

The f-22 and the f-35

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It was the mid 1980s and The Cold War was at its height. The United States had just finished development of their new air superiority fighter, the F-15. The development the F-15 was a milestone in aviation and is an iconic aircraft in the world today.

It is a very capable aircraft but during the 1980s when a U. S. spy satellite picked up new Russian prototype aircraft at a base, the Pentagon became concerned. The Russian planes were the MIG-29 fulcrum which was a newer variant of the mig 29 and the Su-27. It was the Su-27 that sent the alarm bells ringing in the Pentagon and they issued a design challenge in the fear that the F-15 could not handle the these new threats.

Through a long and lengthy development process, the F-22 was born and a contract was awarded to Lockheed Martin for around 600 aircraft.

Unfortunately due to rising costs the number was cut down to 200 and then to 195. Now, entered the F-35 Lightning. In the 1990s the pentagon was looking to try to end something known as the death spiral. This is the phenomenon that with each new plane developed they become more expensive causing the military to buy less of them. Eventually it got to the point where U.

S. could not produce enough planes to have viable airpower because the planes were too expensive. Normally each service (Air Force, Navy Marines) got their own planes. Currently the combat ready planes of each service are as follows: Air Force F-22 , F-15 F-16, A-10, Navy F-18, Marines F-18, AV-88B Harrier II. These are just the main jets and each is designed for each

service's specific needs. The navy and marines tend to need more of a multi role strike fighter, capable of ground attack and air superiority.

While the air force needs strike fighters (F-16 F-15E strike eagle) they also have a need to ensure air superiority hence the F-22 and the F-15. The F-22 does have ground attack abilities, more so than the F-15c, which is purely an air to air fighter jet. It is a common misconception that the F-35 is the Air Force's replacement for the F-22. The F-35 is the replacement for the F-16 and the F-15E strike eagle. Of course this plane also had to fit the requirements of the Navy and the Marines as well. So this plane had to be able to land and take off from carriers, and have vertical landing capability for the marines short carriers.

The pentagon had issued a monumental task and issued a design challenge to the manufacturer's. Lockheed Martin and Boeing were both issued contracts to build a prototype aircraft each. The pentagon would choose the best performing of the two and award the contract to that manufacturer. The two giants in aviation manufacturing went head to head, designing the next strike fighter for America and her allies in what became known as the Joint strike fighter program. The main goal of this program was to produce a 5th generation, relatively cheap fighter jet that followed the same principles of the F-16 but had the technology to deal with threats on the battlefield of the future.

To keep the costs down, multiple foreign allies would be allowed to buy F-35s. Developing this plane was not easy, due to the stringent requirements of the three services combined. Perhaps one of the most complex problems was

the vertical lift system required by the marines. Vertical lift had been done only once before with the Harrier jet, a subsonic plane. The strike fighter had to be a supersonic jet.

This is where Boeing's X-32 and Lockheed martin's X-35 differed greatly in their lift systems. Boeing decided to go with the straightforward "direct lift" system that the harrier jet uses. In this system, nozzles on the side of the plane rotate to direct engine exhaust downward. This creates a single cushion of air for the plane to descend on. This is the most mechanically simple system it does pose some serious problems.

It is dangerous and very hard to maneuver. The engine must be in the middle of the plane which takes away from maneuverability and internal weapons storage (for stealth) characteristics of the plane. Lockheed martin decided to go with a radical new design called a lift fan. In this design the engine is in the rear of the plane and functions like a conventional fighter jet. A singular nozzle on the rear of the plane is directed downward and a lift fan sitting right behind the cockpit is engaged. The fan and the engine provide two separate air drafts making it safer, and allowing for the plane to maneuver more easily.

While the lift system on the X-35 was significantly better than the X-32, it still had many drawbacks, which would ultimately lead to the plane's downfall in performance. Lockheed martin won the defence contract and there X-35 became the F-35. However the development process was far from over. In comparing the F-35 production and testing to the F-22, both were fraught with delays, rising costs and other problems. As of today the F-35

still has not undergone full combat testing and has not been deemed fully combat capable. The F-22's main problem was cost.

Each plane cost around 338 million dollars. The eight additional F-22s built after 2009 were only 138 million dollars. If the united states had ordered the total number of planes we were supposed to the cost per plane may have reduced significantly. After all the F-35 is approaching 100 million, which is not to far off the cost of the F-22s that were added on to the contract. It does not seem that the cost of the F-35 will cease to rise.

In their most recent analysis the pentagon found over 200 deficiencies in all variants of the F-35. These variants are things from flight controls to weapons targeting systems, and all need to be rectified in some way before the F-35 can begin full combat testing. To see why this plane has so many problems one must look at the aspects of the plane and its mission. To Fit each branch's specific needs lockheed martin created three variants of the F-35. The F-35A for the Air Force, which is the base model of the F-35. The F-35B for the marines which has the lift fan to accommodate the mairs short carriers.

The F-35C for the navy, which has a 20 percent larger wing surface and strengthened landing gear for carrier landings. While these variants worked in covering each services specific needs there was one fatal flaw. The aircraft had been designed around its lift fan. That meant that all of the variants had the negative effects of the lift fan even if that particular variant did not (A and C models). To make a stable vertical landing the aircraft needs to be on the small side and the wings are generally smaller.

This hurts the plane's performance at higher altitudes. A plane cannot maneuver as well if it cannot generate enough lift under its wings. The lift fan also takes up a lot of space meaning the F-35 cannot carry as much fuel or weapons internally. Sure you can attach ordnance to the wings of the plane but then you defeat the purpose of a stealth fighter. The main problem is the fuel capacity. To have effective ground support you need a plane that can linger around a combat zone for a while, without having to rendezvous with a tanker to refuel.

This is a problem with all the planes in the United States Air Force but is particularly bad in the F-35. The navy version F-35c has the highest fuel capacity due to its larger wing. This is essential and I don't know why the air force has not adapted the navy's larger wing design. Now that the main issues with the F-35 itself have been addressed we can begin to compare it to the F-22 and explore the options that could have led to a better fighter jet. It would be unfair to directly compare the F-22 to the F-35, because the planes are built for two different purposes.

The F-22 is an air superiority fighter, the heavyweight fighter, more expensive, but with a longer range and able to carry more ordnance like its predecessor the F-15. The F-35 is supposed to be the lightweight multipurpose strike fighter much like the F-16. So in essence I am going to judge the F-35 by seeing if the performance difference between the F-15 and F-16, is different than the performance difference between the F-35 and F-22. Let's start with the performance differences in speed. The F-15's top speed is 1,650 mph, the F-16 comes in at 1,350 mph.

Though these speeds could only be achieved with when the plane is not loaded with any ordinance or extra fuel and in full afterburner. The F-22 top speed is classified but is considered to be mach 2 class and most people could be anywhere from 1700 mph to 2000 mph. The F-35s top speed is a dismally slow 1, 199 mph, it cannot even achieve a speed of mach 2. The F-16 is faster and this is the plane that the F-35 is supposed to be replacing. Between the F-15 and F-16 there is a 300 mph speed difference.

Between the F-35 and F-22 there is anywhere from a 900 mph to a 700 mph speed difference. This is problematic especially when you consider the fact that we are going to buy less F-35s than F-16s. This means less F-35s will have to cover the same airspace, so they will have to be able to fly faster than the F-16 be able to reach more areas in the same time. Except the F-35 is slower than the F-16 for some reason. Now I recognize that very seldomly a fighter jet will hit its top speed due to drag from external fuel tanks and ordinance.

The F-35 and F-22 both have the ability to carry weapons internally which means they could still hit their top speeds even when fully loaded with ordinance. But if you look at the fact that the F-35 cannot carry very much ordinance internally and therefore will have to carry weapons on its wings for extended mission that have multiple targets then you will reduce the F-35s top speed even further. This is significant when you are required to scramble the jet. If there is an ongoing threat the plane that can get there the fastest has the best chance of dealing with it and potentially stop it. For example say terrorists had stolen a plane and were planning to crash it into a significant area.

The F-35 is scrambled but since our air bases are distributed to accommodate for jets with a faster top speed the slower F-35 cannot make the intercept in time, and a catastrophe occurs. I realize that this is very simplified version of a very complicated situation and that playing the “ what if game” can be a dangerous platform in which to form an argument. But still this is a valid concern for a fighter especially considering the threats that we face today. Another crucial comparison is in the area of the amount of ordnance that each plane can carry. It is a relatively simple comparison, the more a plane can carry, the more efficient it is. For the sake of simplicity I am just going to do a direct comparison between the F-22 and F-35 because of how the F-15 and F-16 relate to one another.

Now the F-22 and F-35 have two different weapons configuration, one in regards to stealth and the other not. The stealth loadouts, means that both planes have carry all weapons internally. In regards to stealth the F-22 can carry a couple of loadouts. First is its air to air superiority loadouts which consists of 6 long range Amraam missiles that are radar guided and two Aim 9 sidewinder missiles that are heat seeking and infrared guided. Second is a mixed loadout consisting of two 1, 000 pound JDAM bombs, two Amraam radar guided missiles, and two AIM-9 sidewinder missiles.

Third consists of eight 250 pound GBU-39 small diameter bombs, Two amraam radar guided missiles, and two AIM-9 sidewinder missiles. The F-35 can only carry 4 amrams with no sidewinders in its air to air loadout. It can carry a variety of air to ground loadouts including, two 1, 000 pound jdam bombs and 2 amrams. The internal bay has 4 pylons and only 2 of those are designed to carry bombs less than 1, 000 pounds. These are just the base
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loadouts and more specific loadouts have not been determined since the plane is still undergoing changes.

Still the F-22 can carry more weapons than the F-35. Now for the range of each aircraft. For this category I will go back to my performance difference method to compare each of the two planes. The F-15 has a range of 3,000 nautical miles, and the F-16 comes in with a range of 1,740 nautical miles. This is a huge performance difference and is mainly due to the F-15's ability to carry 3 external fuel tanks and conformal fuel tanks along with its internal fuel.

The F-16 has a very small internal fuel capacity and has to rely on underwing fuel tanks to extend its range. The range difference between the F-15 and F-16 is 1,260 Nautical miles. With regards to the F-22 and F-35 the performance difference is less but the F-35's performance is dismal. The F-22 has a range of over 1600 nautical miles which is decent. Each variant of the F-35 has a different range and are as follows: F-35A 1200 NM F-35B 900 NM F-35C 1400 NM All are significantly less than all of the other planes in the armed forces and poses a big problem in the success of the joint strike fighter. The Boeing F-18 Super Hornet has a range of over 2,000 NM, which compared to the Navy variant of the F-35 has a 600 NM range difference.

A longer range plane is essential in the Navy because they have to launch from ships and hit targets inland and then make it back. With a shorter range plane you have to bring your aircraft carriers in closer which puts the ships at a bigger risk. This problem is even worse in the Marine's version of the aircraft which only has a range of 900 NM. The current plane that the Marines

use is the harrier jet which has a range of 1200 NM. 900 NM is terrible, it is inconceivable how the pentagon even considered giving the marines a plane that is constantly running out of gas, especially considering the marines main mission is close air support which requires plans to linger around the target area. Since the F-35 has such low fuel capacity it cannot lighter in a combat zone as long meaning the air support will not be as dependable as it would with a plane that has a higher fuel capacity.

The final area of comparison involves the plane's maneuverability. One of the most important aspects of a plane's maneuverability is its thrust to weight ratio. All of these planes are around 1-1 depending on their specific loadout so they are all pretty much equal. Except for the F-35. In its typical combat load it has less than a 1-1 thrust ratio, and to make matters worse the A and B models have very small wings to accommodate the marines vertical lift system. This make the plane under perform at altitude and hard to maneuver at low speeds.

There are other aspects of an airplane that make it more maneuverable than another but they are hard to find specific evidence and facts to make a clear determination which is better, it also does not help that a lot of this information is classified. So the F-35 is a decent aircraft, but it is underperforming in the sense of its cost and its performance relation to the F-22. What if the government had taken the trillions of dollars spent on this fighter program and invested it in something different, something better. Personally I believe the concept of a strike fighter for all three services was doomed to fail from the beginning. The marines requirements are simply

incompatible with the other three services. The vertical lift system simply does not fit in with the navy and airforce.

One of the things the government could have done is have a plane developed for the navy and the air force, and a separate one for the marines. Now I realize that that would lead to a more expensive project but I have a solution for that and it consists of one word, capitalism. The problem with how the government does these design challenges is the award the contract to one manufacturer and allow the price of the plane to be raised as much as the company would like to solve any problems. The companies know this and take full advantage of it, charging outrageous prices for tiny tweaks and upgrades. Also due to the contract being binding if the project begins to falter or fail the government is stuck with it until it runs its course.

If you were to allow competition into the making of these planes you probably would get a cheaper, and higher performing plane. Make it so once a company wins a contract they are not irreplaceable, maybe put a clause in that states, a failure to meet specific deadlines and deliver cost efficient upgrades and bug fixes would result in the contract being reassigned to another company.