

412TW-PA-24115



HISTORY OF THE AFFTC, VOL 1 F-16 CHAPTER – PAGES 90-96

**A
F
F
T
C**

AFFTC HISTORY OFFICE

AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE,
CALIFORNIA

1 JUL 75 – 31 DEC 76

RELEASED
23 APRIL 2024

DISTRIBUTION STATEMENT A – APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE MATERIEL COMMAND
UNITED STATES AIR FORCE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

| | | | | | | | | |
|---|------------------------------------|-------------------------------------|---|--|----------------------------|---|--|--|
| 1. REPORT DATE (DD-MM-YYYY) 23-04-2024 | | | 2. REPORT Historical Document | | | 3. DATES COVERED (From - To) 1 Jul 75 – 31 Dec 76 | | |
| 4. TITLE AND SUBTITLE Pages from - History of the AFFTC, Vol 1 (F-16 Chapter) Pgs. 90-96 | | | | | | 5a. CONTRACT NUMBER | | |
| | | | | | | 5b. GRANT NUMBER | | |
| | | | | | | 5c. PROGRAM ELEMENT NUMBER | | |
| 6. AUTHOR(S) AFFTC History Office | | | | | | 5d. PROJECT NUMBER | | |
| | | | | | | 5e. TASK NUMBER | | |
| | | | | | | 5f. WORK UNIT NUMBER | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AND ADDRESS(ES) AFTC/HO 305 East Popson Ave Edwards AFB CA 93523 | | | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER 412TW-PA-24115 | | |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) 412th Test Wing 195 E Popson Ave Edwards AFB CA 93524 | | | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) N/A | | |
| | | | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | | |
| 12. DISTRIBUTION / AVAILABILITY STATEMENT | | | | | | | | |
| 13. SUPPLEMENTARY NOTES | | | | | | | | |
| 14. ABSTRACT | | | | | | | | |
| 15. SUBJECT TERMS AFFTC Histories, F-16 | | | | | | | | |
| 16. SECURITY CLASSIFICATION OF: Unclassified | | | 17. LIMITATION OF ABSTRACT | | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON 412 TENG/EN (Tech Pubs) | | |
| a. REPORT Unclassified | b. ABSTRACT Unclassified | c. THIS PAGE Unclassified | None | | 10 | 19b. TELEPHONE NUMBER (include area code) 661-277-8615 | | |

F-16 Air Combat Fighter

Background. In January 1975, following a prototype competition between the General Dynamics YF-16 and the Northrop Corporation's YF-17 in the lightweight fighter program, the YF-16 was selected by the Air Force for full-scale development.

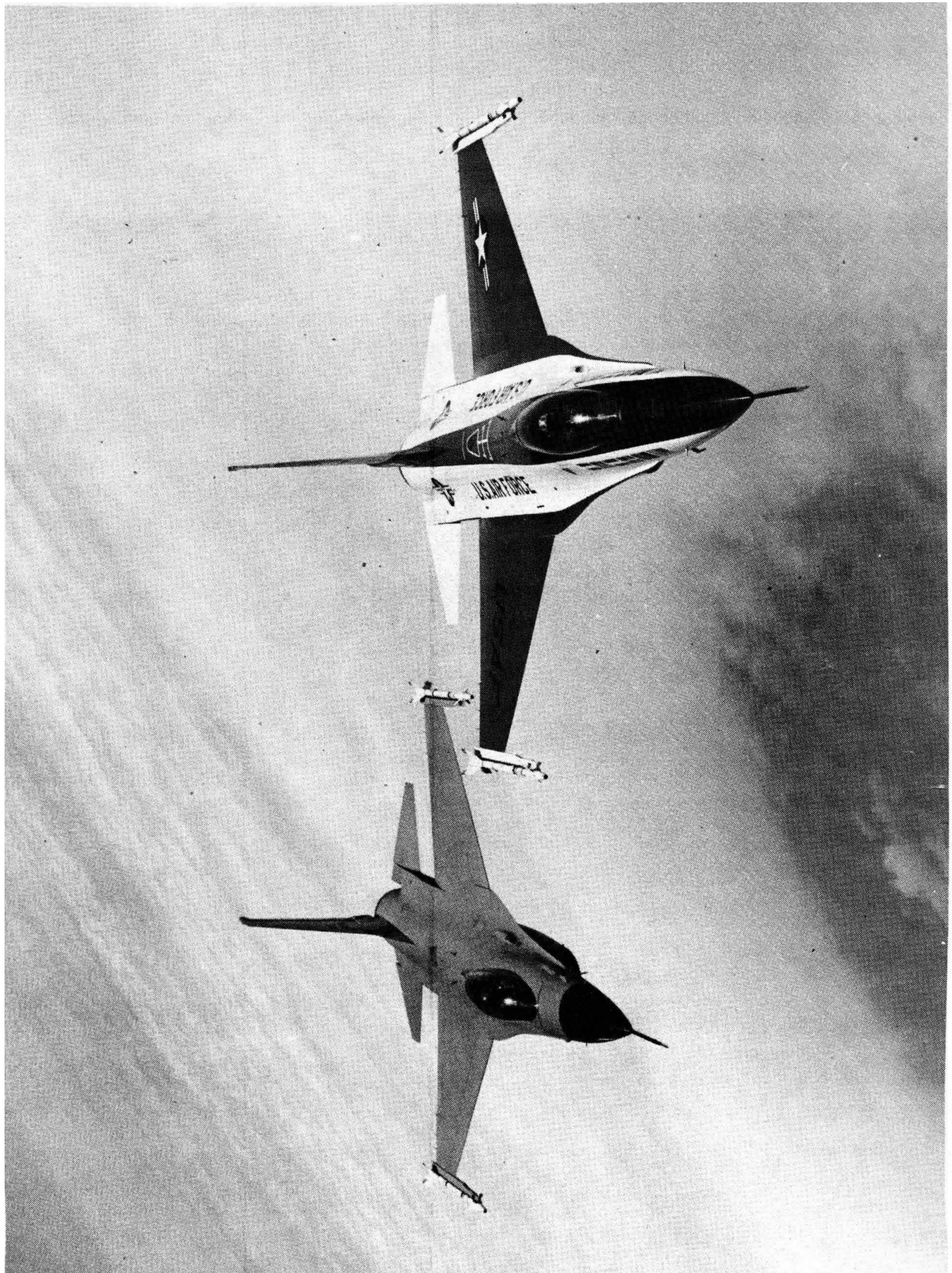
The F-16 was to have a dual role. It was to complement the F-15 in the low-cost part of a high-low aircraft mix and supplement other aircraft in operations against ground targets. It was designed to operate at close quarters, primarily to defeat the large number of enemy fighters expected to provide top cover support for an armored breakthrough in Central Europe, and was given the best possible design for the visual combat arena.²⁴⁴ /

In June 1975, the United States and four NATO countries reached a mutual understanding to coproduce and buy the F-16.²⁴⁵ / That understanding came before the full-scale development program got its first test aircraft in December 1976 and well before the formal Department of Defense decision to produce the aircraft, which was not scheduled to be made until September 1977. The understanding was not final, however, until formal letters of offer and acceptance were signed in May 1977.²⁴⁶ /

244. Fact Sheet, Office of Information, AF Systems Command [AFSC] Subj: F-16 Air Combat Fighter, p. 2; Report to the Congress by the Comptroller General of the United States, Status of the F-16 Aircraft Program [hereafter cited as GAO Rpt, F-16], 1 Apr 77, pp. 1-3; and Dr. Malcolm R. Currie, Director of Defense Research and Engineering, in a statement to the Congress, 3 Feb 76.

245. GAO Rpt, F-16, p. 3.

246. Ibid. p. 1; Ltr, AFFTC/DOVF [AFFTC/F-16 Joint Test Force] to AFFTC/HO [History Office], Subj: Air Combat Fighter [ACF] Historical Report, 24 Jan 77, p. 1 and Fact Sheet, F-16, p. 5.



GENERAL DYNAMICS F 16A

The F-16 was a lightweight aircraft, weighing only about 22,600 pounds and highly maneuverable, a characteristic in considerable part to the high thrust-to-weight ratio of its F100 engine aided by automatic leading-edge maneuver flaps. The craft had a radius of action of more than 500 miles, could carry some 10,700 pounds of ordnance, and fly at speeds better than Mach 2.^{247/}

The F-16's armament included the M61A1 20mm gun mounted internally on the left side of the aircraft with the firing aperture just behind the pilot, and positions for up to six AIM-9 missiles. For air-to-ground operation, a variety of ordnance could be mounted externally.^{248/}

Testing

The F-16 Joint Test Force had only two test aircraft, prototype F-16 numbers 1 and 2, between July 1975 and the delivery of the first full-scale development craft, F-16A number 1, to Edwards AFB on 17 December 1976.^{249/} However, the bulk of the test force's work had to be done with only one YF-16 during that time because YF-16 number 1 was modified and committed to a project not related specifically to YF-16 testing, rather to the gathering of broadly applicable data. That was the control configured vehicle (CCV) research project conducted for the Air

247. Fact Sheet, F-16, pp. 2, 4, & 5.

248. Fact Sheet, F-16, p. 6 and William G. Holder and William D. Siuru, Jr., General Dynamics F-16, Fallbrook, Calif.: Aero Publishers, Inc., 1976, p. 41.

249. Ltr., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, 25 Mar 76, p. 1; Ltr., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, 16 Sep 76, atch p. 1; and Ltr., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, 24 Jan 77, p. 1 & atch p. 1.

Force Flight Dynamics Laboratory with personnel and aircraft of the F-16 test force from mid-March 1976 to its conclusion in 1977.^{250/} YF-16 number 2 was flown more than 250 hours on 238 flights in the 18-month period between 1 July 1975, and the end of 1976.^{251/}

Aircraft YF-16 Number 1. YF-16 number 1 returned from its European demonstration tour to the General Dynamics facility at Fort Worth, Texas, on 9 July 1975. Following some structural ground tests, it was modified for the CCV project and returned to Edwards AFB in March 1976.^{252/}

Twenty-nine flights in the program were completed when YF-16 number 1 was damaged during a landing on 24 June.^{253/} The aircraft was in the landing approach approximately one-half mile from touchdown when it lost power and made a hard landing on the main runway at Edwards AFB. The pilot could not keep the aircraft on the runway because, with the engine out, its ground steering and brakes did not function normally. The plane sustained moderate damage, but the pilot was uninjured.^{254/}

- 250. AFFTC Technical Report 77-23, YF-16 Control Configured Vehicle (CCV) Operational Potential, Flying Qualities, and Performance Evaluation, Jan 78, pp. 11-12 and Ltr., 4486 Test Sq. (TAC) to TACD, Subj: ACF JTF History, 1 Jan-31 Mar 76. 8 Apr 76.
- 251. Ltrs., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, dtd 25 Mar 76, 16 Sep 76, & 24 Jan 77, atch p. 1.
- 252. Ltr., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, 25 Mar 76 and atch p. 1 and Ltr., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, 16 Sep 76 and atch pp. 1-2.
- 253. AFFTC-TR-77-23, p. 12 and Ltr., AFFTC/DOVF to AFFTC/HO, Subj: ACF Hist, 16 Sep 76.
- 254. Msg., HQ ASD to F-16 Project Office et al., YP2423307 Jun 76 and Weekly Activity Report WAR, AFFTC Flight Test Engrg Div, 29 Jun 76, p. 4.

Repair of YF-16 number 1 began on 10 September, but the plane did not fly again in 1976.^{255/} (The CCV project and its results are documented in Air Force Flight Test Center Technical Report 77-23, dated January 1978.)

Effect of Externally Mounted Fuel Tanks. Between March and October 1975, flight tests were conducted to determine the effects of externally mounted fuel tanks on the location of the aerodynamic center of the YF-16. Flights were made with four tanks--two 370-gallon tanks and two 150-gallon tanks--loaded on underwing pylons of the YF-16 and also with just two 370-gallon tanks aboard.

It was found that the tanks moved the aerodynamic center of the aircraft forward significantly. The tanks caused a marked increase in unstable pitching movement. The forward shift of the aerodynamic center was as much as 13 percent at elevated angles of attack. Four tanks caused a greater forward shift than did two tanks at the lower angles of attack. In order to trim the aircraft, an increased trailing-edge-down deflection of the stabilator was required. That deflection was such that under certain flights conditions, the pitch and roll characteristics of the aircraft could combine with it to prevent the stabilator from fully doing its job as a control surface--a condition known as "stabilator saturation."

255. Ltr., AFFTC/DOVF to AFFTC HO, Subj: ACF Hist, 24 Jan 77 and AFFTC-TR-77-23, p. 12.

Test pilot comments also indicated that there was some degradation of the directional stability of the aircraft when it was carrying four external tanks.^{256/}

In August 1975, the YF-16 was flight tested with a 150-gallon fuel tank mounted on the aircraft's centerline to determine what effect it might have on the aircraft's flying qualities. No significant degradation of the aircraft's stability and control was found within the Mach 0.8 speed and 20-degree angle of attack limits of the test.^{257/}

Flight tests in March 1976 with two 370-gallon fuel tanks showed a loss of approximately 50 percent in lateral control authority, particularly at low speed. The reduction of lateral control power was most apparent during landing rollout in a strong crosswind. It was recommended that lateral control effectiveness be examined during a full-scale development program.^{258/}

YF-16 Flight Test Miscellany. A modified aft nozzle fairing--the engine-to-airframe fairing at the engine nozzle, sometimes called "turkey feathers"--was tested in the course of 10 flights between 14 and 22 August 1975. The modification was a shortening of the fairing by about 12 inches. The testing sought to determine the effect of the shortening on the performance of the aircraft.

- 256. Ltr., DOEEP to ASD/YPT, Subj: Effects of Multiple Wing-Mounted Stores on Aerodynamic Center Location, 9 Feb 76.
- 257. Ltr., DOEEP to ASD/YPT, Subj: Effects of Centerline Store on Lateral-Directional Flying Qualities, 24 Dec 76.
- 258. Ltr., DOEEP to ASD/YPT, Subj: Effects of 370-gallon External Fuel tanks on Lateral-Directional Stability and Control, 22 Nov 76.

Test results showed that the shortening had no measurable effect.^{259/}

A free-floating engine nozzle was flight tested on 12 flights between 27 August and 11 September 1975, to determine its effect on the aircraft's performance as compared to the mechanically actuated engine nozzle. Only a negligible performance difference could be detected when the free-floating nozzle was used.^{260/}

A large number of flights were conducted by the YF-16 during the period July 1975 and December 1976 to collect very specific test data. Examples of such data were nosewheel liftoff speed, the drag increment of uprigged leading and trailing edge flaps, and the drag increment of an open gun-vent door.^{261/}

A number of flights were devoted to work on test techniques. Examples of such efforts were the evaluation of two different fuselage-mounted air data probe configurations, demonstration of procedures for generating aircraft flight test drag polars, and an effort to derive a YF-16 maximum thrust model from the analysis of acceleration performance.^{262/}

Pilots reported a low frequency, lightly damped yaw oscillation of the YF-16 during a number of flights in December 1975. The oscillation occurred while flying at 40,000 feet pressure altitude

- 259. Ltr., AFFTC/DOVF to ASD/YPT [Aeronautical Systems Division/F-16 Systems Program Office], Subj: Trimmed Aft Nozzle Fairing Tests, 29 Sep 75.
- 260. Ltr., DOEEP [Performance & Flying Qualities Branch, Directorate of Test Engineering, AFFTC] to ASD/YPT, Subj: Performance Effects of the Free Floating Nozzle, 19 Nov 75.
- 261. Ltr., DOEEP to ASD/YPT, Subj: Nosewheel Lift-off Speed, 16 Apr 76, Ltr., DOEEP to ASD/YPT, Subj: Uprigged Leading and Trailing Edge Flaps, 30 Aug 76; and Ltr., DOVF to ASD/YPT, Subj: Gun Vent Door Drag, undated.
- 262. Ltr., DOEEP to ASD/YPT, Subj: Air Data Probe Evaluation, 10 May 76; Ltr., DOEEP to ASD/YPT, Subj: Drag Polar Development, undated; and Ltr., DOEEP to ASD/YPT, Subj: A YF-16 Maximum Thrust Model Derived From Acceleration Performance Data, 19 Aug 76.

at a speed of Mach 1.4 and while the aircraft's speed brakes were fully extended during level flight. When the brakes were retracted or the pilot maneuvered the aircraft, the oscillation disappeared.

In January 1976, two test flights were flown to examine the oscillation. The condition could be induced at between 35,000 and 40,000 but not below 30,000 feet. In general, the frequency of the oscillation decreased and its amplitude increased with increasing altitude.

Apparently the speed brakes created a shock wave when extended, and at between mach 1.4 and 1.6, the wave propagated along the rudder. It caused a significant loss of rudder power for small deflections and sideslip angles. The oscillation resulted when the aircraft was pulsed in level flight. At speeds between mach 1.5 and 1.6 the oscillation was self-sustaining.

Pilots reported that the oscillation was more a nuisance than a problem. However, tests were recommended with the F-16 aircraft both to confirm the existence of the motion and check for any possible troublesome change in the nature of the oscillation.^{263/}

263. Ltr., DOEEP [Performance & Flying Qualities Branch, Directorate of Test Engineering, AFFTC] to ASD/YPR, Subj: Supersonic Yaw Oscillation with Speed Brakes Extended, 16 Dec 76.