

# Nine Lives of a Phantom II

By: Tony R. Landis



## The Story of YF-4E #62-12200

Throughout aviation history, there have been a number of aircraft that have contributed greatly to the advancement of fighter aircraft technology, the North American P-51 Mustang & F-86 Sabre, McDonnell Douglas F-15, General Dynamics/Lockheed Martin F-16 & F-22, and

many more. As of July 2024, one of those aircraft sits forlornly in the back of a storage hangar at the National Museum of the United States Air Force (NMUSAF). The strange canards added to the upper intakes go unnoticed by most people, yet the McDonnell Douglas YF-4E made significant contributions to advance designs that have direct impact on the aircraft of today.



McDonnell Douglas/AFFDL YF-4E fly-by-wire testbed in flight near Edwards AFB, CA. (AFTC History Office)

This particular Phantom II has a significant and diverse history attached to it. The Navy's F4H-1 was such a success that the Department of Defense (DoD) requested derivatives for the USAF. Designated as the F-110A Spectre, the first Air Force derivatives were actually Navy F4H-1's in disguise. In March 1962, the DoD announced that the aircraft would become the latest fighter and reconnaissance aircraft for the USAF. On March 30, McDonnell Aircraft received a letter of intent for a single F-110A (serial number 62-12199), and on May 29, McDonnell received a second letter for two YRF-110A reconnaissance aircraft (serial numbers 62-12200 and 62-12201).



The first YRF-4C #62-12200 rolls out of the McDonnell Aircraft plant in summer 1963. (Craig Kaston Collection)

Prior to delivery, the Air Force changed the designations of the aircraft from F-110 and RF-110 to F-4C and RF-4C, respectively. YRF-4C #62-12200 performed its maiden flight on 8 August 1963 with William "Bill" Ross at the controls. Though it had the modified nose for the RF-4C, it carried a limited amount of photographic equipment and served primarily as the aerodynamic testbed.



YRF-4C #62-12200 during a test flight in the blue skies above Edwards AFB on 15 January 1964. (AFTC History Office)

Paths to the Present

# FLASHBACK



The YRF-4C is parked on the ramp at Holloman AFB, New Mexico, after its 100th flight on 14 August 1964. (Gerald Balzer Collection)



After McDonnell installed the M61A1 Gatling gun in the nose, the aircraft was known as the 'F-4-TFS'. (Mark Nankivil Collection)

Upon completion of the reconnaissance test program at Holloman AFB, New Mexico, in June 1965, 12200 went back to St. Louis for modifications to remove the photographic equipment and install an M61A1 Gatling Gun, which protruded through the forward-looking reconnaissance window. At this point McDonnell referred to the aircraft as an "F-4-TFS" for Tactical Fighter Support. Upgrades continued on the YRF-4C when the aircraft received new General Electric J79-GE-J1B engines (prototypes of the -10 and -17 series) in February 1966.

YRF-4C 12200 received more modifications to become the aerodynamic prototype for the F-4E program, with the official designation change from YRF-4C to YF-4E on 20 April 1967. Beginning in 1968, the YF-4E tested a rudder made of Beryllium rather than the standard aluminum version. Engineers at the Air Force Flight Dynamics Laboratory (AFFDL) proposed the use of Beryllium as an added weight savings since a Beryllium rudder weighed 34.6 percent less than aluminum. YF-4E 62-12200 conducted its first flight with the new rudder on 14 May 1968 and performed 158 test flights over the next 39 months. While testing the new rudder, the Air Force modified the aircraft to test fixed leading edge maneuvering slats under Project Agile Eagle IV and also tested slotted horizontal stabilators prior to being fitted to the F-4E fleet. The fixed wing leading edge slats were removed at the end of the test program.



The M61A1 Gatling gun is barely visible under the nose in this view of 12200 in flight over St. Louis, MO. (Craig Kaston Collection)



The next step in the evolution of the YF-4E was the testing of a Beryllium rudder and wing leading edge slats during Project Agile Eagle. (Boeing Historical Archives)



During 1970, the YF-4E tested a Simplex Integrated Actuator Package which provides emergency backup hydraulic power in case of main system failure. (NMUSAF Archives)





In 1972, the Air Force and McDonnell Douglas (McDonnell Aircraft and Douglas Aircraft merged to become McDonnell Douglas in 1967) chose YF-4E 62-12200 as the flight test vehicle for the Survivable Flight Control System (SFCS) program. As described in report AFFDL-TR-73-105: Survivable Flight Control System Final Report, "The Survivable Flight Control System (SFCS) is a three-axis fly-by-wire (FBW) primary flight control system using secondary actuators to provide position commands to the surface actuators. In the fly-by-wire system, electrical sensors measure pilot commands, in the form of stick and pedal movements, and the aircraft flight path responses in pitch, roll, and yaw. Computers process the sum of the sensor inputs and act to provide electrical signals which move the primary control surfaces, such as ailerons, to produce the desired aircraft motion. In the event of a total computational failure or sensor malfunction, a direct electrical path, called the electrical back-up mode, is provided to allow the pilot to get home and land. The final configuration of the SFCS provides true fly-by-wire control of all primary flight control surfaces, with no mechanical control system in any axis."



YF-4E #12200 takes-off from Lambert Field in St. Louis, MO, for the first flight of the Survivable Flight Control System (SFCS) program on 29 April 1972, to become the first fighter aircraft to use a fly-by-wire control system. (Mark Nankivil Collection)



The YF-4E during a test flight out of Edwards AFB, CA. The aircraft is carrying the McDonnell Douglas Eliminate Range Zero System (EROS) collision avoidance pod in the aft left missile bay. (AFTC History Office)



AFSC Chief of Staff, Maj. Gen. Vernon R. Turner (left) receives a demonstration flight in the YF-4E on 24 May 1973. McDonnell pilot Pete Garrison (center) and USAF FBW manager James W. Morris (right) are all smiles. (NMUSAF Archives)

The striking white & blue paint scheme of the YF-4E shows up well in this view of 12200 during a test flight. Note the blue stripe was left off of the intake splitter during early test flights. (AFTC History Office)



SFCS Phase I was conducted in the laboratory using ground simulations, actual flight test was conducted during Phase II. The Phase II flight test program was divided into three sub-phases:

Phase IIA- Development and evaluation of the SFCS utilizing a quadruple-redundant,

three-axis analog FBW flight control with an interim mechanical backup control system.

Phase IIB- Evaluation of the SFCS using the three-axis analog FBW control system with no mechanical backup.

Phase IID- Air Force evaluation and demonstration flights.

The YF-4E conducted the first Phase IIA flight from the McDonnell Douglas facility in St. Louis, Missouri on 29 April 1972 to become the first fighter aircraft to fly with an analog fly-by-wire control system (not to be confused with NASA's modified F-8C which made the first Digital fly-by-wire flight on 25 May 1972). Ferried to Edwards AFB, California, soon after the first flight, the majority of testing centered around developing confidence in the system reliability of the analog fly-by-wire control system. After the 27<sup>th</sup> flight on 8 September 1972, the aircraft was temporarily grounded at Edwards while the mechanical back-up system was removed.

Phase IIB began early the following year, with the YF-4E making the first flight with an analog fly-by-wire control system and no mechanical back-up on 22 January 1973 at Edwards AFB. The aircraft made a total of 19 flights for 18.3 flight hours during Phase IIB testing, with the final Phase IIB flight occurring on 7 May 1973, though some Phase IID flights occurred concurrently with Phase IIB testing. The YF-4E also became the first



A specialized control van was assigned to the YF-4E at Edwards AFB, CA, during the Survivable Flight Control System test program. Note blue stripe added to intake splitter. (USAF Photo)



USAF and McDonnell Douglas personnel pose with YF-4E 12200 after its 700th flight. The milestone flight took place at Edwards AFB, CA, during the SFCS fly-by-wire program on 24 May 1973. (Gerald Balzer Collection)



fly-by-wire aircraft to fly at Mach 2 during this series of testing.

Dividing Air Force Phase IID testing into two separate categories, Evaluation and Demonstration, the Evaluation portion began on 21 March 1973 and finished on

8 May 1973 after a total of 21 flights. Phase IID demonstration flights commenced on 25 April 1973, and finished on 31 May 1973. Thirteen pilots from the Air Force, Marines, and NASA participated in the 21-flight program. All participants received back seat flights except for three demonstration pilots that received two flights each from the front seat. Two additional flights were required to ferry the aircraft back to St. Louis.

Once again, the YF-4E was chosen to participate in a new Control Configured Vehicle (CCV) test program under the USAF/McDonnell Douglas-sponsored Precision Aircraft Control Technology (PACT) program. During this program, the aircraft received canards mounted on the shoulder of each intake. As designed,



the canards had a surface area of 40 square feet, yet the outer panels were removable permitting flight testing with partial span canards have a surface area of 17 square feet. Each canard was driven by a production F-15 stabilator actuator with structural clearance providing



Under the Precision Aircraft Control Technology (PACT) program, 12200 was modified with canards on the shoulder of each intake and also had the fixed leading edge slats installed for better maneuverability. (Boeing Historical Archives)





*The initial check flights of the PACT program took place in St. Louis without the canards installed. First flight of the PACT program took place on 5 July 1974. (Mark Nankivil Collection)*

canard movement of +20 degrees (canard leading edge up) and -30 degrees (canard leading edge down) but electronics limited the movement to +/-10 degrees. While undergoing CCV modifications, a set of fixed wing leading edge slats became available and were installed at this time.

The initial shakedown flights took place in St. Louis without the canards installed beginning on 12 June 1974. With these flights completed, the YF-4E was ferried to Edwards AFB on 20 June for continued testing. Once at Edwards, engineers installed the canards and flight testing continued. The modified aircraft

took to the skies for the first time in its canard-equipped configuration on 5 July 1974, with McDonnell Douglas pilot Bill Brinks at the controls. Over the course of the 30-flight test program the aircraft performed 22 flights with full span canards and wing leading edge slats, 2 flights with full-span canards and no wing slats and a single flight with partial-span canards and wing leading edge slats. At the completion of the PACT/CCV program, the YF-4E was



*Stunning over-the-top view of YF-4E 12200 during a test flight over the Mojave Desert during the PACT test program. The canards on each intake and the addition of fixed wing leading edge slats show up well in this view. (AFTC History Office)*



ferried back to St. Louis for disposition on 23 Aug 1974, and never flew again. For these flights, the YF-4E retained the canards and leading edge slats, and also carried along a fuel tank on each wing, as well as a cargo pod on the centerline station.

After years in storage, AFFDL project engineer, James Morris, heard from friends at McDonnell Douglas that the airframe would be scrapped. Morris was able to convince the United States Air Force Museum in Dayton, Ohio to accept the aircraft as a donation. The museum accepted the aircraft on 5 December 1978, now he just had to get it there. Morris placed a call to the 272<sup>nd</sup> Transportation Company, Fort Sill, Oklahoma, and explained his problem. The Commanding officer decided that transporting the aircraft to Dayton would be a great training exercise, and he sent a CH-54B Tarhe (Skycrane) heavy-lift helicopter with a helicopter escort to St. Louis to retrieve the Phantom II. On 9 January 1979, the Skycrane and its cargo departed St. Louis and safely delivered the aircraft to the Dayton museum.

While fly-by-wire control systems are commonplace in today's aircraft, few people understand the difficulty to achieve this goal. The YF-4E serves as a visual reminder of the challenge of building a Fly-By-Wire system.



*After years of storage, the YF-4E was donated to the National Museum of the United States Air Force and transported via CH-54B from McDonnell Douglas's facility in St. Louis. (NMUSAF Archives)*



*The freshly repainted YF-4E is photographed at the NMUSAF before being placed on outdoor display in 1981. (NMUSAF Archives)*



*As of June 2024, YF-4E #62-12200 sits parked in the corner in the Annex of the NMUSAF awaiting its turn at a full restoration and display at the world's premier aerospace museum. (Author photo)*

The author would like to thank the following contributors that made this article possible: Will McLaughlin of the NMUSAF Archives, Mike Lombardi and Amanda Bailey-Storch of the Boeing Historical Archives, Jeannine Geiger at the AFTC History Office, Mark Nankivil, Craig Kaston, Dennis Jenkins and Gerald Balzer.



## YRF-4C/YF-4E #62-12200 Photo Essay



Rare color photo of YRF-4C #62-12200 as it first rolled out of the McDonnell hangar in St. Louis, MO. (Craig Kaston Collection)



The fixed wing leading edge slats show up well in this view of 12200 during Project Agile Eagle IV. (Boeing Historical Archives)



The clear blue skies above St. Louis, Mo, provide the perfect backdrop for this shot of YF-4E 12200. Note the fixed wing leading edge slats and the white-painted Beryllium rudder. The aircraft also carried the McDonnell Douglas EROS collision avoidance system pod. (Boeing Historical Archives)



Rear view of 12200 on the ramp at the McDonnell Douglas facility in St. Louis. Note the words 'Fight Test' painted on the upper surface of the horizontal stabilizers. (Boeing Historical Archives)



The M61A1 Gatlin gun is barely visible under the nose in this view of YF-4E #62-12200 on the ramp in St. Louis. (Mark Nankivil Collection)



*The freshly painted YF-4E is parked outside the hangar at the McDonnell Douglas plant in St. Louis. (Gerald Balzer Collection)*



*YF-4E 12200 parked at the McDonnell Douglas Facility in St. Louis, awaiting delivery to Edwards AFB, CA. (Boeing Historical Archives)*



*YF-4E 12200 was rolled out of the McDonnell Douglas plant showing its new colors on 29 April 1972. (Boeing Historical Archives)*



*Initial test flights of the Survivable Flight Control System YF-4E, like the one at left on 4 May 1972, took place from the McDonnell Douglas facility in St. Louis, MO. (NMUSAF Archives)*





The McDonnell flight crew performs a walk around inspection of the YF-4E prior to a test flight of the Survivable Flight Control System out of St. Louis, MO. (NMUSAF Archives)



McDonnell flight test crew members Bill Brinks and Joe Dobronski review preflight test points with Irv Burrows, Henry Harschburger and others. (NMUSAF Archives)



The Survivable Flight Control System project logo (below) was carried on both sides of the aircraft during the SFCS program. (Mick Roth)

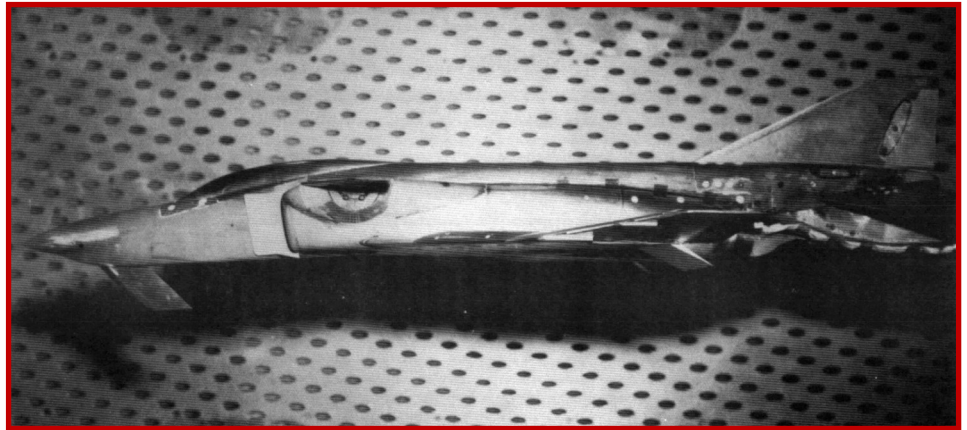
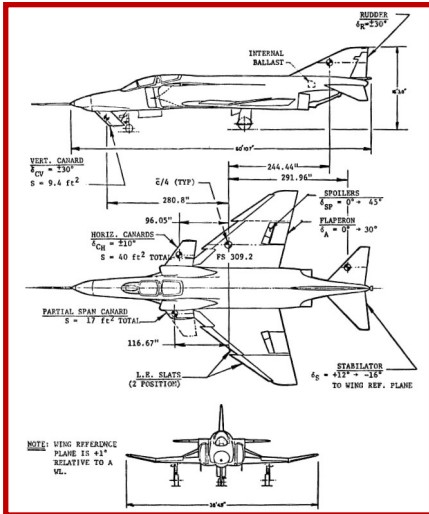


YF-4E 62-12200 was placed on display next to the fourth McDonnell Douglas F-15A Eagle at the Edwards AFB Open House in May 1973. (Mick Roth)

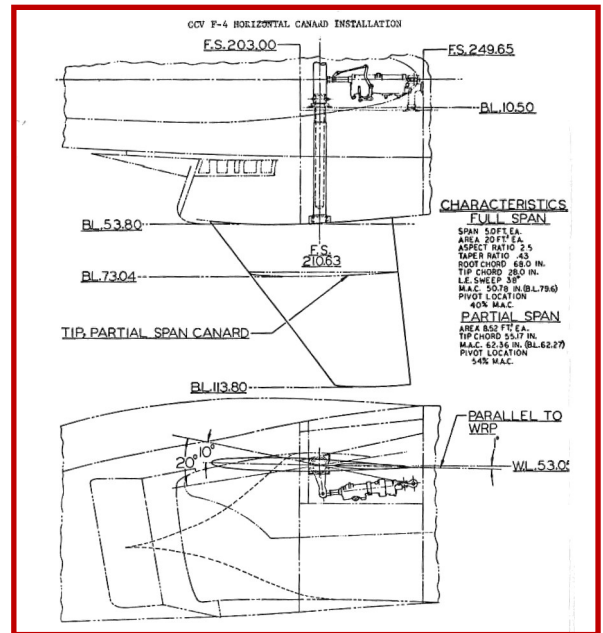
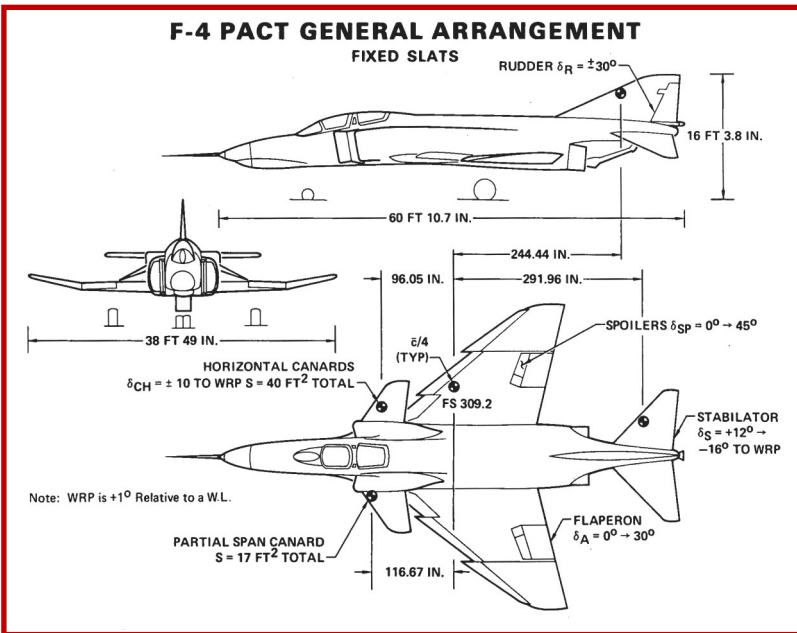


Final preflight checks are performed prior to a test flight out of Edwards AFB, CA. (ASC Photo Collection)





The original layout for the PACT/CCV F-4 modifications included a small fin on the underside of the nose as shown on this wind tunnel model at Arnold Engineering Development Center, TN. (USAF/AEDC Collection)



The canards mounted on the shoulders of each intake have a span of 5 feet with a surface area of 17 square feet. The outer 3 feet of each canard is removable and a single test flight was accomplished utilizing the partial-span canards. (USAF Illustrations)



The removable, white-painted, outer portion of the canards show up well in the underside view above. (Author)



Initial shakedown flights of the PACT-configured aircraft took place in St. Louis without the canards installed. (Boeing Historical Archives)

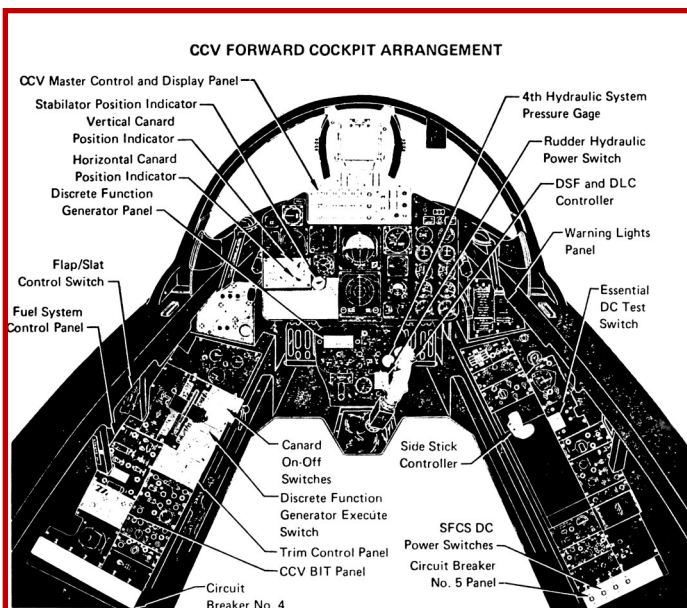




Pilots perform last minute preflight checks on 12200 while parked the east end of Runway 22/04 at Edwards AFB. (Gerald Balzer Collection)



The canard-equipped YF-4E had a unique look when viewed from the front. (Gerald Balzer Collection)



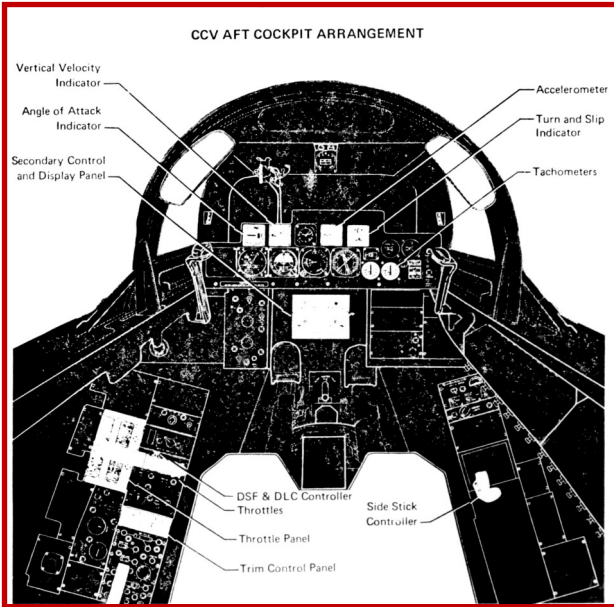
Fair quality illustration showing the modified forward cockpit of YF-4E #62-12200 during the PACT/CCV test program. Note the side stick control on the right hand console in the cockpit, and canard control switches on the left side of the main panel and left console. (USAF)



The heavily-modified cockpit of the YF-4E remains mostly complete as of July 2024. The SFCS/Fly-By-Wire control display occupies the majority of the instrument control panel (above). Unfortunately, the side stick control had been removed from the right side console (left) prior to coming to the museum. (Author)







The YF-4E aft cockpit (above) contained basic flight instruments as the aircraft could be flown from this position. The back-up SFCS/Fly-By-Wire control display is beneath the flight instruments, and the aft side stick control has also been removed. (Author)



The wing leading edge slats and canards show up well in this underside view of the YF-4E taken on 5 July 1974. Note the addition of the PACT emblem on the right side inlet. (AFTC History Office)

The YF-4E, with canards and wing leading edge slats installed, banks away from the camera during a test mission on 18 July 1974. (AFTC History Office)







*This page contains a series of inflight photos taken of the YF-4E with canards and fixed wing leading edge slats during the PACT/CCV test program at Edwards AFB, CA between July & August 1974. Note that the aircraft has the Air Force Systems Command (AFSC) emblem and SFCS logo on the left side and the Air Force Flight Dynamics Laboratory (AFFDL) emblem and PACT logo on the right. (AFTC History Office-all)*







The dark blue bottom (FS 15044) and lack of wing leading edge slats show up well in these 2 flight views of the YF-4E over Edwards AFB on 12 August 1974 at left. (USAF Photos by Sgt. Wayne Berry-AFTC History Office Collection)



Col. Brian D. Ward, Air Force Flight Dynamics Laboratory Commander, received a demonstration flight in the FBW YF-4E with McDonnell Douglas test pilot, Pete Garrison on 15 August 1974. (NMUSAF Archives)



While heading back to Edwards AFB at the end of a test mission on 18 July 1974, 12200 passes over the Rio Tinto Borax Mine in Boron, CA. (AFTC History Office)



Gear down & flaps deployed, the flight test crew of YF-4E #62-12200 prepares to make a left turn approach to the main runway at Edwards AFB. (AFTC History Office)





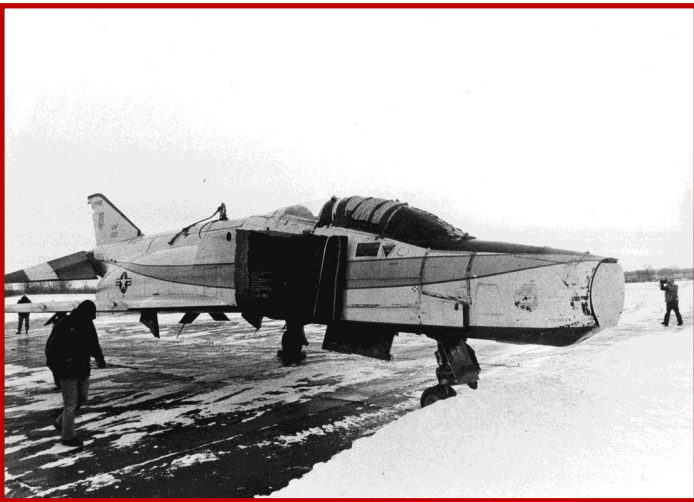
After nearly 5 years in storage at the McDonnell Douglas facility in St. Louis, the YF-4E was accepted into the collection of the USAF Museum (now known as the National Museum of the United States Air Force (NMUSAF)) on 5 December 1978. The aircraft was transported to the museum by air via U.S. Army CH-54B Tarhe (Skycrane) helicopter. The photos on this page show the aircraft's departure from St. Louis. (NMUSAF Archives)







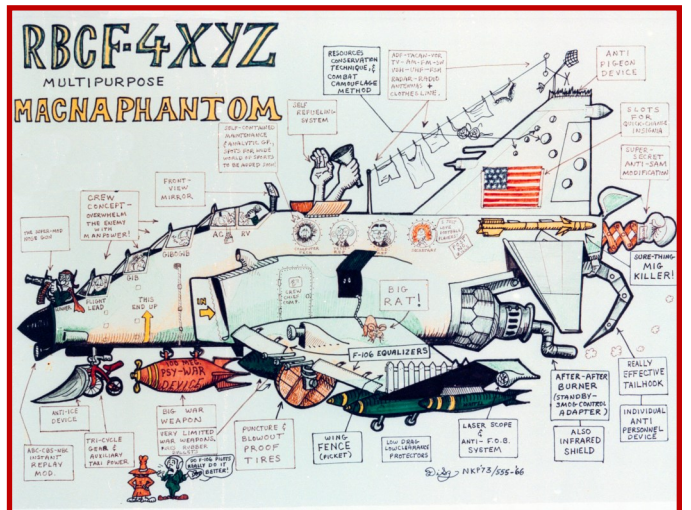
The weather upon arrival to the USAF Museum was overcast with intermittent snow, making for a very chilly arrival to its new home. Many components were removed and shipped by ground to make the aircraft light enough to be transported by helicopter. (NMUSAF Archives)



The restored YF-4E at the National Museum of the United States Air Force in 1981. (NMUSAF Archives)



Beautiful rendition of 12200 in flight, painted in 1979 by artist Edward Kirk, is now displayed in AFMC Headquarters.



Humorous look at the versatility of the F-4 Phantom II aircraft.





## **AFMC History & Museums Program**

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