

The F-35 Engine War

BY LEE HUDSON, ROSMERY IZAGUIRRE | 07/27/2023 05:00 AM EDT

PRO POINTS

- The Pentagon is weighing two options to power future versions of the F-35 – upgrade the existing engine or buy a new propulsion system.
- The status quo helps current engine-maker Pratt & Whitney. A competition for a new system could be a boon for rival GE.
- The Navy and Marine Corps are not interested in buying an advanced engine, which would require the Air Force to pay the bill on its own.

How We Got Here

The military's newest fighter jet, the tri-variant F-35, needs a new engine for upcoming batches because future versions of the warplane will require more power and cooling to support advanced weapons, software and other upgrades.

The multibillion-dollar decision for the Pentagon's most expensive weapons program tees up a new battle between two major propulsion system manufacturers.

The options are to upgrade the existing Pratt & Whitney F135 engine, known as the Engine Core Upgrade, or open a competition for a more advanced system under the Air Force's Adaptive Engine Transition Program.

On one side is RTX, formerly known as Raytheon Technologies, which in 2020 acquired Pratt & Whitney, which makes the warplanes' current F135 engine. The company is pitching an upgrade to secure its monopoly on F-35 engines that features a new emergency power and cooling system to increase range, thrust and durability.

Meanwhile, GE Aerospace, which failed to secure the political muscle to build an alternate F-35 engine more than a decade ago, is trying to break into the program by pitching a next-generation propulsion system for the fighter.

When Congress scrapped the second engine program for the F-35 in 2011, Pratt & Whitney became the sole provider.

Yet the adaptive engine promises to extend the fighter's range and add greater fuel efficiency, which supporters argue is needed in a potential war against China.

If the military and Congress decide to pursue a new engine competition for the F-35, it is not an instant win for GE because both GE Aerospace and Pratt & Whitney are working on the new engine program.

Pratt & Whitney, however, is not outwardly supporting the advanced engine program because the company wants to maintain its F-35 engine monopoly.

The adaptive engine would add a third airstream for more cooling, and provide more thrust and fuel efficiency than current military propulsion systems that use two streams. But critics of the option point out the F-35 is a single-engine fighter, which makes installing a brand-new propulsion system more risky than incorporating the technology into twin-engine planes. If there's a failure on the F-35, there's no backup.

If the military decides not to pursue an advanced engine competition for the F-35, it's not the end of the road for the AETP.

The Pentagon's plan is to feed knowledge from research on the adaptive engine into the Next Generation Adaptive Propulsion program that will power the Air Force's sixth-generation fighter, dubbed Next Generation Air Dominance.

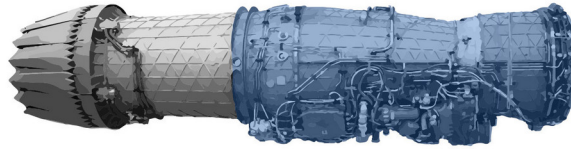
Pentagon weighs options to replace the F-35 fighter jet engines

The two options under consideration are upgrading the existing engine or launching an adaptive engine competition.

F135 engine core upgrade

The upgrade to the F-35's current engine, manufactured by Pratt & Whitney and known as the F135, incorporates features aimed at increasing range, thrust and durability.

The upgrade includes a new emergency power and cooling system.



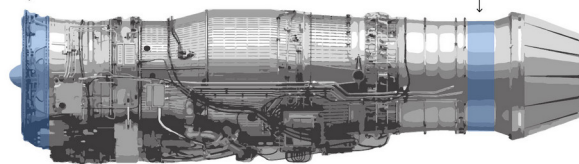
PRATT & WHITNEY F135 UPGRADE

Adaptive Engine Transition Program

Under the AETP, both Pratt & Whitney and GE Aerospace designed new adaptive cycle engines. GE Aerospace's XA100 provides two modes: a high-thrust mode to maximize power and a high-efficiency mode to maximize range.

The three-stream adaptive fan improves thermal management.

Comprising lighter materials such as ceramic matrix composites.



GE AEROSPACE XA100

Sources: Pratt & Whitney, General Electric

What's Next

GE Aerospace and Pratt & Whitney are wrapping up ground testing and other design-related work on their respective AETP prototype engines that will conclude at the end of fiscal 2024. Both propulsion systems require more funding to get them production-ready. GE Aerospace claims the next-generation engine could be ready to power the F-35 in 2028.

The advanced engine program runs out of money in fiscal 2024, adding more pressure on GE to rally support for the project.

Pratt & Whitney, meanwhile, promises the F135 Engine Core Upgrade will be ready to field in 2028.

The F135 Engine Core Upgrade will support all three jet variants and enable joint maintenance operations for the F-35, which is not the case for the adaptive engine. The advanced engine is designed only for the F-35A, the variant the Air Force and the majority of international partners fly.

GE says it can install the new engine design — with modifications — into the F-35C aircraft carrier version that the Marine Corps and Navy fly. But the system cannot go into the F-35B jump-jet variant flown by the Marine Corps, Italy and the U.K.

This is notable because if the military and lawmakers launch an advanced engine competition, the decision will introduce what the Pentagon calls a “mixed fleet,” meaning there will be more than one engine type that maintenance personnel will need the expertise to fix.

Not only does this mean maintainers will have to be versed on how to fix different engine types, but the decision also complicates the logistics chain by requiring the military to have additional spare parts on hand. This will differ across variants and the services.

And because of the hefty price tag for a new engine, other international partners and foreign military sales customers that fly the F-35A are unlikely to buy the advanced engine for their respective fleets. This means the Air Force would not get a better price by buying engines in bulk with the rest of the F-35 enterprise.

Upgrading the F-35’s engine would cost about \$5B less than adopting a new one

A new engine would come with increased performance and cost.

	F135 engine core upgrade	Adaptive Engine Transition Program
Cost estimate	\$2 billion in development costs	\$7 billion in development costs
Integration	Offers support for the full F-35 jet fleet	Designed to support only one F-35 variant
Performance	Improves performance at lower magnitudes than a new engine	Improves thrust and fuel efficiency at higher rates

Sources: Pratt & Whitney, General Electric



POWER PLAYERS

- **Frank Kendall, Air Force secretary:** The service is the largest F-35 customer, and Kendall has said an advanced engine is too costly because the Navy and Marine Corps are not interested, which would require the Air Force to pay the bill on its own.
- **Rep. Rosa DeLauro, Connecticut Democrat and House Appropriations Ranking Member:** DeLauro advocates for the F135 Engine Core Upgrade because Pratt & Whitney built the propulsion system in her home state.
- **Rep. Mike Turner, Ohio Republican and Joint Strike Fighter Caucus Co-Chair:** Turner has not publicly supported either option, but GE operates military engine production facilities in his home state.
- **Rep. Rob Wittman, Virginia Republican and House Armed Services Tactical Air and Land Forces Subcommittee Chair:** Wittman wants to fund both the F135 Engine Core Upgrade and the Adaptive Engine Transition Program.
- **Sen. Susan Collins, Maine Republican and Senate Appropriations Vice Chair:** Collins is a staunch defender of the F135 engine because part of the propulsion system is built in her home state.