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### The Most Fabulous: The F-16 Fighting Falcon

As told in Charles Adolph and Wade Scroggins's article "Lightweight Fighter Program YF-16/YF-17 Fly-Off", a group known as the Fighter Mafia promoted ideas counter to the leading philosophies of the United States military after the Vietnam War. The Fighter Mafia opposed the military's stance on air defense, arguing that instead of focusing on air-to-ground fighter aircraft, the aircraft production and defense goals should be oriented towards producing effective and cost-efficient air-combat aircraft, known air-superiority aircraft (144).

As a replacement for the unwieldy, maladroit F-4 Phantom – which lost fights against dexterous MiG Soviet/Russian fighter jets – and the heavy, expensive F-15 Eagle – which could not perform as well as the MiGs – the Mafia proposed lightweight fighter technology. They argued that lighter and more agile combat aircraft would be more successful.

In truth, the Fighter Mafia was a respectable group of U.S. Air Force officers and other experts on aircraft design and military strategy, though they did disagree with the direction the U.S. military was working regarding air defense. The leaders of the military listened to the Mafia's proposals and suggested a contest: the lightweight fighter (LWF) program which led to the Air Combat Fighter program (145). Essentially, through debate and scrutiny, the most cost-efficient and effective fighter jet was to be determined, even if designing additional aircraft was necessary to provide sufficient options.

In the year 1972, General Dynamics Corporation and the Northrop Aircraft Division were selected to develop prototype fighters that embodied EM theory [the basis of LWF technology]. General Dynamics unveiled the single-engine, single stabilizer YF-16. [...] Northrop subsequently introduced their twin-engine, twin stabilizer YF-17 (145).

Those prototypes would be compared to the U.S. fighters of that time. The companies developed the prototypes YF-16 and YF-17, respectively, and both were inducted into the approved aircraft list for the USAF and other countries' military. The LWF program "between the YF-16 and the YF-17 clearly led to the most successful fighter aircraft acquisition programs in aviation history" (147).

Furthermore, the YF-16-turned-F-16 Fighting Falcon won first place over the YF-17-turned-F/A-18 Hornet. Both fighters performed better than the previous aircraft in terms of cost, weight, weaponry, and thrust, yet the F-16 Falcon turned out to be the best combat fighter (147).

However, times have changed. Europe seems to be on the brink of war and new technology has been introduced. Consequently, air defense within the United States' budget is increasingly crucial. Those previous fighters – the F-15, F-16, and F-18 – have been refurbished. New fighters such as the F-22 Raptor and F-35 Lightning II have been built. The F-16 arose as the best fighter back in 1974, yet has it remained the premier when the newer combat aircraft are included? According to my research, the Fabulous Fighting Falcon is still the most cost-efficient

and cost-effective aircraft of all U.S. fighters due to its cost-to-thrust ratio, maneuverability, and other superior performance factors.

A group of authors from universities in Taiwan, the United Arab Emirates, and Malaysia wrote an article entitled “Major Weapons Procurement: An Efficiency-based Approach for the Selection of Fighter Jets.” This article, hereon referred to as “Selection of FJs,” related the results of analytical tests and data models done with 26 fighter jets of various countries. The authors tried to determine which aircraft performed more efficiently and effectively than others.

The authors, Wen-Min Lu, Qian Long Kweh, Mohammad Nourani, and Jui-Min Shih, discussed work that other authors had done using different analytical methods and considered the strengths and weaknesses of each method. In a way that combined the strengths and minimized the weaknesses of each method, Lu et al examined the key characteristics of the 26 fighter jets and came to a conclusion. They said,

To this end, the basic capabilities of FJs [fighter jets] were categorized into five input and output analysis variables. Input variables comprised FJ price (P) and maximum takeoff weight (MTW). [...] MTW affected flight speed and thrust. Heavy FJs require increased thrust and speed to maintain flight balance; thus, they require more energy, and modifications for such jets should be minimal. Output variables comprised total thrust (TT), maximum flight speed (MFS), and combat radius (CR). [...] TT refers to the lift and flight power of the FJs; MFS refers to the horizontal speed of FJs in midair; CR refers to the maximum combat range of FJs between the takeoff and combat zone. [...] Collectively, the three output variables encompassed the flight, technology, and combat range of FJs (578).

In short, the characteristics that were variables in the analysis were maximum weight, top speed, price, radius of action, and thrust force. These are essential qualities of combat aircraft that determine how well each one functions.

The authors of “Selection of FJs” produced a conclusive cluster point graph, placing each fighter in one of four quadrants, relating each’s efficiency and capability to the others. In the quadrant with the highest efficiency and highest capability were the American aircraft F-22, F-35, F-16, and F-15, among other non-American fighters.

This conclusion narrows down the selection of best U.S. fighter jets, yet not all the American combat planes were analyzed. For example, the widely acknowledged F-14 Tomcat and the lesser-known F-4 Phantom were not included in the data models. The Phantom is decrepit and clumsy, a sign that this discontinued plane might should be skipped. However, the Tomcat, with its variable-sweep wings and large airframe, remains a powerful interceptor and attack craft. What about those planes?

An important factor of fighter jet effectiveness and efficiency is the thrust-to-weight ratio. This is a ratio between the force the aircraft’s engines provide versus the aircraft’s maximum takeoff weight. According to “The Real TOPGUN” by Paul Eden, who described the Navy’s flight school called TOGPGUN, the Tomcat’s thrust force – produced by two engines of equal thrust at afterburner – and max takeoff weight is 40,200 and 72,000 pounds, respectively (48). This yields a thrust-to-weight ratio of 0.56, compared to the F-18’s .65 ratio, the F-16’s .72 ratio, and the F-35’s .61 ratio (calculations based on thrust and weight values from pp. 64, 102, 112). Bill Gunston’s book *Fighter!* gives thrust force and takeoff weight values for the F-15, from which the .71 ratio can be derived – though it varies slightly based on the model (83). The

F-22's thrust and weight data from the Air Force's Fact Sheet provided by Defense Visual Information Distribution Service (DVIDS) yield an insanely excellent ratio of 0.84 (Air Force, "F-22 Raptor").

Based solely on thrust-to-weight values, which relates how easily and efficiently the aircraft can climb, the F-22, F-16, and F-15 come out on top. Yet, as Devin L. Cate says in *The Air Superiority Fighter and Defense Transformation: Why DOD Requirements Demand the F/A22 Raptor*,

[the] F-15C/E does not satisfy all the requirements for a transformational air superiority fighter. It does not exhibit the aeronautical performance required for air-to-air dominance against threats like the MiG-29, Su-27, and Su-35/37. The F15C does not carry out surface attack OCA missions. The F-15E is able to conduct surface attack missions, as well as other air superiority missions, but its increased weight [...] reduces its aeronautical performance. The F-15C/E does not have the low observability required to make it survivable in the modern air defense environment (16).

The F-15 is one of the heaviest fighter aircraft of the U.S. military due to its size and long-range capabilities. As Cate points out, the F-15 is not agile enough to effectively combat the threats of Soviet and Russian fighters.

Later in his book, Cate says the F-22 Raptor is "the best near-term solution for a twentyfirst century fighter" (18), but I disagree. An article from *A Big Deal: Australia's Future Air Combat Capability*, entitled "THE OTHER 'CONTENDERS'," addresses various fighter aircraft from different nations and evaluates their characteristics to see if Australia should adopt those planes into its air forces. Its author Booz Hamilton explains that the F-22's "project has

been extraordinarily expensive” (62) and “[the] bottom line for Australia is that the F/A-22 [the former name for the F-22] has insufficient multi-role capability at too high a price” (62).

According to the F-22’s DVIDS Fact Sheet referenced earlier, the F-22’s unit cost is \$143 million. Contrastingly, ArmedForces.eu – which provides excellent comparison data for various fighters based on the raw numbers – says that the F-16’s price is \$18.8 million, a mere fraction of over a hundred million dollars.

Furthermore, Hamilton says,

“The F-16 gained a long-range air-to-air combat capability with AMRAAMs [a special type of air-to-air missile] and an all-weather strike capability to evolve into a multi-role fighter. The F-16 has been exported to nineteen nations and more than 4,000 aircraft of various configurations have been built. [...] It is a known quantity that works well, and for a small aircraft it carries out its roles with competence and all-round reliability...” (59, 60).

In contrast to the heavy and expensive F-15, the Falcon is light and easily maneuverable. In contrast to the expensive F-22, the F-16 has high agility and effectiveness for its size and price. The several fighter jets of the United States military have complex characteristics; some are strengths and others are weaknesses. In times of increasing tension and impending war, it is essential to pinpoint the most effective and efficient fighter aircraft and investigate why it is so. Through my research as well as others’ findings, I have concluded that the small, agile F-16 Fighting Falcon outranks the others in combat-effectiveness and cost-efficiency. Though the F22 Raptor, F-35 Lightning II, F-15 Eagle, F-18 Hornet, and F-14 Tomcat are excellent combat

aircraft and perform well in their own right, each plane's combined qualities do not match up to those of the F-16.

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