Marquette University
e-Publications@Marquette

Management Faculty Research and Publications | Business Administration, College of

1-1-1997

History of the F-15 Program: A Silver Anniversary First Flight Remembrance

David King
Marquette University, drking@iastate.edu

Donald S. Massey
United States Air Force

Published version. *Air Force Journal of Logistics* (Winter 1997), Permalink. Originally published in the Air Force Journal of Logistics.
David King was affiliated with the United States Air Force at the time of publication.

History of the F-15 Program: A Silver Anniversary First Flight Remembrance

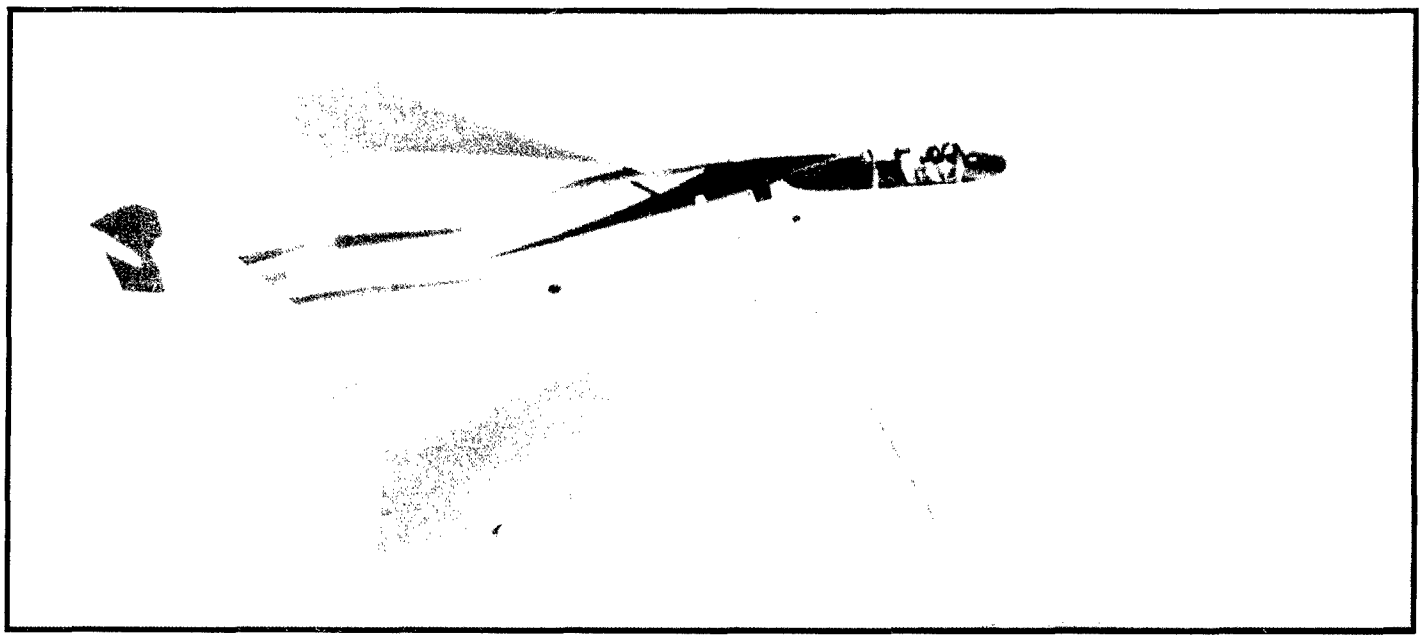
Captain David R. King, USAF
Captain Donald S. Massey, USAF

Introduction

In July 1967, the Soviet Union unveiled a new generation of combat aircraft during an air show at Domodedovo civil airport south of Moscow. The MiG-25 Foxbat, featuring two engines, twin vertical stabilizers, and an estimated speed greater than Mach 2, was the most formidable aircraft in this new air armada. (5) The twin-tailed fighter alarmed Air Force planners and highlighted the need for a new fighter designed to fill the air superiority role—a role that had not been fulfilled since development of the F-86 Sabre in the late 1940s. (27:181) General Dynamics and McDonnell Douglas were awarded concept exploration contracts in December 1967 for "FX Air Superiority"—a fighter superior in air combat to any present or projected Soviet fighters. (25) The contracts resulted in an Air Force request for proposal for preliminary designs of the F-15. Fairchild-Republic, McDonnell Douglas, and North American Rockwell won design contracts for the F-15 in December 1968. (14)

In an effort to reduce development time and costs, the Air Force awarded McDonnell Douglas the F-15 contract on 23 December 1969—without a competitive fly-off. At the time, critics argued that an award of this type would result in cost overruns and program delays. (1:18) However, the F-15 program has become one of the most successful aircraft development and procurement programs in Air Force history. Although mishaps have claimed a number of F-15s, and two F-15Es were lost to ground fire during Operation DESERT STORM, the F-15 has triumphed in 96.5 aerial engagements without loss of a single aircraft. (31) Today, the McDonnell Douglas F-15 remains the Air Force's primary air-superiority and interdiction platform and will continue to operate in that role until replaced by the F-22 early in the next century.

27 July 1997 marks the silver anniversary of the McDonnell Douglas F-15 Eagle's first flight. The F-15 has defended the national interests of the United States and its allies for 25 years—from the rolling hills of Europe, to the vast expanses of the Pacific, to the bitter cold of Alaska and the North Atlantic, to the deserts of the Middle East. To celebrate this silver anniversary, we present a historical review of the F-15 program. Specifically, we explore the evolution of the F-15 program, examine the role of the F-15 in technology development, address logistical challenges to the F-15 program, and highlight the combat history of the F-15. We conclude with a look at what the future holds for the F-15 program. We dedicate this article to the Eagle Keepers who have kept the F-15 at the ready, around the clock, for a quarter of a century.



Initial Flight Test of the F-15A Occurred on 27 July 1972. Production Aircraft Would Incorporate Curved Wing Tip Caps and Notches in the Horizontal Stabilizers to Improve Flight Performance.

Three Generations of Eagles

F-15A/B Eagle

The first F-15A rolled out of the McDonnell Douglas St. Louis assembly plant on 26 June 1972. Following a brief ceremony, the contractor dismantled and loaded the aircraft aboard a C-5A for transport to Edwards AFB, California. (4:18) Irving Burrows, the McDonnell Douglas Chief Test Pilot, flew the F-15A on its maiden flight at Edwards AFB on 27 July 1972. (10) Initial flight testing led to a larger speed brake, notched horizontal stabilizers, and curved wing tip caps. (12:628) On 14 November 1974, President Gerald Ford presided over a ceremony at Luke AFB, Arizona, where the Tactical Air Command and the 555th Tactical Fighter Training Squadron took delivery of the first operational F-15A. (32) The 1st Tactical Fighter Wing (TFW), Langley AFB, Virginia, became the first operational combat wing to receive F-15A/Bs (the F-15A is a single-seat model and the F-15B is a two-seat model) and began converting from the F-4 Phantom in January 1976. (33:17) The following year, the 36th TFW, Bitburg AB, Germany, became the first overseas unit to receive the Eagle. (12:629) Ultimately, McDonnell Douglas delivered over 360 F-15A/B aircraft to the US Air Force, with the last deliveries going to fighter interceptor squadrons throughout the Air Force. (3) As the next generation F-15C/D aircraft began entering the Air Force inventory, existing F-15A/B aircraft were sent to Air National Guard (ANG) units or the Aerospace Maintenance and Regeneration Center at Davis-Monthan AFB, Arizona. (3) Today, F-15A/B aircraft are flown by ANG units in Florida, Hawaii, Louisiana, Massachusetts, Missouri, and Oregon. (8:106)

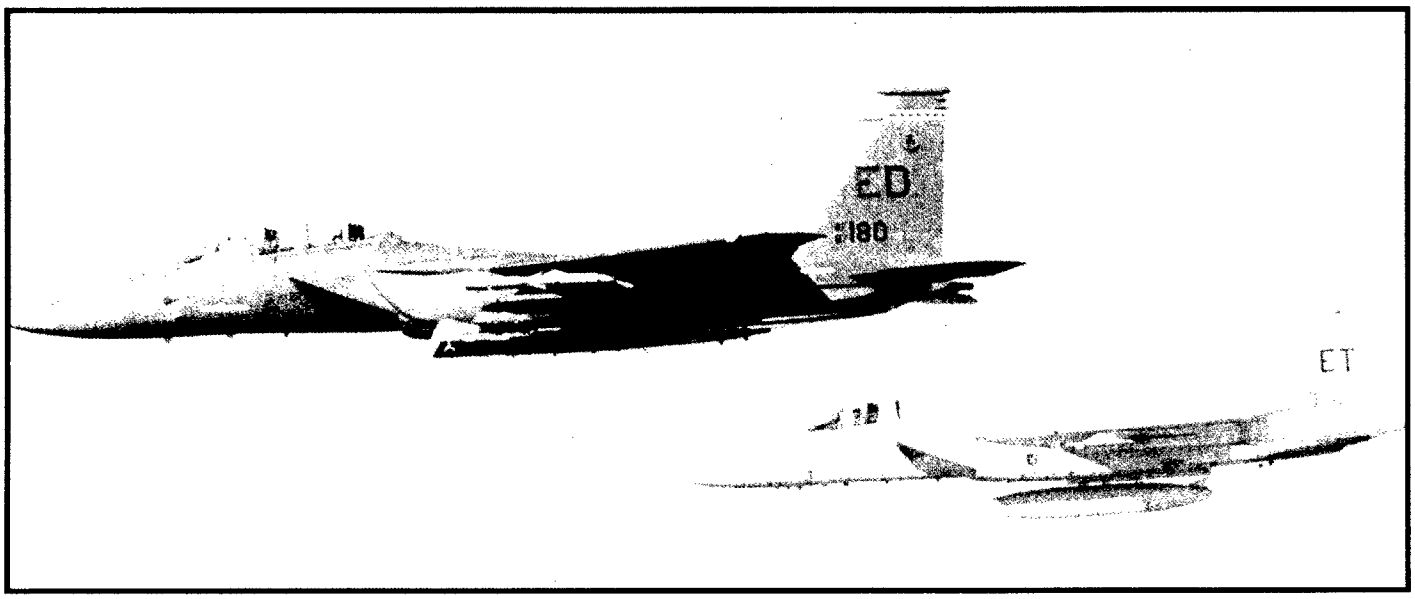
F-15C/D Eagle

The next version of the Eagle, the F-15C/D, began entering service with the Air Force in June 1979. (8:132) The Air Force ultimately received a total of 408 F-15Cs (single-seat) and 62 F-15Ds (two-seat). (3) Externally, the F-15C/D is nearly identical to the F-15A/B. However, the newer model carries an additional 2,000 pounds of fuel internally and has the ability to carry conformal fuel tanks. Additional improvements to the F-15C/D aircraft continued under the Multi-Stage Improvement Program (MSIP). MSIP upgrades were first integrated into the F-15C/D production line and later incorporated into earlier F-15s during retrofit at the depot maintenance facility at Robins AFB, Georgia. The MSIP improvements include structural, radar, and electronic warfare upgrades, along with wiring needed to employ the advanced medium range air-to-air missile (AMRAAM). The F-15C/D aircraft with the MSIP upgrade began entering the Air Force inventory in 1985. (8:132-133) The last F-15 aircraft modified for MSIP improvements left Robins AFB on 20 March 1997. F-15C/D aircraft are currently assigned to Eglin AFB, Florida; Elmendorf AFB, Alaska; Kadena AB, Japan; RAF Lakenheath, United Kingdom; Langley AFB, Virginia; Mountain Home AFB, Idaho; Nellis AFB, Nevada; Spangdahlem AB, Germany; and Tyndall AFB, Florida. (8:77,91,93)

F-15E Strike Eagle

Although the F-15 aircraft evolved as a response to an air-superiority threat from the former Soviet Union, its multi-role potential was recognized as early as 1972 by Air Force leaders. (4:18) The need for a multi-role platform emerged in the early 1980s when the Air Force began looking for a replacement for the F-111 under the Dual-Role Fighter (DRF) program. The DRF concept planned for development of an aircraft with the capability to conduct strike missions unescorted by fighters or jamming aircraft. In order to limit the cost of the DRF program, the Air Force considered variants of existing aircraft that met the DRF requirement. The DRF studies led to a fly-off competition between modified F-15 and F-16 aircraft. (21:18)

The F-15E won the ensuing DRF competition in February 1984. (21:18) Full scale development of the day-night, all-weather F-15E began the same year, with the first production aircraft flying on 11 December 1986. (26) Although the F-15E is very similar to the F-15D and retains the full air-to-air capability of earlier models, the aircraft is optimized for air-to-ground missions. The F-15E incorporates a stronger airframe for carrying



An F-15C Shadows an F-15E During Advanced Medium Range Air-to-Air Missile (AMRAAM) Flight Tests.

air-to-ground munitions, uses conformal fuel tanks for additional range, and employs a second crew member to monitor and employ the aircraft's weapons systems. However, the most significant improvements to the F-15E were in the avionics systems. Improvements included: an improved radar for air-to-ground targeting; a two pod system for high speed, all-weather low level flight and targeting called Low Altitude Navigation and Targeting Infrared for Night (LANTIRN); and enhanced cockpit instrumentation. (16:43-47)

The F-15E achieved initial operational capability in October 1989 at Seymour Johnson AFB, North Carolina. (17:652) Operational F-15E aircraft are currently assigned to Eglin AFB, Elmendorf AFB, RAF Lakenheath, Mountain Home AFB, Nellis AFB, and Seymour Johnson AFB. (8:77,91,93) The last F-15E was scheduled to be delivered to the Air Force in June 1994. However, the production lines were kept open when Saudi Arabia and Israel both ordered foreign military sales (FMS) versions of the F-15E. The FMS purchases, combined with 1995 congressional approval for additional United States F-15E aircraft, should keep the F-15E production line in operation until the end of the century. (17:652)

Technology Development and Foreign Military Sales

Streak Eagle

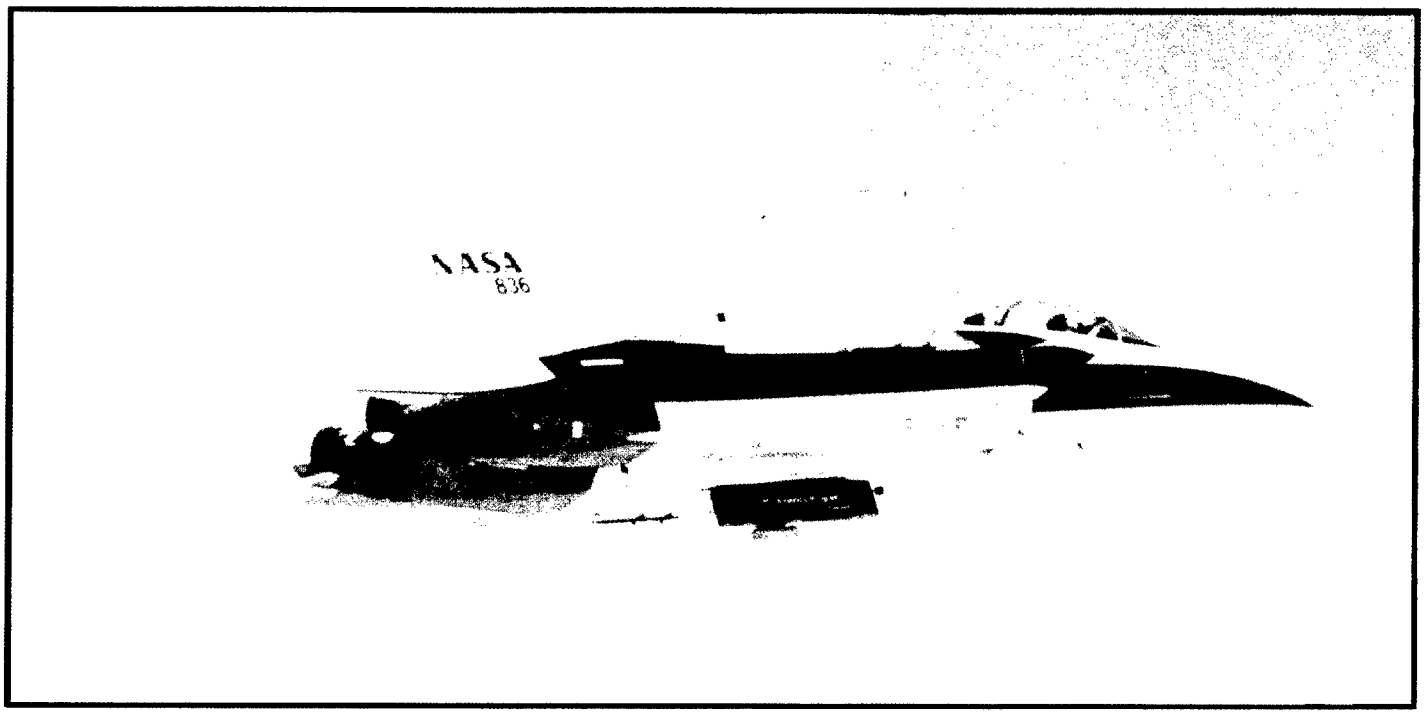
During the winter of 1974-75, the Air Force modified an F-15A for Operation Streak Eagle in an attempt to set world time-to-climb records. To reduce weight, engineers and maintenance personnel removed all non-mission critical systems, including paint. The record attempts were made at Grand Forks AFB, North Dakota, to take advantage of the greater lift provided by the cold, dense air. During the record-breaking attempts, the aircraft carried only enough fuel for each specific flight profile. The Streak Eagle ultimately set eight time-to-climb records, shattering records previously held by the McDonnell Douglas F-4 and the MiG-25. (7) The Streak Eagle is currently on display at the Air Force Museum, Wright-Patterson AFB, Ohio.

National Aeronautics and Space Administration (NASA)

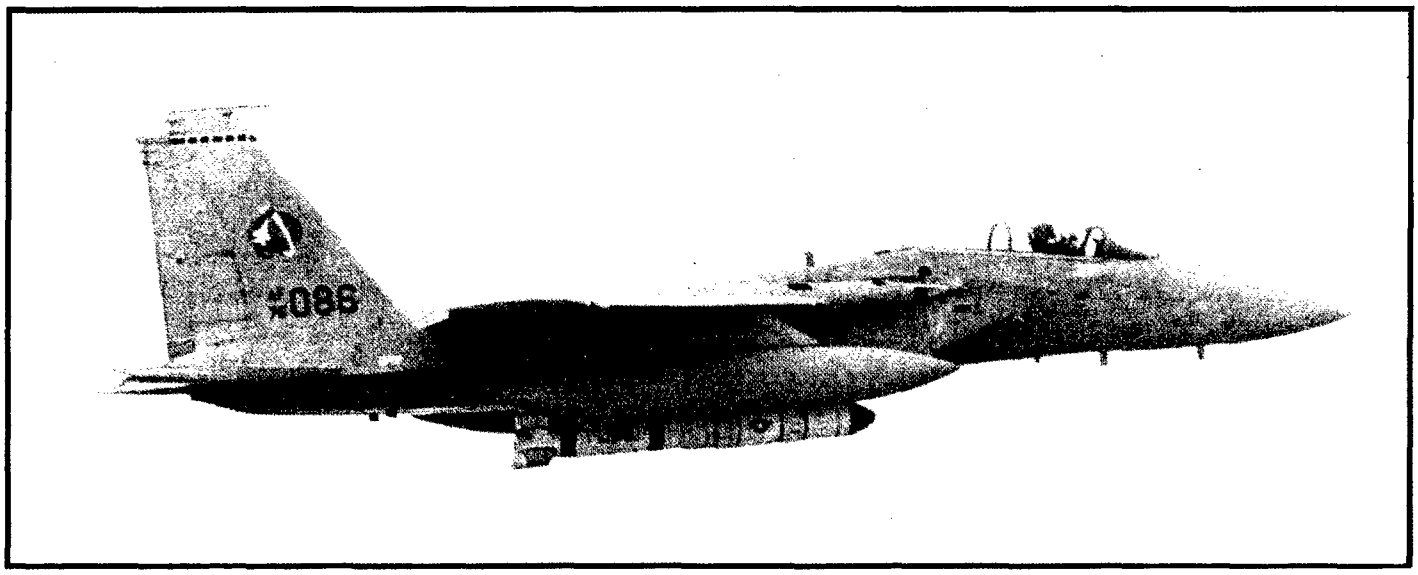
Two F-15As have been assigned to NASA's Dryden Research Center, Edwards AFB, as testbed aircraft since the mid 1970s. These aircraft have been instrumental in developmental testing of advanced aerospace systems being integrated into current and future aircraft. Some of these test programs included: the Self-Repairing and Self-Diagnostic Flight Control Program, the Self-Diagnostic Flight Control System, and the Advanced Digital Engine Control System. (16:71-73) Perhaps the most notable flight experiment involved testing the shuttle's thermal protection tiles. The tiles were mounted on the leading edge of a centerline pylon and subjected to dynamic pressures greater than that experienced by the shuttle during launch. (31)

F-15 Anti-Satellite (ASAT)

The F-15 ASAT program was designed to destroy an orbiting satellite by launching a missile from an F-15 at the upper reaches of the aircraft's flight envelope. The F-15 ASAT missile consisted of a two-stage rocket and a miniature kinetic-energy vehicle. The kinetic-energy vehicle had a liquid helium-cooled infrared seeker to guide the vehicle into a collision with the target satellite. (36:240) An F-15A was extensively modified with a special centerline pylon for carrying the 2,700-pound weapon and a cryogenic tank for carrying liquid helium in the aircraft's ammunition bay. (35) Beginning in the early 1980s, a series of captive and live fire flight tests were conducted to evaluate aircraft and missile compatibility and evaluate overall system performance. (2) The only F-15 ASAT launch against an actual



A National Aeronautics and Space Administration (NASA) F-15A Serves as the Testbed for Space Shuttle Tile Weather Durability Tests. Tiles are Mounted on the Leading Edge of a Modified Centerline Pylon.



The F-15 Anti-Satellite (ASAT) Program Brought a New Dimension to Air-to-Air Combat.

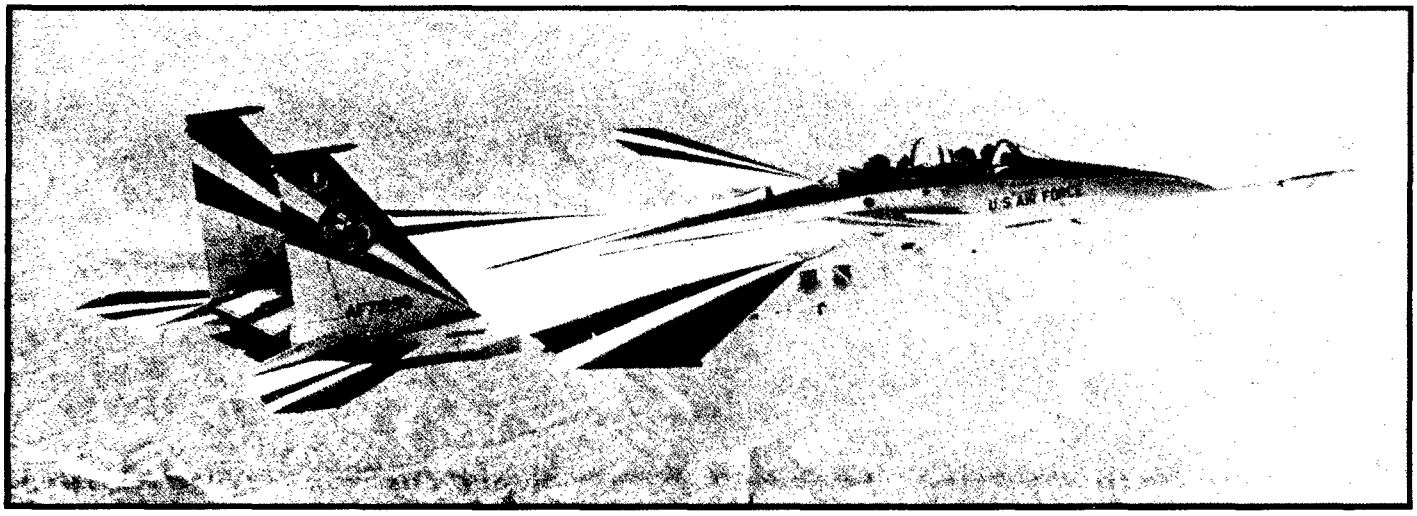
satellite occurred on 13 September 1985 when the test aircraft took off from Vandenburg AFB, California, climbed to 80,000 feet, and launched the 17-foot long, 18-inch diameter missile against the Solwind P78-1 satellite. The F-15 ASAT system performed flawlessly and destroyed the Air Force operated satellite. (9:20) However, the F-15 ASAT program was officially terminated in 1988, after Congress prohibited further tests because they were viewed as a violation of a US-Soviet treaty forbidding the development and testing of anti-satellite weapons. (24:15)

Agile Eagle

In 1984, the Air Force awarded a contract to McDonnell Douglas for an advanced Short Take-Off and Landing (STOL)/ Maneuvering Technology Demonstrator (MTD) experimental aircraft. The goal of the program, dubbed Agile Eagle, was to develop an aircraft that could land and take off from battle damaged runways and demonstrate improved maneuverability. An F-15B was modified as the STOL/MTD aircraft for the project. The F-15 STOL/MTD modifications, designed to give the aircraft the ability to land on wet, 50 x 1,500-foot runways at night or under adverse weather, included: canards, a fly-by-wire integrated flight/propulsion control (IFPC) system, two-dimensional thrust vectoring and reversing engines, and advanced avionics. (18:107,109) The Agile Eagle program ended in August 1991 after meeting all of its flight objectives. (34) Engine technology acquired during the Agile Eagle program was used in development of the F-22's Pratt and Whitney F119-PW-100 vectored thrust engines. The F-15 STOL/ MTD aircraft is currently at NASA's Dryden Research Facility and has completed 33 flight tests of a Pratt and Whitney three-dimensional vectored nozzle (vectored thrust in 360 degrees, including pitch and yaw). (6)

Advanced Medium Range Air-to-Air Missile (AMRAAM)

The F-15C was one of four aircraft involved in the development and testing of the Advanced Medium Range Air-to-Air Missile (AMRAAM). The AMRAAM program was placed in jeopardy in late 1989 after four AMRAAMs simultaneously launched from the F-15 test aircraft missed the four target aircraft.

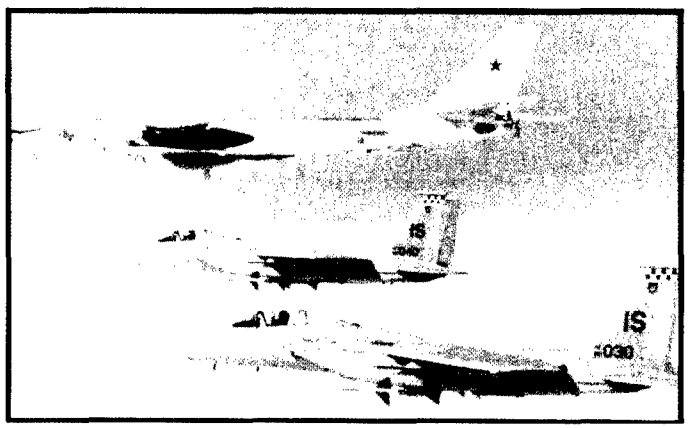


The Agile Eagle Short Take-Off and Landing/Maneuvering Technology Demonstrator Featured Canards and Vectored Thrust Engines.

(23:24) However, the test was successfully completed in May 1990 after a combination of missile and aircraft compatibility problems were corrected. (13) Although none were launched in combat, the F-15 became the first aircraft to carry the AMRAAM into battle, when the missiles were carried on 33rd TFW aircraft towards the end of the Gulf War. (19:7)

Conformal Fuel Tanks

Fuel and Sensor Tactical (FAST) packs, later called conformal fuel tanks (CFTs), were developed to increase the combat capability of the F-15C/D. The CFTs attach to the fuselage along the side of each air intake and permit the carriage of either air-to-air or air-to-ground weapons. CFTs extend the range, sortie duration, and combat capability of the aircraft, while minimizing the limitations imposed by external fuel tanks. F-15C/Ds using CFTs increase their fuel load by 25% and experience 40% less drag when compared to aircraft configured with two wing tanks. Degradation of air-to-air capability is minimal since the CFTs become non-load bearing components of the aircraft structure once empty. (38) Currently, only F-15E aircraft use CFTs. The last F-15C/D unit to fly with CFTs was the 57th Fighter Squadron, Keflavik Naval Air Station, Iceland, where the nearest divert location was over 750 miles away in Lossiemouth, Scotland.



F-15Cs of the 57th Fighter Interceptor Squadron, Keflavik Naval Air Station, Iceland, Intercept a Soviet Bear Bomber Over the Frigid North Atlantic. Conformal Tanks Extended the Range and Sortie Duration of the F-15.

Foreign Military Sales

During the 1970s and 1980s, US aircraft manufacturers experienced fierce competition for military aircraft sales abroad. Aircraft such as the Grumman F-14 Tomcat, the General Dynamics F-16 (now produced by Lockheed Martin), and the McDonnell Douglas F-15 and F-18 vied with one another, and aircraft produced by other countries, for lucrative foreign military contracts. Ultimately, the F-15 found its way into the air forces of Israel, Japan, and Saudi Arabia. In 1976, Israel became the first foreign country to take delivery of the F-15, and since that time, the Israel Defense Force has confirmed 59.5 kills with the F-15. (12:630; 31) Israel currently maintains 44 F-15A/B and 28 F-15C/D aircraft and will begin taking delivery of 21 export versions of the F-15E in 1997. (28) In the late 1970s, Japan became the second foreign country to receive the F-15. Following an initial delivery of McDonnell Douglas built aircraft, Mitsubishi Company assumed the role of primary contractor for production of Japanese Air Self Defense Force F-15J/DJ aircraft. (16:51-52) Including scheduled deliveries, Japan currently maintains an inventory of 166 F-15J (single-seat) and 43 F-15DJ (two-seat) aircraft. (29) Saudi Arabia began purchasing F-15C/D aircraft for the Royal Saudi Air Force (RSAF) in the early 1980s and has programmed purchases of an export version of the F-15E through 1998. (30) The RSAF downed two Iraqi Mirage F-1s with the F-15 during Operation DESERT STORM. (31)

Logistics Support

The F-15 program has experienced numerous logistical challenges during the last 25 years. Initially, Air Force planners concentrated on procurement of aircraft as opposed to procurement of spares, and early F-15 units suffered from spares shortages. (11,20:24) The shortages were exacerbated as more aircraft entered service. While initial shortfalls in spares procurement have been largely resolved, many systems on the aircraft continue to experience parts shortages. Additionally, poor reliability plagued the F-15A/B's new Pratt and Whitney F100-PW-100 turbofan engines. (11) The reliability problems associated with this new generation, modular engine were largely overcome through technical modifications and improvements to materials, maintenance, and operating procedures. Over the years, engine upgrades have improved the performance and supportability of the F-15's engines.

Current logistics challenges for the F-15A/B/C/D stem from subsystem incompatibility between older and newer configurations, and accumulated wear and tear on flight control surfaces. Logistics support for older avionics systems like the APG-63 radar requires innovative parts management and unique software support to incorporate improvements to the older systems. Additionally, cathode ray tubes (CRTs) used in the F -15 cockpit are increasingly difficult to support as the aerospace industry moves to flat panel displays, and fewer contractors are available to build and repair CRTs. Finally, aging flight control surfaces require ever increasing attention due to limited funding and difficulties associated with repair of older flight control components. (3)

Today, logistic support problems for the F-15E center around CRTs. The monthly demand rates for CRTs often exceeds the capacity of available contractor support. In the case of the multi-purpose color display (MPCD), the addition of another contractor certified for CRT production should resolve current shortfalls. However, for many other systems using CRTs, an upgrade to the system itself may prove to be the only real solution. (37)

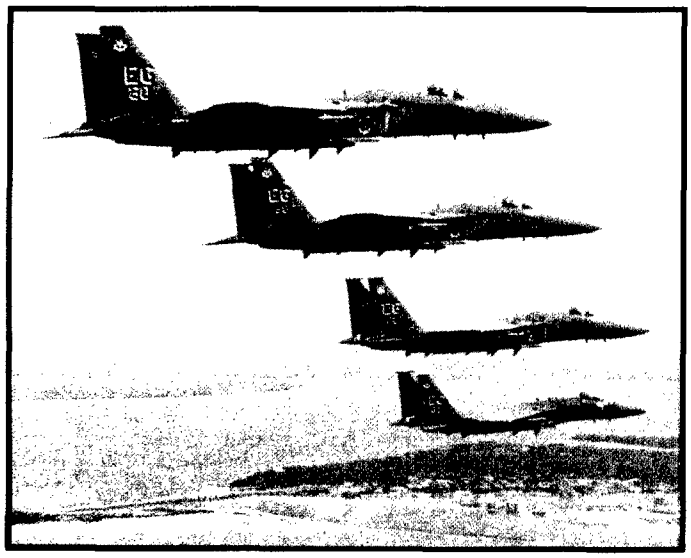
Combat

Ironically, the F-15's first combat engagement was not flown by the US Air Force, but by the Israeli Defense Force (IDF). On 27 June 1979, during an escort mission for aircraft striking terrorist bases in southern Lebanon, a flight of Syrian MiG-21s attempted to intercept the attacking Israeli force. Six Israeli F-15s engaged and destroyed five MiG-21s, enabling the IDF

aircraft to complete their mission and return safely to base. (15:166) The first victory against a MiG-25, the threat the F-15 was designed to counter, was also claimed by the IDF.

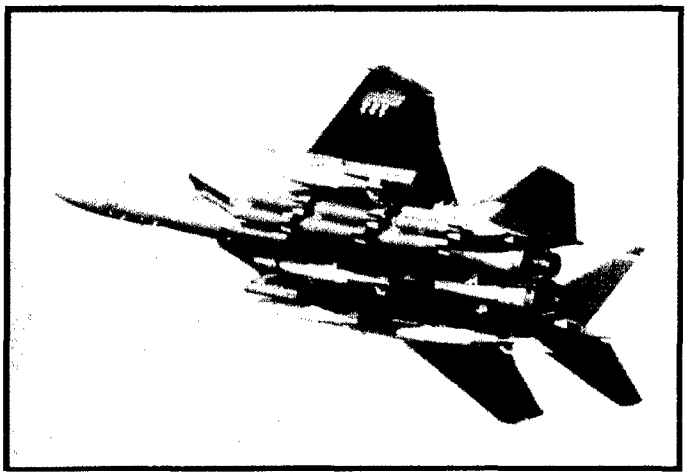
The first aerial victories for US Air Force F-15s would not be in the skies over Europe, as had been anticipated during the height of the Cold War, but over the deserts of the Middle East. At the beginning of August 1990, Iraqi forces invaded Kuwait and began a massive buildup along Saudi Arabia's northern border. On 6 August 1990, following a series of meetings with Saudi and Kuwaiti leaders, the US responded to the Iraqi aggression with Operation DESERT SHIELD. Within 36 hours of deployment notification, F-15C/D aircraft from the 1st TFW, Langley AFB, were on the ground in Saudi Arabia. (22:32) Over the next five months, other F-15C/D/E units from the 4th TFW, Seymour Johnson AFB; the 33rd TFW, Eglin AFB; the 36th TFW, Bitburg AB; and the 32nd TFG, Soesterberg AB, The Netherlands, would deploy to Saudi Arabia and Turkey. (19:7) Throughout the buildup of coalition forces, F-15C/D/E aircraft flew combat air patrols and training missions with the air forces of other coalition nations. On the morning of 17 January 1991, coalition forces took the offensive as Operation DESERT SHIELD gave way to Operation DESERT STORM.

The majority of coalition air-to-air engagements during the Gulf War were fought by US Air Force F-15Cs against Iraqi aircraft attempting to flee to Iran. In total, F-15Cs accounted for 36 of the 39 enemy aircraft destroyed by the Air Force during the war. (8:133) The fact that the 36 kills were achieved without a single combat loss is testament to the capabilities of the weapons system and the abilities of our pilots and logistics personnel. Twenty-five of the F-15C kills were beyond visual range using the AIM-7 Sparrow missile, while ten additional kills were made with the AIM-9 Sidewinder missile. Perhaps the most unusual F-15 victory of the war occurred when an F-15C pilot maneuvered his aircraft in such a manner that his MiG-29 opponent was forced into the ground. (19:6-7)



F-15Cs, Including Those of the 58th Tactical Fighter Squadron, Eglin AFB, Flew Over 5,900 Sorties and Dominated the Skies Over Iraq.

In early August 1990, F-15Es of the 336th Tactical Fighter Squadron (TFS), 4th TFW, Seymour Johnson AFB, deployed to the Persian Gulf region. Although these aircraft lacked the targeting pod for the LANTIRN system, the Strike Eagles served as a viable deterrent to further escalation on the part of Iraq. (19:8) In December 1990, F-15Es of the 336th TFS joined those of the 335th TFS (its sister squadron from Seymour Johnson AFB) at Al Kharj, Saudi Arabia. (16:68) While at Al Kharj, both squadrons received a total of 24 LANTIRN targeting pods, which were successfully employed throughout the war. Perhaps the most publicized of the 2,200 sorties flown by the F-15Es during the war were "Scud-busting" missions. During these missions, Strike Eagles joined other coalition aircraft in searching for and attacking Iraqi Scud missile launchers targeted at Israel and Saudi Arabia. (19:8)



An F-15E Undergoing Weapons Flight Tests Illustrates the Level of Firepower Brought to Operation DESERT STORM by the 4th TFW, Seymour Johnson AFB.

A Look Ahead

Today, US Air Force F-15s continue to enforce "no-fly" zone restrictions on Iraqi fixed-wing aircraft imposed under the terms of the United Nations cease-fire agreement and are an integral part of ongoing Air Expeditionary Force deployments. Although the F-22 is scheduled to begin replacing F-15 C/D aircraft as early as 2005, the F-15C/D fleet should remain in service well beyond that date. Additionally, because a replacement is not currently on the books, one can expect the F-15E Strike Eagle to remain in service well into the next century. As we move into the 21st century, the F-15 weapon system will remain the US Air Force's primary air superiority and interdiction platform.

The F-15 program has a proud history highlighted by combat success, numerous time-to-climb records, and innovation for aerospace technology. The accomplishments of the F-15 program can be attributed to the myriad of people supporting the program over the last 25 years. As the F-15 launches into the next century, the continued success of this premier air superiority and interdiction aircraft is in the safe, capable hands of the Eagle Keepers.

As the Mission Draws to an End, This F-15C Returns Home to the Capable Hands of the Eagle Keeper.

References

1. "Air Force Hopes for Approval of F-15 Buy to Total 700." *Aviation Week and Space Technology*, Vol. 92, No. 1 (5 Jan 70), pp. 18-19.
2. "Air Force Tests Antisatellite Payload." *Aviation Week and Space Technology*, Vol. 121, No. 21 (19 Nov 84), p. 28.
3. Battle, Crawford. F-15 Structural Engineer, F-15 System Program Office, interview with Captain David R. King, Warner Robins Air Logistics Center, Robins AFB, GA, 24 Feb 97.
4. Brownlow, Cecil. "Air-to-Ground Capability Seen for F-15," *Aviation Week and Space Technology*, Vol. 97, No. 1 (3 Jul 72), pp. 18-19.
5. ————. "Soviet Air Force Unveils Advanced Designs for Expanded Limited War Capability," *Aviation Week and Space Technology*, Vol. 87, No. 3 (17 Jul 67), pp. 32-35.
6. Bursey, Roger. Program Manager Advanced Engines, Pratt and Whitney, Government Engines and Space Division, West Palm Beach, FL, telephone conversation with Captain David R. King, 28 Feb 97.
7. Correll, John T., Major, USAF. "The Fastest Climb," *AIRMAN*, Vol. XIX, No. 5 (May 75), pp. 30-34.
8. ————, et al, (eds). "USAF Almanac 1996," *Air Force Magazine*, Vol. 79, No. 6 (May 96).
9. "Defense Dept. Plans Next Test Firing of Air-Launched Asat System." *Aviation Week and Space Technology*, Vol. 123, No. 12 (23 Sep 85), pp. 20-21.
10. "F-15 Advanced Fighter Makes First Flight." *Aviation Week and Space Technology*, Vol. 97, No. 6 (7 Aug 72), p. 19.
11. "F-15, F-111s Help Depress USAF Tactical Readiness." *Aviation Week and Space Technology*, Vol. 111, No. 7 (13 Aug 79), p. 16.
12. Francillon, Rene J. *McDonnell Douglas Aircraft Since 1920*, London: Putnam & Company, 1979.
13. Fulghum, David. "AMRAAM Improvement Plan To Gain Conditional Approval," *Aviation Week and Space Technology*, Vol. 132, No. 22 (28 May 90), p. 21.
14. "FX Awards." *Aviation Week and Space Technology*, Vol. 90, No. 1 (6 Jan 69), p. 31.
15. Halperin, Merav, and Aharon Lapidot. *G-Suit Combat Reports from Israel's Air War*, London: Sphere Books, Ltd., 1990.
16. Holder, Bill, and Mike Wallace. *McDonnell-Douglas F-15 Eagle*, Atglen, PA: Schiffer Publishing, 1994.
17. Jackson, Paul, et al, (eds). *Jane's All the World's Aircraft 1996-97*, Alexandria, VA: Jane's Information Group, Inc., 1996.
18. Kandebo, Stanley W. "First Flight of STOL Performance F-15 Demonstrator Set for July," *Aviation Week and Space Technology*, Vol. 128, No. 25 (20 Jun 88), pp. 107-109.
19. Kinzey, Bert. *U.S. Aircraft & Armament of Operation Desert Storm*, Waukesha, WI: Kalmbach Publishing, 1993.
20. Kozicharow, Eugene. "USAF Adopts Spare Parts Plan," *Aviation Week and Space Technology*, Vol. 119, No. 20 (14 Nov 83), pp. 24-26.
21. ————. "USAF Selects F-15 as Dual-Role Fighter," *Aviation Week and Space Technology*, Vol. 120, No. 10 (5 Mar 84), pp. 18-19.
22. Martin, Jerome V., Lt Col, USAF. *Victory From Above*, Research Report No. AU-AC1-92-8, Maxwell AFB, AL: Air University Press, Jun 94.
23. Morrocco, John D. "AMRAAM Unsuccessful In Key Test Launch; Congress Cuts USAF Missile Programs," *Aviation Week and Space Technology*, Vol. 131, No. 7 (14 Aug 89), pp. 24-25.
24. ————. "USAF Budget Cuts SICBM Program, Delays Initial ATF Procurement," *Aviation Week and Space Technology*, Vol. 128, No. 8 (22 Feb 88), pp. 15-16.
25. News Digest. *Aviation Week and Space Technology*, Vol. 87, No. 23 (4 Dec 67), p. 33.
26. ————. *Aviation Week and Space Technology*, Vol. 125, No. 24 (15 Dec 86), p. 28.
27. Pace, Steve. *X-Fighters*, Osceola, WI: Motorbooks International, 1991.
28. Peacock, Lindsay. "Israel," *Jane's World Air Forces*, edited by Paul Jackson, Alexandria, VA: Jane's Information Group Inc., 1996.
29. ————. "Japan," *Jane's World Air Forces*, edited by Paul Jackson, Alexandria, VA: Jane's Information Group Inc., 1996.
30. ————. "Saudi Arabia," *Jane's World Air Forces*, edited by Paul Jackson, Alexandria, VA: Jane's Information Group Inc., 1996.
31. Phillips, Dave. McDonnell-Douglas Aircraft, F-15 Division, St. Louis, MO, telephone conversation with Captain David R. King, 28 Feb 97.
32. Schlitz, William P. Aerospace World, *Air Force Magazine*, Vol. 58, No. 1 (Jan 75), p. 16.
33. ————. Aerospace World, *Air Force Magazine*, Vol. 59, No. 3 (Mar 76), pp. 17-18.
34. "S/MTD Night Landing." *Aviation Week and Space Technology*, Vol. 135, No. 8 (26 Aug 91), p. 11.
35. "USAF Flight Tests Asat Weapon." *Aviation Week and Space Technology*, Vol. 120, No. 5 (30 Jan 84), p. 19.
36. U.S. Department of Defense, Strategic Defense Initiative; U.S. Congress, Office of Technology Assessment; and The Heritage Foundation. *Anti-Missile and Anti-Satellite Technologies and Programs, SDI and ASAT*, Park Ridge NJ: Noyes Publications, 1986.
37. Vaughn, Jerry. Chief, F-15 Avionics Branch, F-15 System Program Office, interview with Captain David R. King, Warner Robins Air Logistics Center, Robins AFB, GA, 24 Feb 97.
38. Wetmore, Warren C. "Fuel Pallets Increase Range of F-15A," *Aviation Week and Space Technology*, Vol. 111, No. 10 (9 Sep 74), pp. 39-41.

Captain King is an acquisition officer and has worked with the F-15 program for six years. He is currently the Chief of the F-15 Avionics Section, F-15 System Program Office (SPO), Warner Robins Air Logistics Center, Robins AFB, Georgia. He was previously assigned to the F-15 SPO, Wright-Patterson AFB, Ohio, as a program manager for weapons integration and as an F-15E flight test manager.

Captain Massey is presently a project manager in the Maintenance and Munitions Division at the Air Force Logistics Management Agency, Maxwell AFB, Gunter Annex, Alabama. He was previously assigned to the 57th Fighter Squadron, Keflavik Naval Air Station, Iceland, where he was responsible for F-15C/D flight line maintenance.

The authors gratefully acknowledge the assistance of the History Office at Edwards AFB, California, and the 46th Test Wing, Eglin AFB, Flordia, for much of the photographic support used in this article.