

Centrale Nantes working with STELIA Aerospace on a world first: 3D printing of self-reinforced metallic fuselage panels

An aircraft has several panels that form its fuselage, its empennages and wing sections. These panels are reinforced by stiffeners, which are usually riveted or even welded to the panels.

A demonstrator for metallic fuselage panels with stiffeners directly built into their surface by additive manufacturing was produced on Centrale Nantes' rapid manufacturing research platform.



The 3D printed fuselage panel - the rough printed surface on the left, the polished and painted surface on the right

This demonstrator was produced as part of Stelia Aerospace's collaborative R&T DEFACTO project (*DEveloppement de la Fabrication Additive pour Composant Topologique*), in partnership with Constellium and CT Ingénierie. France's Directorate General for Civil Aviation financed half of project, with the balance funded by the partners.

The 1m² panel was produced using the additive manufacturing robotic cell at Centrale Nantes, through the deposit of aluminium wire melted by electric arc. It represents a new disruptive design for panel stiffeners.

This new large-scale 3D printing technology makes it possible today to consider producing such concepts in the future, thus freeing production from the complex constraints inherent in the assembly of stiffeners.

Jean-Yves Hascoët, professor and head of the Rapid Manufacturing Platform at Centrale Nantes in the GeM laboratory (UMR CNRS 6183), is an international expert in additive manufacturing, a disruptive technology targeting new approaches to production, whereby material is added by deposit and not subtracted by machining.

He explained that *"additive manufacturing offers unlimited production possibilities: less material used, the integration of additional functions, the ability to reinforce assembled parts with complex geometry. It allows for new designs, weight gains, better parts reliability and lower manufacturing costs."*

Cédric Gautier, CEO of Stelia Aerospace. *"Through its R&T department, and thanks to its partners, Stelia Aerospace is thus preparing the future of aeronautics, with a view to developing ever more innovative technologies that will directly impact our core business: aero structures."*

Press Contact:

Ecole Centrale de Nantes

Valérie Chilard - 02 40 37 16 87 / valerie.chilard@ec-nantes.fr



Additive Manufacturing Robotic Cell, Rapid Manufacturing Platform

The cell accommodates a high-capacity robot, which allows a weight of 500 kg to be displaced 3 metres at arm's length. This exceptional machine allows the hybrid manufacture of large parts.

Hybrid, because it combines several processes: wire-based (aluminium, titanium, steel etc.) whereby the wire is melted with an electric arc (WAM) or powder-based (LMD). Two heads deposit the powder, one with a thickness of 2.5 mm, the other of 4 mm.

The machine can also perform finishing (machining and polishing) of parts.

About Centrale Nantes

Centrale Nantes is a French engineering school and member of the Écoles Centrale Group. Its graduate, master and PhD programmes are based on the latest scientific and technological developments and the best management practices. Founded in 1919, Centrale Nantes' 40-acre campus welcomes 2250 students, including 1340 graduate students, 200 Executive Education and degree apprenticeship students, 240 PhD students and 270 Master students.

About STELIA Aerospace

With a turnover of 2.2 billion euros in 2017 and 6,900 employees worldwide, (4,600 in France, 600 in North America and 1,700 in Tunisia and Morocco), STELIA Aerospace is a leading global player in aero structures, pilot seats, and first class and business passenger seats.

STELIA Aerospace designs and produces the front fuselages for the whole Airbus family as well as specific fuselage sections and subassemblies for Airbus, the wings for the ATR aircraft, the equipped central fuselage of the Bombardier Global7000 aircraft, and complex metal and composite aero structure parts for Boeing, Bombardier, Embraer, Northrop-Grumman etc.

About CT Ingénierie

CT Ingénierie is a leading engineering group in technological innovation. The company has teams of engineers and technicians involved in the most innovative industrial programmes in Europe. CT Ingénierie is part of The CT Engineering group, an international engineering group with branches in Europe, America and Asia, and supplier to the major industrial firms in the aerospace, automotive, rail and naval sectors, industrial sites, and renewable energy.

About Constellium

Constellium is specialized in the manufacture of innovative and high value-added aluminium products, with solutions dedicated to the aerospace, automotive and packaging markets. With 11,000 employees around the world, Constellium operates worldwide with 24 production sites and technology centres. With nearly 200 highly qualified employees based in Voreppe (France), the C-TEC Technology Centre is the company's innovation centre.

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