

PROJECT

## SPLEEN

### Secondary and Leakage Flow Effects in High-Speed Low-Pressure Turbines

**Funding:** European (Horizon 2020)

**Duration:** Nov 2018 - Feb 2022

**Status:** Ongoing

**Total project cost:** €1,964,515

**EU contribution:** €1,964,515



**Call for proposal:** H2020-CS2-CFP07-2017-02

[CORDIS RCN : 219263](#)

#### Objectives:

One of the key technologies to enable efficient Ultra-High By-Pass ratio geared turbofans is the low-pressure turbine (LPT). While the geared engine architecture allows a large reduction in LPT stage count and weight, the LPT operates at transonic exit Mach numbers and low-Reynolds numbers. Within this range of operating conditions, there is a critical shortage of aerodynamic and performance measurements. A lack of relevant experimental data in these engine-like conditions also concerns the interaction of the secondary-air and leakage flows with the mainstream. SPLEEN aims at filling up this gap with an extensive experimental undertaking that investigates the aerodynamics of high-speed LP turbines of geared-fan propulsion systems.

The project focuses on the interaction of cavity purge and leakage flows with the mainstream and its impact on the turbine performance. SPLEEN addresses this challenge with detailed flow measurements in two world-class turbine rigs: a large scale, transonic, low-Reynolds number linear cascade including periodic incoming wakes, and a high-speed 1.5 stage turbine rig.

#### Methodology:

The project first investigates the effect of cavity geometries and purge flow rates on the local flow features and turbine performance in the linear cascade. A new technology for the reduction of leakage-induced losses will be proposed, designed and tested in the cascade facility. In the second part of SPLEEN, a 1.5 LP turbine stage is tested at scale 1 in the rotating rig. The flow structures, turbine global performance and the unsteady leakage/purge flow interactions are measured at fully representative engine conditions. Turbine experiments are carried out at different operating conditions for two sets of hub and shroud cavity configurations. The SPLEEN project will validate new high-speed LPT technologies in engine-relevant environments (TRL up to 5) delivering new critical knowledge and unique experimental databases of major importance for turbomachinery designs.

#### 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-CfP07-ENG-01-23 Improvement of high speed low pressure turbine performance through reduction of secondary effects

#### Lead Organisation:

**Institut Von Karman De Dynamique Des Fluides**

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Chaussee De Waterloo 72  
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Belgium

**EU Contribution:** €1,964,515

### **Technologies:**

Manufacturing processes  
Advanced Manufacturing Processes for Gas-Engine Turbine  
Components

**Development phase:** Demonstration/prototyping/Pilot Production

**STRIA Roadmaps:** Vehicle design and manufacturing

**Transport mode:** Air transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Other specified

**Geo-spatial type:** Other