

Developing next-gen, smart engine fan blades

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Credit: Andrea Piacquadio from Pexels

The Fourth Industrial Revolution (Industry 4.0) is transforming the way companies in many industries are manufacturing their products, and the aerospace industry is no exception. For example, aircraft manufacturers are improving manufacturing processes by embedding sensor technologies into engine components. An EU-funded project called

MORPHO has also jumped on the Industry 4.0 bandwagon with an innovative proposal: embed printed and fiber optical sensors in aircraft engine fan blades to endow them with cognitive capabilities while they are being manufactured.

Smart, multifunctional and multi-material fan blades

"The fan blades are designed and manufactured using a hybrid material. The core body of the fan blades is built up with a 3D-woven composite, while the leading edge is made of titanium. As an example, this material technology is used in the LEAP Engine family (1A, 1B, 1C), allowing them a mass gain while exhibiting [high strength](#) and [fracture toughness](#)," the MORPHO team reports in a [press release](#) posted on "The Aviation Times."

Project team members will develop and test core technology building blocks on a demonstrator called a Foreign Object Damage (FOD) panel. FOD is a major cause of metal failure in aviation and other environments that are prone to damage from debris or loose objects. The MORPHO FOD panel represents the chord of a fan blade—in other words, the blade's width from the leading (or foremost) edge to the trailing (or rear) edge—at a specific height. The panel's main purpose is to test the fan blade's design before manufacturing so as to minimize risks.

The press release provides further insight into the project's use of FOD panels: "MORPHO proposes to embed printed and fiber-optical sensors in FOD panels, thus providing them with cognitive capabilities from the moment they are manufactured. The parallel development of digital/hybrid twin models will drastically improve the FOD Life Cycle Management. Throughout the project, demonstrators will be developed to analyze and validate the proposed methods and tools."

Caring about the environment

MORPHO also intends to ensure efficient, profitable and eco-friendly manufacturing, maintenance and recycling of its next-generation, smart engine fan blades, in line with the EU's new Circular Economy Action Plan. Another priority is the environmentally friendly recycling of costly components. The project aims to develop a methodology that combines two innovative processes: laser-induced disassembly, and pyrolysis technology for the optimal recycling of end-of-service-life parts.

MORPHO (Embedded Life-Cycle Management for Smart Multimaterials Structures: Application to Engine Components) is coordinated by École nationale supérieure d'arts et métiers, France, and brings together aircraft equipment manufacturers and software and sensor-system developers, as well as recycling technology and intelligent process monitoring companies, universities and research organizations from six European countries. External guidance and expert advice will be provided by an international advisory board possessing diverse skills and expertise that reflect the range of organizations that the project seeks to engage. The 3.5-year project ends in September 2024.

More information: MORPHO project website: morpho-h2020.eu/

Provided by CORDIS

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