Concurrency And Commonalities Catastrophic For F-35 And DoD

Norwegian Ministry of Defence via Flickr
Close up of the first Norwegian F-35 production line

The massive defense project, which is projected to cost $1.5 trillion over its lifetime, has experienced setback after setback. Despite its recent successes, (the F-35B was declared operational on July 31, 2015), numerous design and implementation problems still face the engineers at the more than 2000 contracted companies. It is generally agreed upon that the F-35 joint strike fighter program is lacking in design and development efficiency. The organizational structure of the program is the main contributor to this failure.

At this point, the organizational structure of the F-35 program is set in stone, but progress arises from mistakes. Now is the time to analyze the failures and

successes of the program for the improvement of future defense projects. Identifying the root causes of the program's failure will help prevent similar mistakes in the future. Continued application of the economic philosophies that drove the F-35 program could prove disastrous for the United States defense industry. The United States government cannot afford more high-cost, high-risk programs like the F-35.

The F-35 fighter itself is intended to be used as a multi-purpose fighter for all three major branches of the United States military. The F-35A will be used in the Air Force; the F-35B is currently in use in the Marines; and the F-35C will be used in the Navy. As the testing phase continues, F-35 fighters are already being implemented in military operations as exemplified by the F-35B. However, a leaked report, written by an F-35 test pilot, reveals that the fighter essentially lost a dogfight to an F-16, a model which has been used in military operations for over 30 years. In the report, the test pilot calls the F-35 "substantially inferior." The report has caused many to question whether the fighter is ready for a role in United States military defense.

In July, CNN reported that the program is "[t]hree years behind schedule and some $200 billion over its original budget." One contributing factor to the delay is the Department of Defense's strategy of concurrency. Concurrency means that production of the F-35 fighters begins while they are still being developed and tested. This strategy is intended to produce working fighters faster, for use in the military. However, as testing continues and more problems are identified, the models that have already been produced must be modified to account for the problems. Again the question arises; should American military pilots be flying aircraft that are not finished products?

Each of the three F-35 designs, or variants, has its own unique challenges that must be overcome before it becomes a finished product. The dependency on structural design commonalities among the three F-35 variants has limited specialization. The main rationale behind creating one fighter with three variants lies in the application of economies of scale and simplification of design parameters. In order

to take advantage of economies of scale, Lockheed Martin and the other contractors intend to produce 240 F-35s per year once full production is achieved.

Their production capability is based on their ability to identify buyers for each fighter. This is in part achieved through the multinational investments that the program has garnered. However, the interest of other nations is dependent upon completion of promised capabilities, and successful tests of the F-35. The United States' own ability to purchase the aircraft is also dependent on the amount the Department of Defense spends on the design and development phase of the program. The design and development phase has lasted 15 years up to this point, and accounts for the majority of the money spent on the project.

The simplification of design parameters has reduced costs, but many of the program goals specific to each military branch were compromised in the consolidation of the parameters. Each variant has different methods for take-off and landing. Aircraft are generally designed around their method of flight, because the design of the components is centered around the intended use of the aircraft. The F-35 A, B, and C employ conventional takeoff and landing (CTOL), short takeoff and vertical landing (STOVL), and carrier variant (CV) methods respectively.

The main drawback here is that the common fuselage and overall shape of the F-35 has to accommodate all three take off and landing methods. The short takeoff and vertical landing approach used for the F-35B is specific to the needs of the United States Marines, and essentially requires an engine that can rotate 90 degrees. This requirement significantly alters the fuselage design of the F-35, which incidentally affects the other two variants as well.

The focus on using the commonalities of the aerial goals three separate military entities has restricted the capabilities of the final products, and ultimately cost the Department of Defense more money than it has saved. On paper the use of one

basic aircraft design to develop three variants to serve each purpose seems like an efficient approach to the problem. However, the logistics and design requirements of combining what should essentially be three separate aircraft into one generic design has become an engineering nightmare. According to the Project On Government Oversight,

> The F-35 has nearly 30 million lines of constantly changing aircraft and support system computer code, a maintenance-intensive stealth skin, a problem-ridden helmet system, excessive engine failure rate, significant maintenance burdens, constantly emerging structural defects, and continuing reliability problems throughout the all-electric control and integrated power generation systems.

Adoption of different economic and design philosophies that do not rely on commonalities and concurrency will be necessary to reduce risk in future projects. One of the biggest pitfalls for the Department of Defense was its reliance on the success of a singular program, which it invested a large sum of money in. This reliance stems from the initial contract award, and the use of design commonalities. The use of concurrency was a reactionary measure to delays that was intended to account for the Department of Defense's reliance on the success of the program.

As the program continues to encounter problems in its testing and implementation phases, it will be under more scrutiny. As it stands the program is seen as "too big to fail," and has support from the majority in Congress. Congressional support is largely attributable to lobbyists and industry impact from the F-35. More cost-effective approaches to defense programs can be chosen in the future through the democratic process.