



Press Release

GE receives Air Force airworthiness qualification in under a year for first metal 3D-printed, critical jet engine part

Pathfinder with the USAF's Propulsion Directorate and [Rapid Sustainment Office \(RSO\)](#) gathers momentum as it establishes its own qualification path for additively manufactured metal parts.

Cincinnati, OH, June 8, 2021 – GE Aviation has received Engineering Change Proposal (ECP) approval from the US Air Force (USAF) for an [F110 additively manufactured sump cover](#). The latest milestone in the USAF and GE's pathfinder Pacer Edge program, this F110 component is the first engine component designed for and produced by metal additive manufacturing to be qualified by any US Department of Defense entity.

From contract to flight in less than a year

"Much like the [GE90 T25 sensor](#) that was an FAA certification pathfinder for metal additive manufacturing for GE Aviation in commercial aerospace, the F110 sump cover sets a solid foundation for many more additively manufactured component qualifications with GE's military customers," said Matt Szolwinski, chief engineer and leader of GE's Large Military Engineering team.

"The Pacer Edge program is an important initiative for reducing risk and showcasing the application of additive manufacturing in aerospace. The ability to additively manufacture an aircraft engine part and gain military airworthiness is a significant step forward in growing the adoption of additive manufacturing in the Air Force," said Nathan Parker, deputy program executive officer for the USAF RSO.

"The Chief of Staff of the Air Force, General Charles Q. Brown, Jr., has challenged us to 'accelerate change or lose.' The entire Pacer Edge process is built around the 'accelerate change' philosophy, and the speed of the F110 sump cover development and airworthiness approval is evidence of that. The capability that Pacer Edge is demonstrating and proving will be a game changer to engine production and sustainment and will resolve many future Air Force readiness challenges," said John Sneden, director of the USAF's Directorate of Propulsion.

Spiral development enhanced by experience and a digital thread

The airworthiness qualification of the sump cover brings Pacer Edge Phase 1a of the pathfinder to its conclusion. Part of the key to the accelerated qualification -- in under a year -- was GE's decade of metal additive engineering and manufacturing expertise.

The team's in-depth knowledge of commercial aerospace engine airworthiness for [flightworthy 3D printed metal parts](#) is proving instrumental in helping USAF establish its own robust process validation and certification processes for military airworthiness.

Close collaboration and knowledge sharing have enhanced USAF's spiral development approach of continuously identifying, reverse engineering and developing technical data packages (TDPs) for increasingly complex and larger parts suitable for metal additive manufacturing.

"USAF's strong vision for additive as part of its wider sustainment and readiness strategy has allowed our combined team to progress at speed. We continue to share our learnings and have developed an efficient, structured way of working -- especially for developing qualification processes and expediting design iterations. This lean, operational efficiency is already driving results and now sets us up for the next phases of the program, including looking at complex and large format, load-carrying structures," said Szolwinski.

Phase 1b is already underway and focuses on an out-of-production sump cover housing on the [TF34 engine](#), which has been in service more than 40 years.

"We're thrilled to be on this journey with USAF. Additive journeys are great, but even better when you have a good map and experienced guides. We started with a relatively easy part, but the spiral development model is coming into its own. It provides focus for the team and our experts help navigate and problem solve along the way," said Lisa Coroa-Bockley, general manager for GE's Advanced Materials Solutions.

A digital thread also runs through the pathfinder. GE experts focused on digital twinning, maintenance-based predictive analytics and part lifecycle management expertise have been able to complement the USAF's digital engineering strategy and in-house knowledge.

"Human interaction and collaboration both add immense value to our work, but digital is the enabler. Additive is a powerful digital technology that spans the entire process, from design and modelling, to in-situ monitoring through to inspection and final level assurances," added Coroa-Bockley. "Adding digital twinning and predictive analytics on top brings new horizons into view, such as systems management, diagnostics and repair of in-field systems."

Tinker AFB as airworthiness metal additive supply chain hub

“Subsequent phases of the Pacer Edge program involves the establishment of a metal additive manufacturing supply chain at Tinker Air Force Base in Oklahoma, capable of producing airworthy components in support of the DoD’s sustainment needs,” said Lauren Tubesing, director - military accounts at GE Additive.

Recently, the Air Force’s Propulsion Directorate and RSO invested \$10M to fund additional phases of the Pacer Edge program, leveraging the Defense Logistics Agency’s (DLA) Captains of Industry contract vehicle.

This funding will accelerate the development of the USAF’s organic AM capability and capacity to design and print flightworthy hardware for military engines, aircraft and support equipment. The Pacer Edge team is utilizing this capability to alleviate hard-to-source and obsolete spare parts constraints for legacy systems.

“The F110 sump cover was a terrific pathfinder, allowing us to exercise the USAF’s airworthiness process. There are numerous parts in queue that are ideal candidates for metal 3D printing. Next, we are focused on refining the airworthiness process, so it is as responsive as the technology,” said Melanie Jonason, chief engineer for the USAF’s Propulsion Sustainment Division.

About GE Additive

[GE Additive](#) – part of GE (NYSE: GE) is a world leader in metal additive design and manufacturing, a pioneering process that has the power and potential to transform businesses. Through our integrated offering of additive experts, advanced machines, and quality powders, we empower our customers to build innovative new products. Products that solve manufacturing challenges, improve business outcomes, and help change the world for the better. GE Additive includes additive machine brands Concept Laser and Arcam EBM, along with additive powder supplier AP&C.

About the Air Force Rapid Sustainment Office

Established by the Secretary of the Air Force in 2018, the RSO increases mission readiness by rapidly identifying, applying, and scaling technology essential to the operation and sustainment of the United States Air Force. www.afroso.com

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John Sneden, director US Air Force Propulsion Directorate.
(Photo: GE Additive, GEADPR049)



Nathan Parker, deputy PEO US Air Force Rapid Sustainment Office.
(Photo: GE Additive, GEADPR049)



Additively manufactured, cobalt-chrome sump cover for F110 engine. Produced on a GE Additive Concept Laser M2 machine at the GE Additive Technology Center in Cincinnati, as part of collaboration with the US Air Force's Rapid Sustainment Office (RSO). (Photo: GE Additive, GEADPR049)



GE Aviation F110 engine. (Photo: GE Additive, GEADPR049)

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