Northrop F-5 Tiger II/T-38 Talon - Archived 5/2008

Outlook

- U.S. Air Force funding for T-38 upgrades to continue beyond 2013
- T-38 to remain in USAF trainer fleet through 2020
- F-5 fleets worldwide are shrinking as new aircraft come into service

Orientation

Description. The F-5 is a twin-engine, one- or two-seat light fighter. The T-38 is a two-seat trainer.

Sponsor. United States Air Force, Aeronautics Division.

Status. Series production ended in 1987, although some additional F-5s have since been assembled from major spares components. The final aircraft was completed in 1989.

Total Produced. 3,806 F-5/T-38 aircraft produced.

Application. Light multirole fighter-bomber with reconnaissance variants.

Price Range. FY83 (last year of U.S. F-5 procurement) unit cost for the F-5E/F was $11.1 million.

T-38 TALON TRAINER

Source: U.S. Air Force

Contractors

Prime

Northrop Grumman Corp	http://www.northropgrumman.com, 1840 Century Park E, Los Angeles, CA 90067-2199 United States, Tel: + 1 (310) 553-6262, Fax: + 1 (310) 201-3023, Email: onewebmaster@ngc.com, Prime

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Technical Data

(F-5E)

Design Features. Fuselage is light alloy basic structure, with small quarter-circle engine air intakes on each side of fuselage below canopy. Automatically operated auxiliary air inlet doors on each side of fuselage just aft of wing trailing edge. No dihedral, no incidence to wings. Flaps are auto-maneuvering. Tailplane is one-piece all-moving, with hydraulically powered rudder. Tailplane incidence varied by hydraulic actuators. Tricycle-type landing gear.

	Metric	U.S.
Dimensions		
Length overall(a)	14.45 m	47.40 ft
Height overall	4.07 m	13.35 ft
Wingspan	8.13 m	26.67 ft
Wing area, basic	17.3 sq m	186.0 sq ft
Weight		
Empty	4,410 kg	9,723 lb
Max external fuel weight	2,415 kg	5,324 lb
Max T-O	11,214 kg	24,722 lb
Performance(b)		
Max level speed	Mach 1.64 (at 10,976 m/36,000 ft)	
Max range(c)	2,863 km	1,545 nm
Service ceiling	15,793 m	51,800 ft

Propulsion

F-5E/F (2) GE J85-GE-21B augmented turbojets rated 22.24 kN (5,000 lbst) each.

Armament

Two M39A2 20mm cannon in nose. Two AIM-9 Sidewinders on wingtip launchers. One underfuselage and four underwing stations carry up to 3,175 kilograms (7,000 lb) of mixed ordnance, including Durandal air-to-surface missiles, rockets, bombs, flare dispensers, and tow targets. Optional capability for Maverick missiles, a centerline multiple ejector rack, and laser-guided bombs.

(a)Includes nose probe.
(b)At combat weight of 6,056 kilograms (13,350 lb) unless indicated otherwise.
(c)With maximum fuel and reserves for 20-minute maximum endurance at sea level; tanks dropped.

Variants/Upgrades

T-38. USAF advanced trainer. Preceded F-5 fighter. Instructor sits behind the pupil. Powered by two GE J85-5A turbojets, producing 17.12 kN (3,850 lbst) with afterburner. Distinguishing features (compared to the two-seat F-5F) include slightly smaller engine air intakes. No wingroot strakes.

F-5A. Initial F-5 version, a single-seat fighter powered by two GE J85-GE-13 afterburning turbojets. The first production F-5A made its initial flight in October 1963.

F-5B. Two-seat version of F-5A version, a dual fighter/ trainer that flew in February 1964.

CF-5A/D. Canadian version of F-5A/B, entered service in 1968. Improvements over F-5A/B included flight refueling capability and higher-thrust engines (J85-CAN-15). Canadair built 115 CF-5s under license.

NF-5A/B. Royal Netherlands Air Force version built by Canadair, entered service in 1969. 105 produced. Included Doppler nav system, maneuvering flaps, 275-gallon fuel tanks.

SF-5A/B. Spanish version built by CASA. A total of 70 were manufactured. Also known as C-9/CE-9.

F-5E. Advanced version with more powerful engines, maneuvering flaps, two-position nosewheel gear. Also built under license in Taiwan and South Korea. Some Es were assembled in Switzerland.

F-5F. Two-seat version of F-5E, used for both training and combat. First flight was in September 1974.

RF-5A. Recon version of F-5A with four KS-92 cameras.

RF-5E. Recon version of F-5E. For flexibility, Northrop grouped differing configurations of cameras/ sensors on portable pallets. The selected pallet is loaded quickly into forward fuselage compartment. Flew in 1979.

RF-5G. Royal Norwegian Air Force designation for RF-5As.

Program Review

Background. Northrop began designing the F-5 in 1955 for a U.S. government study on Asian and European high-performance fighter needs. In 1956, both the USAF and U.S. Navy showed interest in a trainer derivative. The T-38 trainer, developed in parallel with the fighter, flew in 1959.

In 1962, the U.S. Secretary of Defense approved the F-5 for export to friendly nations. Production ended in 1987. Major upgrades of the electronics, airframe, and armament systems are under way by several operators. Service life extension programs are also being undertaken in conjunction with these efforts. Major upgrades include the following:

Old Dogs, New Tricks

USAF T-38 Propulsion Modernization. USAF began procuring kits to upgrade J85 components in FY01 in a $3.0 billion program to modernize engines for 466 T-38s. The upgrade package includes a modified propulsion system-air induction inlet and a new ejector nozzle to increase single-engine performance during takeoff and landing.

A total of 216 aircraft were to be modified and returned to service by the end of FY06, and all T-38s in the program are to be upgraded by the end of FY12. GE Aviation Engines is the prime contractor, with Smith Aerospace acting as a risk-sharing partner for the provision of major components for up to 750 engine upgrade kits.

USAF T-38C Upgrade. The USAF is funding a $1.1 billion avionics upgrade program (AUP) that will upgrade 410 aircraft to a new T-38C configuration.

The aircraft's cockpit will be upgraded and modified to more closely resemble that of current front-line USAF combat aircraft, with systems to include a head-up display (HUD) as the primary flight reference as well as multifunction head-down displays. A GPS receiver will also be fitted, and other modifications will result in improvements in reliability, maintainability, and availability. Honeywell was subsequently selected to provide these systems.

The service was scheduled to receive 372 upgraded T-38Cs through FY06 and is to take delivery of the remainder by the end of FY07.

AIDC Upgrade. Taiwan's Aerospace Industrial Development Corp (AIDC) has flown a prototype of its upgraded F-5E and is now upgrading approximately 40 aircraft to incorporate an improved ground attack capability.

The upgrade includes hands-on-throttle-and-stick (HOTAS) controls, beyond-visual-range missiles, integrated satellite/INS, a wide-angle HUD, and a multimode pulse-Doppler radar.

AIDC has also been contracted by the Air Force to sell 62 surplus F-5-series aircraft. This could bring in work to refurbish stored aircraft to serviceable condition for resale. AIDC has estimated the unit cost of the upgraded aircraft at $2 million to $5 million, depending on the scope of upgrades selected.

Brazilian Upgrade. Embraer of Brazil is prime contractor on a project to upgrade 45 F-5E/F aircraft with a new multimode radar, EW systems, a glass cockpit, and updated weapons systems. Elbit of Israel was chosen as systems integrator on the six-year project, which is valued at $285 million.

The first of the aircraft was rolled out upon completion in December 2003.

In mid-2005, Brazil purchased nine F-5E/Fs from Saudi Arabia as stop-gap fighters until these upgrades are complete.

Spanish Upgrade. Israel Aircraft Industries' Lahav division was chosen as prime contractor on an initial $20 million project to upgrade four Spanish Air Force SF-5B two-seat trainers with a digital avionics suite. Also working on the project were EADS CASA and INDRA of Spain. The first two aircraft were redelivered in July 2002. Equipment included a mission computer, a 6-inch x 8-inch avionics display screen in each cockpit, a new Elbit HUD, a Honeywell/Collins INS/GPS, and a Honeywell TCAS (traffic collision alerting system).

The contract was subsequently increased by about $22 million to upgrade another 20 SF-5s. Work on the first of these aircraft was begun in 2003 and should keep them flying until about 2020.

Malaysian Upgrade. The mission systems aboard seven aircraft (five F-5Es, one F-5F, one RF-5E) are being upgraded under the direction of Malaysia's AIROD engineering group.

Northrop Grumman is involved in unspecified structural upgrades while U.K. Caledonian Airborne Systems is responsible for systems installation and integration, and Recon Optical will supply new dual-band cameras for the RF-5E. Smiths Aerospace and Thales are also aboard the program.

Original plans called for upgrading about 20 aircraft, but budget constraints resulted in the figure being scaled down; those F-5s in Malaysia's inventory not slated for the upgrade will be sold off.

Significant News

Iran Debuts Modified F-5 – Iran successfully demonstrated a remodeled F-5E in September 2006. Referred to as the Saeqeh – the Farsi term for Thunderbolt – the F-5E carried out a mock bomb run on virtual targets in northwestern Iran. While Iran has not disclosed the extent to which the aircraft has been refurbished, state television broadcasts showed the Saeqeh to be equipped with twin tail fins. (Reuters, 9/06).

Funding

No funding for F-5 modifications since FY89. Recent and requested T-38 funding is as follows:

U.S. FUNDING

	FY05 QTY	FY05 AMT	FY06 QTY	FY06 AMT	FY07 QTY	FY07 AMT	FY08 (Req) QTY	FY08 (Req) AMT
T-38 Modifications	-	170.9	-	212.3	-	143.2	-	130.8

All $ are in millions.

Timetable

Month	Year	Major Development
	1955	Northrop begins design work on N-156C
Jul	1959	First flight of initial prototype
Mar	1961	T-38A enters service with USAF
Apr	1962	USAF selection of F-5 approved by Secretary of Defense
Oct	1963	Initial flight of first production F-5A
Aug	1972	First flight of F-5E
	1973	Initial deliveries of F-5E
Sep	1974	First flight of F-5F
	1976	Initial deliveries of F-5F
	1987	F-5 production ended
	1989	Final F-5 delivered
	2020	U.S. T-38 to be retired

Worldwide Distribution/Inventories

(As of March 2007)

Operator	Designation	Qty.
Austria Air Force	F-5E	12
Bahrain Air Force	F-5E	8
Bahrain Air Force	F-5F	4
Botswana Air Force	CF-5A	9
Botswana Air Force	CF-5D	5
Brazil Air Force	F-5E	49
Brazil Air Force	F-5F	6
Chile Air Force	F-5E	13
Chile Air Force	F-5F	3
Germany Air Force	T-38	35
Honduras Air Force	F-5E	9
Honduras Air Force	F-5F	2
Indonesia Air Force	F-5E	7
Indonesia Air Force	F-5F	2
Iran Air Force	F-5E	50
Jordan Air Force	F-5E	41
Jordan Air Force	F-5F	12
Kenya Air Force	F-5E	5
Kenya Air Force	F-5F	2
Korea Republic of (South) Air Force	F-5A	20
Korea Republic of (South) Air Force	F-5B	15
Korea Republic of (South) Air Force	F-5E	142
Korea Republic of (South) Air Force	F-5F	32
Korea Republic of (South) Air Force	RF-5A	5
Korea Republic of (South) Air Force	SF-5B	17
Korea Republic of (South) Air Force	T-38	30

Northrop F-5 Tiger II/T-38 Talon

Operator	Designation	Qty.
Malaysia Air Force	F-5E	6
Malaysia Air Force	F-5F	2
Malaysia Air Force	RF-5E	2
Mexico Air Force	F-5E	8
Mexico Air Force	F-5F	2
Morocco Air Force	F-5A	3
Morocco Air Force	F-5B	2
Morocco Air Force	F-5E	12
Morocco Air Force	F-5F	4
Morocco Air Force	RF-5A	2
NASA - National Aeronautics and Space Admin	T-38	4
Norway Air Force	F-5B	8
Saudi Arabia Air Force	F-5E	2
Saudi Arabia Air Force	F-5F	1
Singapore Air Force	F-5S	32
Singapore Air Force	F-5T	9
Singapore Air Force	RF-5S	6
Spain Air Force	SF-5B	16
Spain Air Force	SF-5M	4
Sudan Air Force	F-5E	4
Sudan Air Force	F-5F	1
Switzerland Air Force	F-5E	42
Switzerland Air Force	F-5F	12
Taiwan Air Force	F-5E	25
Taiwan Air Force	F-5F	34
Taiwan Air Force	T-38	40
Thailand Air Force	F-5B	2
Thailand Air Force	F-5E	31
Thailand Air Force	F-5F	4
Tunisia Air Force	F-5E	10
Tunisia Air Force	F-5F	2
Turkey Air Force	NF-5A	26
Turkey Air Force	NF-5B	15
Turkey Air Force	T-38	68
United States Air Force	AT-38B	31
United States Air Force	T-38A	199
United States Air Force	T-38C	246
United States Navy	F-5E	26
United States Navy	F-5F	4
United States Navy	F-5N	6
Venezuela Air Force	CF-5A	8
Venezuela Air Force	CF-5D	1
Venezuela Air Force	NF-5B	3

Operator	Designation	Qty.
Yemen Air Force	F-5B	2
Yemen Air Force	F-5E	9

Forecast Rationale

Current plans call for the U.S. Air Force to keep its fleet of T-38 trainers in operation for at least another two decades. Over the next 10 years, the T-38 program will experience a series of dovetailed upgrades to keep them flying through 2020. The $66 million brake system improvement will begin in 2008 just as the current avionics upgrade program winds down. In the meantime, the propulsion modernization program and escape system upgrade will continue through 2010.

Foreign operators of the F-5/T-38, including Brazil, Malaysia, Spain, and Taiwan, are all implementing upgrades of their own fleets. Malaysia has indicated that those members of its F-5 fighters in its inventory that are not upgraded will be marked for export. Switzerland continues to seek international buyers for its retired fleet of F-5s.

Ten-Year Outlook

The 10-year production chart has been omitted because this aircraft has not been under production for more than a decade. A detailed 10-year forecast of upgrade and modernization programs is available in the "Northrop F-5/T-38 Series" report in Forecast International's *Airborne Retrofit & Modernization* Forecast.

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