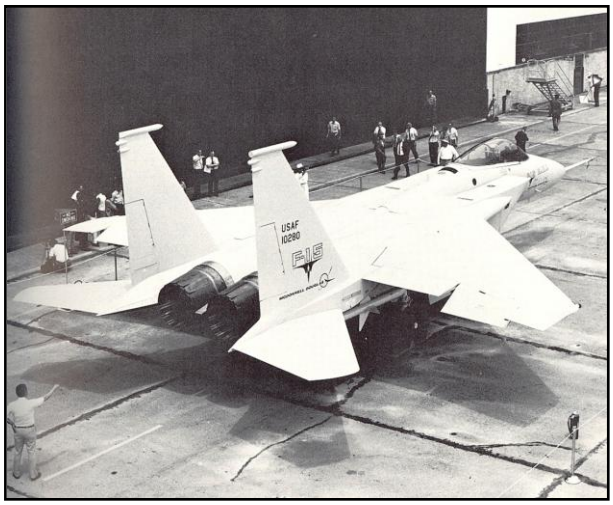
FORTY YEARS OF AIR SUPREMACY
F-15 EAGLE—THE BEGINNINGS

27 July 1972. The pre-dawn desert temperatures were in the mid-seventies, and the skies were clear with a bright full moon. It promised to be another 115 degrees or more in the Mojave Desert's Edwards Air Force Base. It was early, a full hour before the 0600 dawn, when the McDonnell Aircraft Company support staff arrived at their workstations in the large hangar on Contractor Row. Those directly involved with the planned day's activities had not slept well the previous night. Likely, Experimental Test Pilot, Irv Burrows, had gotten far less sleep. This was to be the day—**First Flight of the F-15 Eagle!**

This day would be the culmination of a decade of USAF and Contractor studies, simulations, and ground tests aimed at providing the United States with the best Air Superiority fighter in the world—the first fighter designed specifically for Air Superiority since the F-86 Sabre Jet developed more than 20 years earlier.

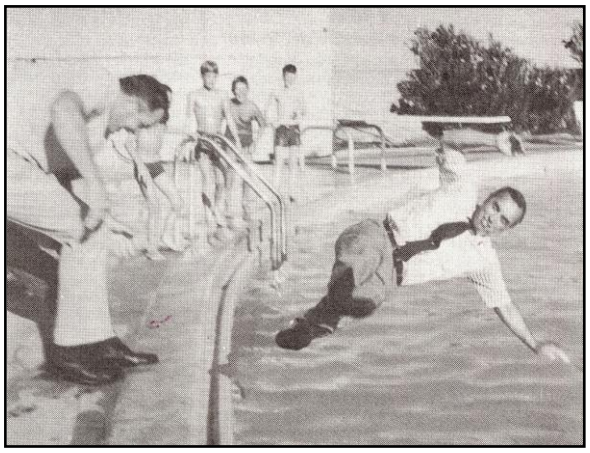
A cadre of about 100 McDonnell experts in various specialties had anticipated this day for 3 ½ years. These personnel had moved from St. Louis to California during the few weeks before. Most had participated in the airplane development and flight test planning beginning in early 1969 during the competition between three airframe contractors and had worked on the proposal effort. Many had continued with the program through Contract Award, the various Design stages, and Fabrication. (Before the test program ended, there were nearly 400 St. Louis transplants, and there were an additional 100 or so who were locally hired). In addition to the McDonnell personnel were several supplier representatives from Pratt & Whitney, General Electric, etc. Of course, the Air Force Flight Test Center at Edwards was deeply involved in the program—the F-15 Joint Test Force (JTF) had been formed more than a year before.



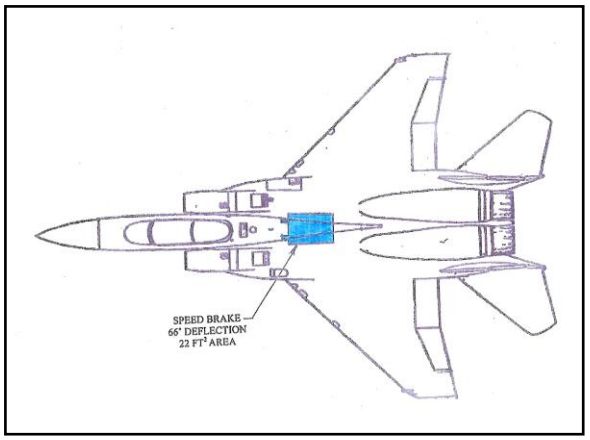
Following the "Roll-Out" ceremony at the St. Louis manufacturing plant, F-15 #1 was partially disassembled and flown to Edwards as cargo in an Air Force C-5A. After re-assembly at Edwards, several engine runs, and four high-speed taxi tests, all agreed that it was time for the Eagle to fly—a month earlier than originally scheduled and only 31 months after Contract Award (contrast that 31 months with the 73 months for the F-22 and 62 months for the F-35, both of which had been preceded by "fly-off" prototype programs!).

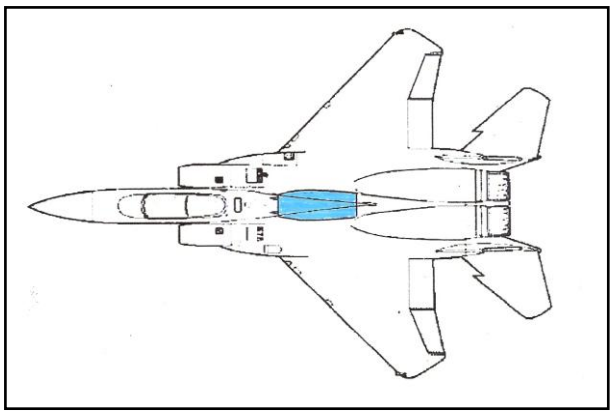
Eight or ten engineers were on duty in the Test Control and Telemetry Room well before engine start time. After what seemed like a very long time, but actually only 25 minutes after engine start, the brakes were released (0820 hours) to begin the takeoff roll. The liftoff from Runway 04 (northeast over the dry lake bed in the event of an emergency) took place in front of an assembled crowd of employee families and various VIPs positioned on a small hill near the predicted liftoff point. The guests remained there for the duration of the maiden flight and witnessed the landing as well as the takeoff. Although there were a couple problems uncovered during the flight (to be discussed later), the first Eagle flight was a resounding success. Likewise, the celebration party that evening was very successful. Several dignitaries were in attendance, including "Pancho" Barnes, the famous early aviatrix and proprietress of the "Happy

Bottom Riding Club;" the World War II ace, C.E. "Bud" Anderson (the McDonnell Facility Manager at Edwards); Don Malvern (McDonnell F-15 Program Manager, later company President); and General Ben Bellis (Air Force F-15 Program Manager). Test Pilot Irv Burrows received the traditional dunking in the Officers' Club swimming pool.



Although the McDonnell design philosophy was always, "Do it right the first time" rather than the "Fly and Fix" practices of some later airplane programs, there were a few areas where design changes were required. On the first flight, two problems were unveiled: the **left main gear door** refused to close all the way (resulting in reversion to an alternate, gear down test plan) and the **speedbrake-induced buffeting** impacting the vertical tails was considered excessive.





The gear door problem was resolved by re-rigging before the next flight. The speedbrake-induced buffet took a little longer to fix, however. In perspective, the specification requirements for the speedbrake were unprecedented—satisfying the deceleration requirements was equivalent to generating a one-half **g** "eyeballs out" **g** force—about the same as achievable with an automobile on hard, dry pavement. The first flight configuration, a 22 square feet board with a maximum deflection of 66 degrees would have satisfied this requirement, but the buffeting was objectionable. After a series of wind tunnel tests in St. Louis and a flight test evaluation of 12 different configurations, a final version was accepted—31 ½ square feet (that's about the same size as a 4x8 sheet of plywood) deflected 45 degrees.

Contractor (Category I) and USAF (Category II) flight testing proceeded at a brisk pace. Aircraft #1 accumulated more than 60 flights in less than two months. On six days during that time, three sorties per day were flown. Aircraft #2 joined #1 at the end of the initial two-month period. At the end of three months of flying, the two airplanes had accumulated some 93 sorties, averaging nearly 1 ½ sorties per work day.

During a test sortie, the supporting engineers continuously watched time histories of selected parameters telemetered from the instrumented test aircraft. In those early days of the F-15, "Brush" recorders were used to trace of to eight measureands onto large rolls of continuous-motion graph paper. There were no computer screens or software to make real-time comparison of predicted and flight test data as in today's test world.

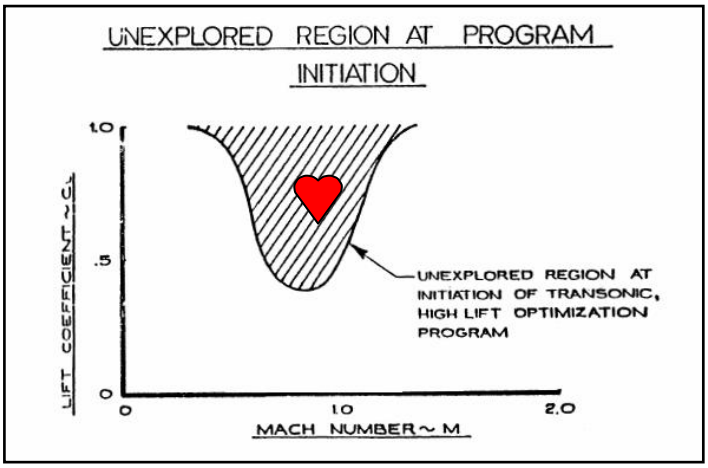
Each aircraft was instrumented with close to a thousand measureands. A dozen Eagles were tested at Edwards during 1972-1975, each of which were devoted to specific test purposes or mission types. Eight more were delivered directly to the Air Force during this time, although the JTF participated in the early flying of the first 12 airplanes. In general, a new airplane arrived on-site about once every two months the first couple years.

PRIMARY TEST AIRCRAFT ASSIGNMENTS

F-1 Envelope Expansion, Flying Qualities, External Stores
F-2 Engine Development, Performance
F-3 Avionics, Airspeed System
F-4 Structural Loads
F-5 Armament, Tank Jettison
F-6 Avionics, Fire Control System
F-7 Armament
TF-1 Two-Seater Evaluation, Training, VIP Fam Flights
F-8 High AOA, Stalls, Spins
F-9 Aircraft and Engine Performance
F-10 Tactical Electronic Warfare System, Radar [Airplane Tested at Eglin AFB, FL]
F-17 Time-to-Climb Record Setting
TF-2 Special Programs

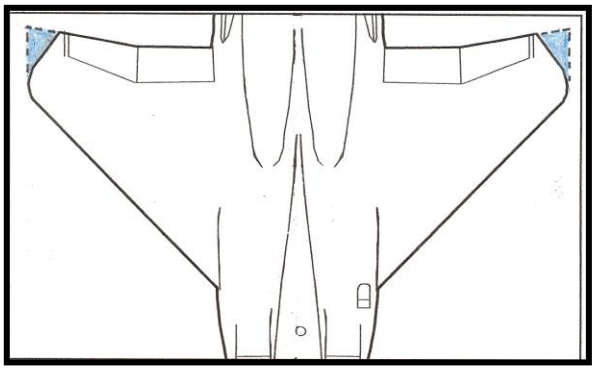
None of the problems occurring during flight test that resulted in changes to the airplane were show-stoppers, nor were the changes revolutionary—they were all evolutionary involving relatively minor efforts to implement the fix. Most changes were internal to the mold line (control schedules, fuel system, ECS, rudder actuator, etc.). But, in addition to the speedbrake, two other visible changes were incorporated.

Wind tunnel testing during the summer of 1972 revealed a desire to improve the flutter margin. **A horizontal tail modification** was made to the actual airplane in October 1972 which consisted of removing part of the inboard LE surface (thus changing the mass balance) creating a "snag" leading edge. At this time, flight testing for flutter had barely begun; the tail change came about strictly as a result of wind tunnel tests.



During normal envelope expansion during the early part of the flight program, it was determined that there was objectionable airframe buffeting problem right in the very **heart** of the air combat maneuvering flight envelope--Mach≈0.9, 5 g, 30,000 feet altitude—a region where the state of the art of wind tunnel testing was lacking. The solution to the problem was to merely saw off some 4 ½ square feet of each wing tip and

smoothing the ragged edges with duct tape. Coincidentally, **clipping the wing tips** solved another perceived problem as well—excessive outer wing bending moments at Mach 1.02, 20,000 feet altitude.



A problem which got a lot of attention for a while was that of making **cross-wind landings** in a 30 knot direct cross-wind. It was learned that the main gears tended to act as skate boards during cross-wind operations. In addition to some minor control system changes, a modification to the gear load-stroke characteristics took care of the cross-wind problem (at the same time, the gear was moved aft nearly 3 ½ inches to improve the tip-back tendencies at light gross weights.

The **high angle of attack, stall, and spin** program was the last of the Category I/II flight tests. This testing began rather auspiciously with an inadvertent spin with F-15#1 which was caused by an extraordinarily large left/right wing fuel asymmetry. Recovery using normal anti-spin control application was normal. Later, with F-15#8, a very thorough test program proved the airplane to have outstanding high angle of attack flying qualities—arguably the best of any jet fighter in existence.

The Category I/II flight tests were completed in August 1975 without the loss of a single test aircraft. Initial Operational Capability with the Air Force was declared on October 1976. Since then there have been several other **First Flights** of improved F-15 configurations fulfilling many different roles.

- TF-15 (F-15B)—7 July 1973.
- F-15C—26 February 1979.
- F-15D—19 June 1979.
- F-15J (Japan)—4 June 1980.
- F-15E—11 December 1986.
- F-15S/MTD (Technology Demonstrator)—7 September 1988.
- F-15S (Saudi Arabia)—19 June 1995.
- F-15I (Israel)—12 September 1997.
- F-15K (Korea)—3 March 2005.
- F-15SG (Singapore)—16 September 2008.

The evolution of this remarkable airplane continues. After forty years, the F-15 Eagle is still the Master of the Sky.