

Accelerated Structural Design of Sustainable Aviation Projects

Organizations

ElevonX is an Unmanned Aerial Systems (UAS) producer and developer, focusing on UAS systems in the take-off range of 25 kilograms.

AFormX is an SME company that delivers composite airframes and provides simulations for sustainable aviation original equipment manufacturers (OEMs).

University of Maribor provides knowledge for Finite Element Method (FEM) simulations and helps to deploy the workflow on HPC.



End User



Domain Expert



HPC Expert



University of Maribor is part of the Slovenian NCC.



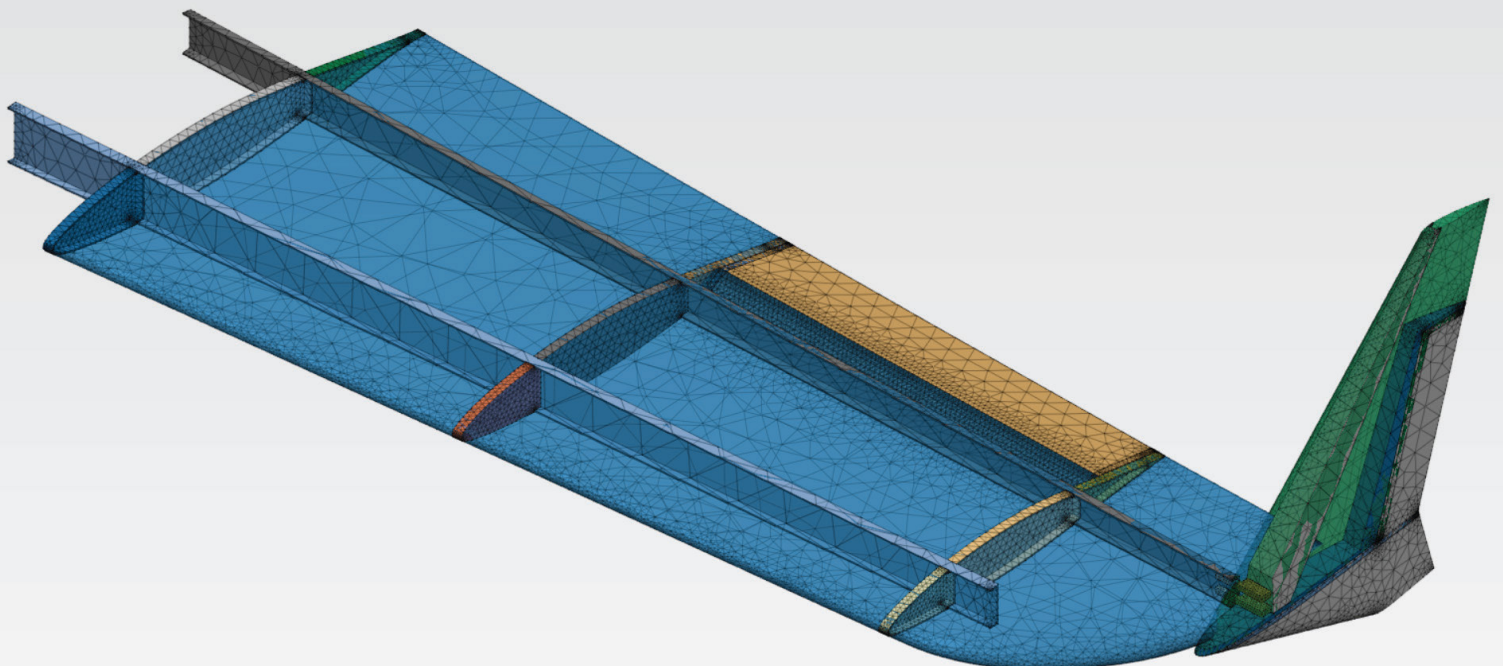
The Challenge

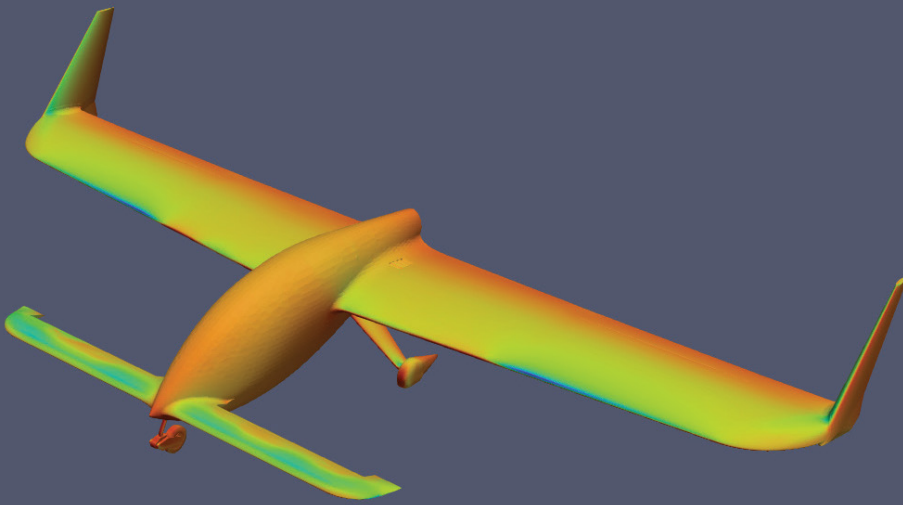
When aircraft made the step from propeller to jet, it was not only the powertrain that changed. Jet aircraft brought changes also in layout like podded engines, swept wings and more. A similar change is currently happening due to electrification.

The electrification of the powertrain will lead to changes in the airflow control around the aircraft and also interact with flight controls. Sustainable electrically powered aircraft will look significantly different than today's aircraft.

If the skin of the aircraft - fuselage, wings and other flying surfaces - is currently undergoing significant changes, it means that also the structural frame - the bones - requires novel approaches. Frames, bulkheads, longerons, spars and skins require novel architecture to match the requirements of the new outer shapes.

The business opportunity to provide early structural analysis for these innovative vehicles was identified by AFormX and ElevonX to be addressed by the FF4EuroHPC experiment. The goal was to provide green aviation start-ups with better conceptual structural design, be they OEMs like ElevonX or Tier One suppliers such as AFormX.





Industry Sector

Aerospace

Technology used:

**HPC,
CFD and FEM Simulation**

The Solution

The solution is an HPC-based workflow that will be offered as a service to the aviation market and can be used by OEMs and service providers. FEM simulations – using results from CFD simulations as boundary conditions – are performed for significantly different designs of the structural frame of the aircraft. The use of HPC makes it possible to efficiently explore a much wider design space: one design can be investigated in 20 hours of computing effort using 128 processors.

The Impact

The business impact for the SMEs AFormX and ElevonX is positive, increasing the level of their services and products. AFormX got in contact with many interested OEMs and has already received tentative orders exceeding €200,000.

The benefit for the OEM using the design tool scales in orders of magnitude: €1,000–€10,000–€100,000. €1,000 EUR is the cost for core hours. €10,000 will be the market price of the service. And €100,000 is the resulting cost saving for the OEM in the production run calculated per one unit (one aircraft). Lower cost results from better and more elegant architecture, reducing the material used and the build and assembly time. A lighter structure also creates a positive weight reduction spiral leading to less wing area, less drag, less power and lighter batteries.

Moreover, this experiment is proof that smaller SMEs can adopt the use of HPC in their processes and that HPC computing hours are affordable.

The workflow directly supports the green transition in aerospace, helping to design more efficient and cleaner aircraft and accelerating the electrification of aviation.

Benefits

- Tentative orders for the new service in the next 2 years at the present time exceed € 200,000.
- AFormX interacted with 7 new OEMs and deepened relationships with 2 existing OEM partners.
- Entry into the HPC aerospace field for the University of Maribor.