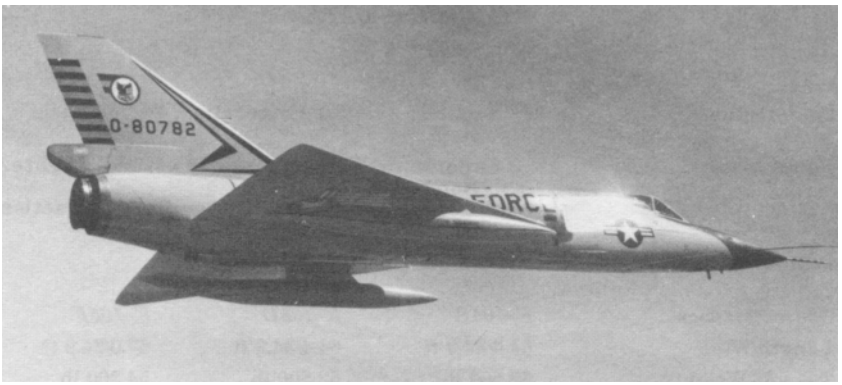

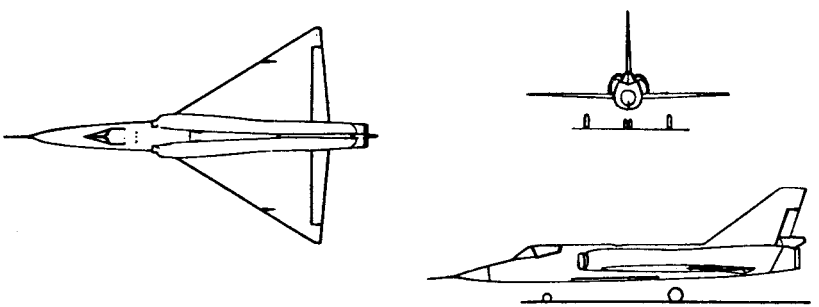

CONVAIR F-106 DELTA DART

F-106A: After many years of duty, the supersonic delta wing F-106A remained a most competent all-weather interceptor.

F-106B: Aside from the second seat, that took the place of one of the fuel cells of the single-seat F-106A, the two were practically identical.

CONVAIR F-106 DELTA DART

Manufacturer's Model 8-24
Weapon System 201B

Basic Development

Convair F-106, like the preceding F-102, grew out of the company's delta-wing XF-92A—an American application of Germany's wartime theories and preliminary testing. The F-106 and F-102 in fact originated as only one aircraft, the so-called "1954 Ultimate Interceptor."

Advanced Development Objective **13 January 1949**

The ADO of early 1949 called for an advanced, specially designed interceptor that would be operational in 1954—a project which soon became one of the most complicated undertakings in the history of the Air Force.

Production Decision **24 November 1951**

After the customary call on industry and the September 1951 selection of Convair competitive entry, the Air Force decided in November 1951 to expedite production of the 1954 Ultimate Interceptor. The decision did not affect the weapon system concept and Cook-Craigie production outlined in the ADO of January 1949.[1]

Program Change **December 1951**

The production decision of November 1951 also did not ignore the fact that the state of the art would probably preclude the 1954 Interceptor from meeting its operational deadline. Hence, since some sort of advanced interceptor was needed as soon as possible, the Air Force in December 1951 authorized a two-step production of the aircraft. First would come the F-102A, an interim, less ambitious version that would be produced in limited quantity. The Ultimate Interceptor, no longer referred to as the 1954 Interceptor, would follow as the F-102B. The two models would have the same airframe that was to be produced by Convair, as the winner of the MX-1554 airframe competition initially held for the so-called 1954 Interceptor. They would have different engines, however, with the F-102B retaining the high thrust J-67, an American version of the British Bristol Olympus turbojet to be produced under license by the Wright Aeronautical Corporation of America. Finally, only the F-102B would be equipped from the outset with the highly sophisticated electronic control system being developed

[1] The weapon system concept, introduced in the late forties, integrated from the start the design of the entire weapon system to make each component compatible with the other. The offshoot of this concept's failure when first applied was the F-102. The Cook-Craigie production policy called for early tooling, limited production at first, elimination of faults by test flights, and accelerated production thereafter. The F-102 also bared some of this production plan's pitfalls.

by the Hughes Aircraft Company under project MX–1179, a project around which the MX–1554 airframe specifications had actually been drawn.

Program Slippage **1952–1955**

The F–102's two-step development plan, despite its blueprint logic, did not work as anticipated. The decision to produce an interim version of the interceptor (F–102A), with an interim engine and interim fire-control system, devolved from delays in the development of important subsystems. Yet, concentration on new requirements lessened the attention that could be given to these subsystems and to the F–102B as a whole. Another unfortunate consequence of the two-step development plan was that components for the F–102A could be financed from production funds, while development of the F–102B J–67 engine and MX–1179 ECS had to come from less plentiful research money. Meanwhile, problems with the original configuration of the Convair airframe almost obliterated the entire F–102 program. By the end of 1954, when the F–102 fuselage problems were solved, the production-delayed F–102A, after losing its interim status, had acquired further importance at the F–102B's expense.

Development Problems **1952–1955**

While airframe deficiencies hampered the F–102A, technical difficulties and a basic funding problem retarded the F–102B's progress. In mid–1953 development of the MX–1179 ECS (later the MA–1 Automatic Weapon Control System)[2] was slipping badly, and it took another year before a nearly completed experimental sample of the system could be installed in a T–29B for testing. Similarly, although the J–67 showed early promise, in August 1953 Wright was almost a year behind schedule in adapting the engine to the future F–102B, and the Air Force had begun to consider use of another engine. As Wright's trouble with the J–67 did not subside, the Pratt and Whitney J–75 engine (an advanced model of the J–57 eventually used in the F–102A) gained added favor. Its substitution for the J–67 was approved in early 1955.

Initial Procurement **November 1955**

Satisfied with the F–102's new airframe configuration (extensively tested since the successful Hot Rod flight of December 1954), the Air Force awarded Convair new production contracts. One covered 562 F–102As, pushing to 749 the F–102As thus far on order. Another, first of its kind, was for 17 F–102Bs—a far cry from the December 1951 USAF plans, calling for few interim F–102As and large-scale F–102B production.

[2] The MA–1 Automatic Weapon Control System (AWCS)—until 1960 more often referred to as the MA–1 fire-control system or MA–1 ECS—was first used by an F–106A on 18 March 1958.

Mockup Inspection **December 1955**

Of primary interest was the proposed cockpit arrangement for the Hughes MA-1 fire control system (the former MX-1179), a radical deviation from standard cockpits and instrument displays. A recently approved armament change (with more to come) was also discussed.

First Definitive Contract **18 April 1956**

The Air Force finalized the F-102B production contract of November 1955, earmarking the 17 aircraft for testing. Although the aircraft's redesignation was not yet official, this production document basically became the first F-106 research and development contract. One prototype was to be delivered in December 1956, the other in January 1957. Other deliveries would begin in July 1957.

Redesignation **17 June 1956**

The F-102B designation of the ultimate interceptor was changed to F-106. The redesignation symbolized the past technical differences that had distorted the original F-102 program. It also recognized that further changes could be forthcoming.

Production Policy **August 1956**

Two months after the F-102B's redesignation, the Air Force practically re-endorsed the production policy originally outlined for the "1954 ultimate interceptor." On 18 August 1956 it issued a system development directive calling for concurrent development and production of the new F-106—a procedure responsible for several later problems.

Initial Requirements (F-106) **28 September 1956**

As stated in a system development directive, issued by the Air Force on 28 September 1956, the new F-106 would be capable of intercepting and destroying hostile vehicles under all weather conditions, at all altitudes up to 70,000 feet, and within a radius of 375 nautical miles. Interceptions would be accomplished at speeds up to Mach 2 at 35,000 feet. Flight would be "under automatic guidance provided by the ground environment and the aircraft's fire-control system." The F-106 would carry guided missiles and rockets with atomic warheads. It would be available in August 1958—some 4 years past the original deadline of the Mach 1.93, 60,200-ft altitude "ultimate interceptor."

First Flight (Prototype) **26 December 1956**

Convair test flew the F-106 for the first time on 26 December 1956, 38 months after the F-102A (the Air Force's first supersonic delta-wing interceptor) made its first flight. The second F-106 prototype, after being also transported from its San Diego plant to Edwards AFB, was initially flown on 26 February 1957.

Initial Shortcomings **1957**

The first USAF F–106 test flight, made from Edwards AFB on 29 April 1957, showed deceptive results. The F–106 reached a speed of Mach 1.9 and an altitude of 57,000 feet. However, upon completion of the Category II flight tests (started in May 1957 and purposefully accelerated to end in July of the same year), the first F–106 prototype's overall performance (after more than 70 flights) was much less impressive. The F–106's acceleration and maximum speed were both below Convair's estimates and a September preliminary Category II end-report on the second F–106 prototype proved equally discouraging. Mach numbers above 1.7 were not considered tactically usable because of the aircraft's poor acceleration. Under standard conditions, the airplane took almost 4½ minutes to accelerate from Mach 1 to Mach 1.7 and another 2½ minutes to accelerate to Mach 1.8—eating up 2,000 pounds of fuel in the process.

General Operational Requirements **19 June 1957**

The F–106 requirements, underlined in the system development directive of September 1956, were finalized in June 1957. Maximum speed (at least, Mach 2.0) and combat radius (375 nautical miles or better) were unchanged, but the aircraft's required combat ceiling was reduced from 70,000 feet to a minimum of 55,000 feet.[3] The F–106's required capability of operating on 6,000–ft runways was defined as well as its armament. The F–106 would carry one MB–1 air-to-air atomic rocket and four GAR–3/GAR–4 Falcons, launchable in salvo or in pairs. The new interceptor would be provided with TAGAN (tactical air navigation), BROFICON (broadcast fighter control), and an AMTI (airborne moving target indicator) unit that would assure an interception capability at any altitudes between sea level and the aircraft's maximum combat ceiling.

Early Modifications **1957**

The F–106 deficiencies, pinpointed by the first Category II flight tests, although disappointing, came as no great surprise. The Air Force (after reviewing the flight test data obtained during Convair Category I testing of the first F–106 prototype) had already decided that modification of the aircraft's inlet duct cowling and charging ejectors would probably increase speed and acceleration. It planned to modify the aircraft upon completion of the Category II tests and to evaluate the results of these changes during the Category III testing. The Air Force made every effort to hasten the F–106 development/production cycle. In April 1957 it author-

[3] By way of comparison, the performance required of the F–102A called for a speed of Mach 1.2 and a 54,000–ft combat ceiling. The F–102 and F–106 combat radius was later stretched to 566 nautical miles and 633 nautical miles, respectively, by adding external fuel tanks to the aircraft.

ized the conditional acceptance of several aircraft from the Convair flight-test inventory. In September, it quickly approved a Convair engineering proposal to enlarge the capture area of the F–106 ducts and to thin down the duct lips in order to satisfy the J–75–P–9 engine's airflow requirements, higher than anticipated. Hopefully, these changes would reduce drag, raise the aircraft's ceiling by 5,000 feet, and increase maximum speed. Acceleration time (from cruise speed to maximum Mach conditions) would be shortened by perhaps as much as 3 minutes. Meanwhile, there were other problems.

Other Problems **1957**

While airframe modifications were being worked out to satisfy the requirements of the F–106's engine, all was not well with the engine itself. The Pratt and Whitney J–75–P–9 turbojet, substituted for the Wright J–67 in 1955 because of rapid development progress, had also become a source of delay. In June 1957 production was still behind schedule, and upon availability the J–75–P–9 (later replaced by the more powerful 17,000 lb s.t. –P–17) proved to be less reliable than the Air Force would have liked. Another problem of long standing, which reached a climax in 1957, pertained to the F–106 cockpit. After endorsing relocation of the F–106 center-mounted control stick to the side of the pilot to assure his unrestricted view of Hughes proposed-Horizontal Situation Indicator (HSI), the Air Force reversed its decision. It confirmed that both the USAF vertical instrument flight panel and the HSI would be incorporated in the F–106 but announced that the pilot's control stick would be returned to its original center position. This final change proved to be sound, but its delayed approval precluded it from being incorporated in any of the F–106 test aircraft. Altogether, the Air Force's late decision of 1957 concerning the cockpit foretold a $10 million cost increase that could not have been more ill-timed.

Program Reappraisal **1957**

A severe fund shortage caused the Air Force to reappraise many of its plans. While the F–106 program came to the fore because of its great cost, other factors singled it out for reappraisal. Besides the aircraft's disappointing overall performance, its J–75 engine and MA–1 ECS still did not function properly by the spring of 1957. Moreover, as a result of the numerous development delays since the ADO of 1949, other weapon systems—such as the McDonnell F–101B interceptor—had been partially substituted for the F–106, which had long lost the high priority initially afforded to the Ultimate Interceptor. Hence, the Air Force considered giving up the entire F–106 program, or redesigning the aircraft as a long-range interceptor. In its financial dilemma, the Air Force

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finally raised the possibility that the F–101B might have to be dropped if the F–106 was retained. The Air Defense Command liked none of these alternatives. It believed redesign as a long-range interceptor would take so long that it would mean the end of the F–106. If a shortage of funds required buying fewer interceptors, even though the F–101B was cheaper than the F–106, ADC wanted to spread the reduction over each kind, since the two aircraft were complementary.[4] ADC won its case and the F–106 program did survive. However, not without drastic changes.

F-106A

Program Change and Final Procurement **1957-1958**

In mid–1957, when only 120 F–106As had been funded for procurement and Headquarters USAF thought of liquidating the entire program, ADC plans called for an F–106 buildup of 40 squadrons (more than 1,000 aircraft). This total was reduced to 26 squadrons by the end of the year, and another cut took place in September 1958. This last reduction finalized the F–106 force level at little more than one-third of the 1,000 aircraft originally sought by ADC.[5] The decrease was so sharp that the Air Force, despite the extra expense, decided in August 1959 to convert the F–106 test aircraft (35 in all by that time) to operational status.

Enters Operational Service **May 1959**

ADC's 498th Fighter Interceptor Squadron at Geiger AFB, Wash., reached an initial operational capability in October 1959 (5 years later than originally planned). Notwithstanding, the 498th on 21st July scrambled five F–106s on a simulated combat mission with remarkable success. All targets were found and destroyed within 10 minutes after takeoff.

Operational Problems **1959-1960**

In spite of the initial achievements of the first F–106s, ADC was not fully convinced that it was getting a combat-ready aircraft.

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[4] At the time, the F–101B had a maximum speed (at 35,000 feet) of about Mach 1.7, a combat ceiling of 50,000 feet, and a combat radius of about 600 nm, compared respectively with the F–106 tentative figures of Mach 1.8+, 53,000 ft, and 350 nm.

[5] Another casualty of the late fifties' financial crisis was the F–108 Rapier, cancelled by the Air Force on 23 September 1959. The F–108, formerly referred to as the LRIX (long-range interceptor, experimental) and officially named the Rapier on 15 May 1959, was being developed by North American Aviation since 1957. As called for by USAF GOR 114 (6 October 1955), the stainless steel, two-place, two-engine, Mach 3, 70,000–ft altitude weapon system for use during the 1963–1970 time period, was designed to launch an atomic missile 1,000 miles from home base and return to base within 30 minutes. Despite encouraging development progress and a satisfactory mockup inspection in January 1959, the Rapier was cancelled before production of the first prototype.

Generator defects, fuel-flow difficulties (particularly acute in cold weather), and fuel-combustion-starter malfunctions were only a few of the frequent problems. In December 1959, after a canopy had been accidentally jettisoned in flight, all F–106s were temporarily grounded. Some of these early problems persisted a year later.

Flight Testing **1957-1961**

Testing of the F–106 was extensive. The Category II flight tests conducted at Edwards AFB, after being first accelerated, were extended and did not end until June 1959. Because of a shortage of aircraft, the Category III tests did not begin until July 1959 (a few months after the F–106 entered operational service with ADC's 498th FIS). They were conducted by another ADC unit, the 539th FIS at McGuire AFB, N. J., with the assistance of that command's interceptor and missile school at Tyndall AFB, Fla., where the ADC pilots learned to fire the new interceptor's armament. Category III testing ended in early 1961, after being somewhat hampered by logistical shortages.[6] Meanwhile, justifying ADC suspicion of the F–106's initial combat readiness, each phase of the test programs gave way to important engineering changes. Yet, each change had to be "defined, engineered, reviewed, and approved for production" before modification of aircraft off the assembly line could begin. Hence, by 1960 ADC possessed so many divergent F–106 configurations that maintenance support was almost impossible—a problem partially due to the Cook-Craigie production policy re-endorsed in August 1956. Moreover, in spite of successive production-line improvements (and an advanced Category III end-report in late 1960 declaring the F–106 operationally suitable) the Air Force still sought ways to enhance the aircraft.

Necessary Retrofit **September 1960**

Two major modification projects were undertaken. Wild Goose (started in September 1960 and completed in exactly 1 year), was designed to standardize the F–106 fleet.[7] It was largely retrofit work, mostly done at ADC bases by roving AMC field assistance teams supported by ADC maintenance personnel. Broad Jump (also initiated in late 1960) was a long-term program to improve the new interceptor. It took the Sacramento Air Materiel Area an

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[6] Despite fire-control problems and a lack of scoring equipment and targets, MB–1 atomic warhead rocket and radar-guided GAR–3 Falcon firing missions of the Category III tests ended at Tyndall AFB in May 1960. The entire Category III testing was completed with a series of GAR–3A and infrared GAR–4A tests.

[7] Early in 1960 ADC could list 63 changes in the F–106's fire-control system and 67 changes in the airframe that would be necessary to give early F–106 productions the same configuration as the most recent aircraft off the assembly line.

average of 60 days per aircraft to apply Broad Jump, which extended through early 1963.[8]

Other Improvements **1960**

Endorsement of the Wild Goose and Broad Jump modifications in the summer of 1960 did not deter the Air Force from seeking further F–106 improvements. Devices for long-range detection and electronic counter-counter measures (CCM), parametric amplifiers, along with angle chaff, silent lobing, and pulse-to-pulse frequency shift techniques were among those recommended and, for the most part, eventually approved. Meanwhile, Convair's struggle to provide the F–106 with a better supersonic ejection seat (one that would also work safely at low speed) had sufficiently progressed to warrant installing the new seat in the last 37 F–106A productions and its future retrofit in all others.[9] In 1960 Hughes flight-tested an infrared search-and-track sight that could operate at low altitudes and against varied backgrounds.[10] Tests were so encouraging that the infrared unit was included in the F–106 program of possible improvements, some of which were developed soon enough to become part of the Broad Jump program.

Other Postproduction Modifications **1961–1964**

In face of Wild Goose and Broad Jump changes—and Dart Board, another retrofit/modification program (August 1961–April 1962)—the F–106 weapon system still had problems. Dart Board had given the aircraft a thermal flash blindness protection hood, provided it with Convair's new Upward Rotational Ejection Seat, and added devices to help correct flameout from fuel starvation (one of the F–106's first deficiencies). But a lot more remained to be done. The MA–1 AWCS, "the most complex, sophisticated and completely integrated automatic weapon control system" designed for an all-weather fighter-interceptor aircraft, remained unrelia-

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[8] Not more than half of any squadron's F–106As were released to Wild Goose and Broad Jump at one time, so as to preserve a measure of combat capability during the $15 million, 800,000–manhour modification period.

[9] Development of the supersonic ejection seats (two-stage boom seats) required by the F–106B, the two-seater trainer variant of the F–106A, took longer, and sled tests did not start until mid–1960. As in the case of the F–106A, the F–106B's ejection seats featured a dual timing system, one for high-altitude/low-speed ejection and one for high-altitude/high-speed ejection. At sufficient flying speed, either seat enabled pilots to escape safely at low altitude.

[10] Hughes infrared search and track sight was an outgrowth of the ASG–18 pulse-doppler fire-control system developed by the same firm for the F–108 interceptor. The F–108 program was no longer in existence, but development of the ASG–18 and its accompanying GAR–9 missile (later designated AIM–47A) continued. The Hughes ASG–18/AIM–47A combination became part of the Lockheed YF–12A interceptor, first publicly displayed on 30 September 1964.

ble.[11] Correction efforts unabated, the Air Force embarked in two new modification programs. One involved the installation of parametric amplifiers in the MA–1 AWCS to up the system's detection and lock-on range by about 30 percent. The other also dealt with the MA–1, mainly to add anti-chaff devices. The two new in-house modification programs, involving 314 F–106s, were to be completed by the end of 1963.[12]

Initial Modernization **1965–1967**

After divers modification programs, the F–106, the Air Force's first-line interceptor since 1959, entered its modernization phase. In 1965 the Air Force awarded a $6.2 million contract for producing new tactical air navigation systems for its best interceptor. The new TACAN, the first to use microelectronic circuits, would be one-third the size and weight of the current F–106 navigation system and would provide 450 hours of maintenance-free operation. The Air Force in addition approved in-house modifications that would give the F–106 an in-flight refueling capability for long-range ferrying. The installation of new external wing-mounted supersonic fuel tanks, also authorized, would increase the F–106's radius of operation. These modifications would allow F–106 deployment for air defense of US forces overseas in an emergency. They had been applied to two squadrons of F–106s by the end of 1967—just a few months before the North Korean seizure of the USS *Pueblo*. Modification of the entire F–106 fleet was scheduled for completion by the fall of 1969.

Modernization Planning **1967–1968**

The F–106 modernization, begun in 1965, would satisfy neither long-term air defense requirements[13] nor potential short-term ones. The F–106 needed a 20–mm gun (for close-in attack against hostile fighter aircraft). It required a new canopy (for better observation of the air battle), radar homing and warning equipment (to warn the pilot of enemy air/ground radar and missile

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[11] The MA–1 AWCS was made up of 170 "black boxes" and weighed about 1,800 pounds. Practically all the F–106's electronic equipment, including the communication receiver and transmitter, the gyro compass, automatic direction finding and certain electronic counter-counter-measure (ECCM) elements, were part of the MA–1 complex. The nine subsystems of the MA–1 contained about 200 major components.

[12] During the same period, similar modifications were programmed for the MG–13 fire-control system of 431 F–101Bs.

[13] The Air Force directed upgrading of the existing manned interceptor force in the mid–1960's as a stop-gap measure, pending outcome of advanced manned interceptor (AMI) studies such as operational versions of the YF–12A and F–111. Other candidates for the AMI role later included the F–14 (a proposed Navy aircraft), possibly a new interceptor, and the proposed F–106X, a drastically modified F–106.

launches), and a device to show when maximum turn angle of attack had been reached. In addition, the F–106 could fire its air-to-air missiles in salvo or in pairs, but not singly, and missile preparation took too long. The F–106 weapon system nonetheless remained the best interceptor available, and ADC (still intent upon making it more reliable and easier to maintain) readied for USAF approval a program which was called Simplified Logistics and Improved Maintenance (SLIM). This original SLIM improvement package carried in September 1967 a price tag of $120 million. The Secretary of Defense's decision on 23 November 1967 to discontinue F–12 development and to select the F–106X as the future interceptor to complement a new airborne warning and control system (AWACS)[14] altered ADC planning.[15] The SLIM program was put aside in favor of a more costly one—nearly $1 billion—for the so-called (but as it proved out, never-to-be) F–106X.

Oversea Deployments **March 1968**

As part of the Korean buildup stemming from the *Pueblo* crisis, a series of F–106 deployments to Korea began. The first F–106s deployed from McChord AFB and conducted in-flight refueling en route—the first such refueling of F–106s.

Other Modernization **1969–1973**

When it appeared in late 1968 that the F–106X would not materialize,[16] ADC renewed its efforts to modernize the entire F–106 weapon system which, it believed, had become one of the Air Force's most competent fighters. The original $120 million SLIM program of September 1967 was revived and further simplified. It eventually emerged in mid–1969 as the cheaper Minimum Essential Improvement in System Reliability (MEISR) program ($91 million for 250 F–106A/B aircraft). MEISR would still significantly improve the radar, automatic flight control and DC power system of the F–106[17] and it was quickly approved by the Air Force. Though MEISR modifications were to be done by AFLC[18] person-

[14] Approved for development in November 1967.

[15] On 15 January 1968 the Air Defense Command became the Aerospace Defense Command.

[16] As estimated in mid–1969, the F–106X would require the expenditure of more than half a billion dollars ($626.2 million), but money alone probably did not decide its fate. The impasse between the Department of Defense (pro–F–106X) and Congress (supporting the Air Force-preferred F–12) most likely also contributed to the demise of the F–106X program.

[17] Overall weapon control system mean time between failures (MTBF) would be increased by 80%, and annual maintenance would be reduced by more than 50%. Intercept success rates would increase from 75% to 87% with primary armament; from 58% to 85% with secondary armament.

[18] The Air Force Logistics Command (the former Air Materiel Command) came into being on 1 April 1961.

nel at Hamilton AFB (where ADC's F–106s would be rotated through the 4661st Air Base Group), budgetary constrictions would probably delay completion until sometime in 1973. Despite austere funding, the Air Force in 1969 also endorsed most of Sixshooter—an ADC project outlined in February 1967, after the F–106 had shown the speed and maneuverability for a fighter-to-fighter role. Foremost among the Sixshooter F–106 modernization projects were addition of a 20–mm. gun (M–61), a lead-computing gunsight, a clear cockpit canopy, electronic countermeasures gear, and a RHAW device. The Air Force spent $1.5 million for a Sixshooter "feasibility demonstration" with generally satisfactory results, but eliminated the ECCM improvements recommended by ADC. All other Sixshooter modernization projects were approved, but technical as well as financial difficulties slowed their progress. The Air Force decided in October 1969 that something better than the current (and, in any case, extremely scarce) RHAW equipment would have to be developed to cope with increasingly sophisticated enemy radars. Similarly, installation of the clear-top canopy was not expected to begin until January 1972, and testing of the new gunsight, not before mid–1972.[19]

Special Testing **1972–1974**

In June 1972 one F–106 entered a Convair flight-and-fatigue test program to recertify the aircraft for longer service life—8,000 flight hours instead of the current 4,000. This program, expected to run through mid–1974, would also further evaluate the F–106's new stretched-acrylic, clear top canopy.

Subsequent Model Series

F–106B

Other Configurations

None. Production of two other F–106 model series, the F–106C and F–106D, was first considered, then dropped. The proposed F–106C would have featured a new engine (JT4B–22), a new fuselage structure, and a variety of technical changes. For example, a new 40–inch radar that would only slightly decrease the aircraft's absolute altitude and combat radius, but would appreciably increase its "kill" probability by extending search range a minimum of 50 percent. While the F–106D never went past the planning stage, the Air Force in mid–1957 anticipated the production of at least 350 F–106Cs. Two F–106C prototypes were built and accepted by the Air Force in December 1958—a few months after cancella-

[19] The Air Force approved on 27 January 1972 Air Force Academy development of the new gunsight that would complement the F–106's forthcoming M–61. While contractor gunsight engineering costs were estimated at something over $6 million, the Academy required only an initial $100,000 to get its work under way.

tion of the F–106C program.[20] Some 10 years later a third configuration, the so-called F–106X,[21] received considerable attention. The F–106X was a basic F–106 that would feature a new radome and a larger radar antenna. It would also receive, among other things, a modified fire-control system (providing "look-down" capability) and a new air-to-air missile with "shoot-down" capability. Like the superior Lockheed F–12,[22] the so-called F–106X did not materialize.

End of Production **December 1960**

With delivery of the last eight F–106As.

Total F–106As Accepted

The Air Force accepted 275 F–106As, including the first production aircraft earmarked for testing (later modified for tactical use) and the two F–106s used as prototypes.

Acceptance Rates

Two F–106As (designated YF–106As) were accepted in FY 57, 16 in FY 58, 45 in FY 59, 150 in FY 60, and 62 in FY 61 (during the second half of 1960).

Total RDT&E Costs[23]

$1.0 million

Flyaway Cost Per Production Aircraft

$4.7 million—airframe, $2,090,000; engine (installed), $274,000; electronics, $1,300,000; armament, $950,000; ordnance, $102,000.

Average Cost Per Flying Hour

$1,600.00 (maintenance included)

Operational Status **Mid–1973**

The Air Force in mid–1973 retained 174 of the 340 F–106s produced, the last of which had been delivered in December 1960. Seventy-three other F–106s were flown by the Air National Guard, ADC's increasingly close partner. Moreover, modernization of the versatile F–106 was in process. Obviously, the upgraded F–106 would be around for many years to come.

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[20] F–106Cs and F–106Ds were deleted when Headquarters USAF limited on 23 September 1958 the F–106 production program to a total of 340 aircraft (F–106Bs, included). Two YF–106Cs, already funded, were accepted.

[21] A somewhat misleading designation. The "X" implied that a new model would be created, which was never intended to be the case.

[22] As demonstrated by available YF–12As, the F–12 could fly faster than Mach 3 and reach an altitude of 70,000 feet with ease. It was the most advanced aircraft during the late 1960's but fabulously expensive.

[23] Prorated, this amounted to $2,941 that were reflected in the flyaway cost of each F–106. By contrast, cumulative modification costs of $659,603 (spent on each F–106A by 30 June 1973) were excluded.

Record Flight **15 December 1959**

An F–106 jet interceptor at Edwards AFB set world speed record of 1,525.695 mph on 11–mile straightaway course, eclipsing the Russian mark of 1,483.84 mph set in an "E–66" delta-wing aircraft.[24]

Other Milestones **December 1967**

F–106s flew nonstop from McChord AFB to Tyndall AFB for the first extended-range interceptor flight marked by inflight refueling and missile firing. In early 1968, air-refueled F–106s flew from Richards-Gebaur AFB, Mo., to Elmendorf AFB, Alaska.

F-106B

Manufacturer's Model 8-27
Weapon System 201B

Previous Model Series

F–106A

New Features

Tandem two-seat cockpit, redesigned fuselage tank area, and Hughes AN–ASQ–25 fire-control system—equivalent to the F–106A's MA–1.

Go-Ahead Decision **3 August 1956**

The Air Force authorized production of a trainer version of the F–106A. A late August decision not to confine the aircraft to a trainer role prompted its redesignation. The future TF–106A became the F–106B, a two-seater packing the F–106A's tactical punch.

Development Engineering Inspection **13 September 1956**

One day after that of the F–106A.

Mockup Inspection **September 1956**

The first of several, chiefly concerned with the aircraft's cockpit. The second inspection of the F–106B's cockpit, also at the Convair Fort Worth plant, was conducted in mid-December.

Contractual Arrangements **April 1957**

Procurement of the F–106B was included in the third F–106A contract, but the F–106B definitive contract was not finalized until 3 June 1957.

First Flight (Prototype) **9 April 1958**

The Air Force accepted the aircraft during the same month.

[24] Design of the basic E–66 was attributed to Artem Mikoyan, who worked with Mikhail Gurevich in designing the MIG–15, the first really-modern Soviet jet-fighter. The delta-wing E–66, powered by a single turbojet engine, seemed a version of the MIG–21 Fishbed, one of the many configurations progressively developed from the MIG–15. The MIG–21 was first seen in the Soviet Aviation Day display at Tushino Airport, Moscow, on 24 June 1956.

First Flight (Production Aircraft) **October 1958**

Basically similar to the F–106A, the F–106B shared the former's development and production vicissitudes. The Air Force accepted nine F–106Bs between April and December 1958, but did not initially release any of them to the operational forces.

Initial Operational Capability **July 1960**

Eight months after ADC achieved an IOC with the A model. The first F–106B, earmarked from the onset for the operational inventory, was accepted from Convair in February 1959.

End of Production **December 1960**

Production ended with delivery of the last two F–106Bs.

Total F–106Bs Accepted

63

Acceptance Rates

One F–106B (prototype) was accepted in FY 58 (April 1958), 11 in FY 59, 36 in FY 60, and 15 in FY 61 (during the last 6 months of 1960).

Flyaway Cost Per Production Aircraft[25]

$4.9 million—airframe, $2,200,000; engine (installed), $274,000; electronics, $1,350,000; ordnance, $24,000; armament, $1,089,000.

Average Cost Per Flying Hour

$1,600.00 (maintenance included)

Modification/Modernization Programs **1960-on**

The F–106B, of necessity, participated in all F–106A modification and modernization programs. Like the 35 F–106As initially allocated to testing, the first 12 F–106B productions were eventually brought up to the tactical standards of the entire F–106 fleet. In the process, they exchanged their original J75–P–9 turbojet engine for the more powerful J75–P–17. All 64 F–106Bs received Convair's new ejection seats (two-stage boom seats) after production.

Operational Status **Mid-1973**

Each ADC and ANG F–106 squadron had several two seaters for normal intercept missions as well as combat proficiency training and checks. Hence, the F–106B's operational life was likely to last as long as that of the F–106A.

PROGRAM RECAP

The Air Force accepted a grand total of 340 F–106s—275 F–106As, 63 F–106Bs, and 2 YF–106Cs. Included in the F–106A total were the 2 prototypes, first referred to as YF–102Bs, and early productions marked for testing but later modified for operational use.

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[25] Excluding modification costs totaling $59,251 by 30 June 1973.

TECHNICAL DATA

F–106A and F–106B

Manufacturer	Convair Division of General Dynamics Corporation, San Diego, Calif.
Nomenclature	Supersonic, all-weather, fighter-interceptor.
Popular Name	Delta Dart

Characteristics	*F–106A Point Interceptor*	*F–106A Area Interceptor*	*F–106B Point Interceptor*
Takeoff Weight	36,000 lb	38,700 lb	36,500 lb
Length Fuselage[26]/Wing	70.'7'/38.'3'	70.'7'/38.'3'	70.'7'/38.'3'
Max. Speed	1,100 kn	1,100 kn	1,100 kn
Radius (combat)	NA	633 nm (w/ external fuel tanks)	633 nm (w/ external fuel tanks)
Engine, Number & Designation[27]	1J75–P–17	1J75–P–17	1J75–P–17
Takeoff Ground Run	3,000 ft	3,600 ft	3,200 ft
Rate of Climb (sea level)	39,800 fpm	7,170 fpm	39,400 fpm
Combat Ceiling	52,000 ft	52,000 ft	51,400 ft
Crew	1	1	2
Ordnance/Armament	1 AIR–2A Genie, plus 4 AIM–4F Falcons, or 4 AIM–4Gs, or 2 AIM–4Fs & 2 AIM–4Gs	1 AIR–2A Genie, plus 4 AIM–4F Falcons, or 4 AIM–4Gs, or 2 AIM–4Fs & 2 AIM–4Gs	1 AIR–2A Genie, plus 4 AIM–4F Falcons, or 4 AIM–4Gs, or 2 AIM–4Fs & 2 AIM–4Gs

[26] Including nose boom

[27] Pratt & Whitney; 17,200 lb s.t. (24,000 lb with afterburner).