PROJECT

NATHENA

New Additive manufacTuring Heat ExchaNger for Aeronautic

Funding: European (Horizon 2020)
Duration: Mar 2018 - Feb 2022
Status: Ongoing
Total project cost: €1,499,178
EU contribution: €1,499,178

Call for proposal: H2020-CS2-CFP06-2017-01
CORDIS RCN : 213938

Background & policy context:

Existing heat exchanger manufacturing technologies and processes (mechanical assemblies of repetitive and regular unitary components, such as folded sheet metal and/or tubing, which are mostly welded) can hamper progress towards higher performance.

Traditional manufacturing entails limits for the customisation of the inner structure, which have a direct impact on the thermal behavior of the exchanger core. Design and manufacture a complex core structure accordingly and well adapted to the inner thermal phenomenon seems to be a promising way to increase performances. Accordingly, NATHENA project aims at developing new complex inner structures for heat exchangers.

Objectives:

The NATHENA project will focus on the design development of a complex compact heat exchanger that best addresses thermal performance, made by additive manufacturing. These new compact air-air heat exchangers developed in NATHENA project will provide an efficient thermal management system dedicated to hybrid propulsion system.

Two types of material will be studied regarding heat exchanger use:

- Aluminium for low temperature range and
- Inconel for high temperature range.

The set objectives (see targets below) will be reached using calculation and multi-physical simulation (thermo-mechanical-fluidic) applied to evolutionary latticed and thin-walled structures combined optionally with fins to form a matrix of complex structures.

Predictive models and/or laws will be developed for pressure and temperature drop. Topological and parametric optimization will be carried out in an iterative way towards the most efficient model.

Through sample tests and final element method, calculation correlations will be carried out to ensure the relevance and validity of the basic structural choices as well as their combinations.

Targets:

- Delta temperature: 200°C to 400°C
- Flow: 0.01kg/s to 2kg/s
- Power: 0.5 to 500kW
- Reynolds number: 400 to 10000
- Pressure drop: 100mBar max
- Size: up to 500x300x300mm

Parent Programmes:
H2020-EU.3.4. - Horizon 2020: Smart, Green and Integrated Transport

Institute type: Public institution
**Institute name:** European Commission  
**Funding type:** Public (EU)  
**Other programmes:** JTI-CS2-2017-CFP06-LPA-01-35 Innovative compact heat exchangers modelisation & characterisation

**Lead Organisation:**

Sogeclair Aerospace Sas  
**Address:**
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31700 BLAGNAC  
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**EU Contribution:** €416,913

**Partner Organisations:**

AddUp  
**Address:**
5 RUE BLEUE ZONE INDUSTRIELLE DE LADOUX  
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France  
**EU Contribution:** €388,440

Temisth Sas  
**Address:**
45 rue Frédéric Joliot-Curie  
13382 MARSEILLE  
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**EU Contribution:** €326,225

Institut Von Karman De Dynamique Des Fluides  
**Address:**
Chaussee De Waterloo 72  
1640 Rhode Saint Genese  
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**EU Contribution:** €367,600

**Technologies:**
Aircraft propulsion  
New concepts for heat exchangers  
**Development phase:** Research/Invention

**STRIA Roadmaps:** Vehicle design and manufacturing  
**Transport mode:** Air transport  
**Transport sectors:** Passenger transport, Freight transport  
**Transport policies:** Other specified  
**Geo-spatial type:** Other