Lightme

Aerospace Lightweight Components

The aerospace industry is always seeking the development of new materials with reduced weights, improved application specific performances and reduced costs.

Typically, in the aerospace sector aerostructure parts (wings, fuselage) are made of two materials: Al for lightweight low structural load parts and Ti for high structural load parts. While Al is used wherever possible to keep cost down, Ti is only used in areas that need extra structural strength.

The **LightMe project** will look to develop lightweight nano-particle reinforced materials, the application of this which would provide lower density and higher performance materials, compliant with aerospace industry standards and aspirations. AML at present operate within several different markets, the largest for **AML** being the UK civil Aerospace market working for clients such as Rolls Royce, Incora and Boeing. AML's experience will provide a route to market for the LightMe application within the Aerospace sector.

AML aims to provide design and manufacturing input into LightMe via an Enhanced Aerostructure Rib (EAR), consisting of an enhanced structural component for assembly on aircrafts, and use of the novel materials in engine blade manufacture. The rib component is a core part of the aircraft wing structure and provides the supporting structure to the wing assembly hence it is essential for these components to be High strength and low weight. The main principle of this lightweight design is related to the use of less material or materials with lower density but ensuring the same or enhanced technical performance. The blade application will benefit from enhanced fatigue resistant properties.

In the project **AML** will provide the use case component and conduct part machining including any associated trials. The use case in this application is the Aero-rib and blade components looking at Al (Almacan) applications for both component types.

AML will look to conduct simulation trials of the full-scale Aero-rib for load testing comparing reinforced and non-reinforced materials. Billets will be produced of each material, allowing for AML to conduct machinability trials, this will serve to provide AML will the optimum conditions in which to manufacture large quantities of the materials and more importantly highlight give insights to some of the material properties. Scale components will be initially manufactured through WLAM and then subsequently finished machined by AML, this will serve as the main project output for the Aerospace application. Example blades will also be produced for testing around the enhanced properties.

For more information:
www.lightme-ecosystem.eu

Co-funded by the Horizon 2020 programme of the European Union. This project has received funding from European Union's H2020 innovation programme under the grand agreement number 814552.

EXPECTED OUTCOME

As detailed previously **AML** conducted both simulations and machining trials of which the results are outlined below:

Simulation Trials

In the case of the Aerorib made of **Ti-6Al-4V**, and an Alumnium variant, with wall thickness of the ranging between **10-12 mm**.
Through simulation under given load, maximum stress from FEA is **251 MPa**, matching the fatigue strength of the material (≈ 250 MPa).
The application of nanoparticle reinforcement could see the rib wall thickness reduced by **2mm**, reducing the overall weight by **6%**.

Machineability Trials

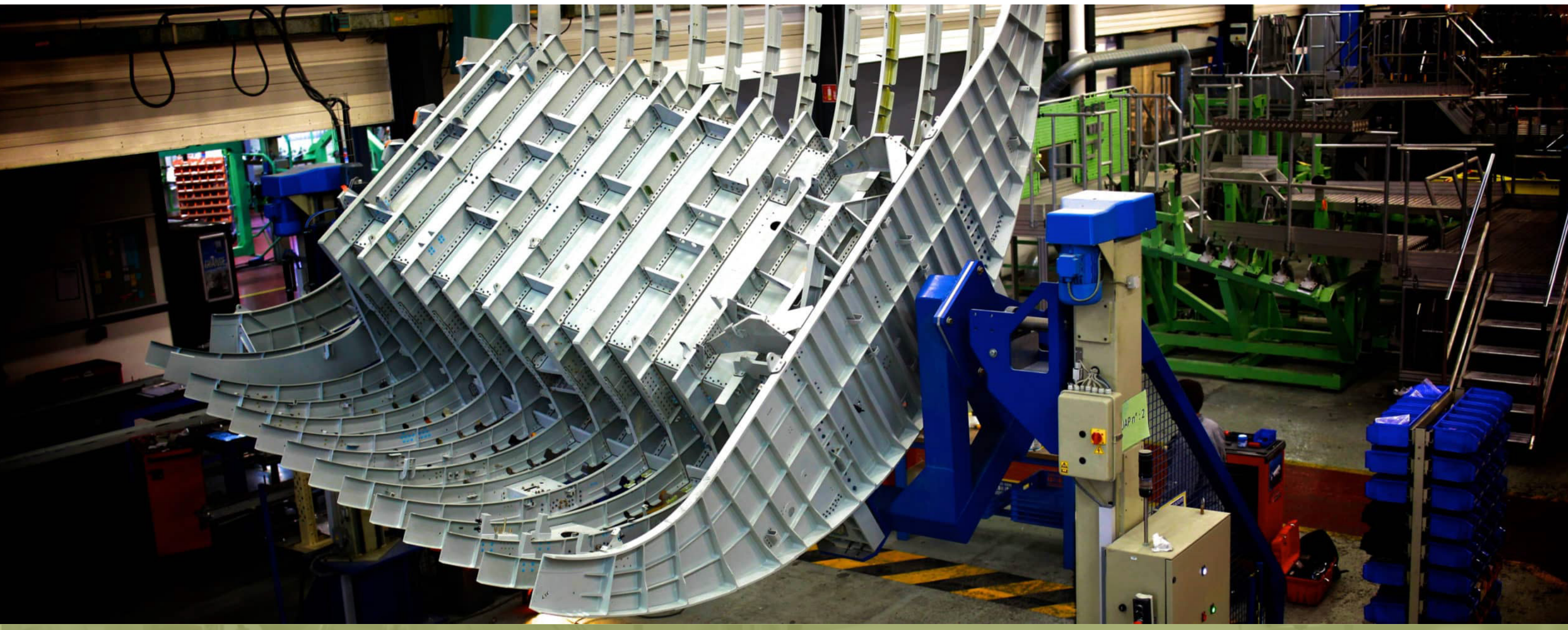
- With an increase in the % SiC (silicon carbide) of the host material to provide the reinforcement properties, the cutting forces would be expected to increase correspondingly. Typically, this was around 25% depending on the process type.

- The Scalmalloy that contained the SiC addition caused more cutting tool wear than the Scalmalloy without the SiC addition. This is evident as shown in the report detailed within the project and would need significant consideration in any application business case.

- Both material types were machined for 20 mins, with 1280 cm^2 of milled surface generated (at 64 cm^2 per minute), without the inserts failing based on tool wear measurement.

- In addition to this, surface measurements were also performed on the machined surface for both the Scalmalloys, with and without the SiC addition. From this analysis it was found that the surface roughness of the materials with and without the SiC additions were in the range of 0.15 to 0.3 µm Ra.

In summary, these pieces of work show the potential to improve the design of Aerospace components to provide improved functionality, however there would be corresponding increases in the production costs associated with manufacture.



For more information:
www.lightme-ecosystem.eu

Co-funded by the Horizon 2020 programme of the European Union. This project has received funding from European Union's H2020 innovation programme under the grand agreement number 814552.