

NACELLES

# CLEEN PHASE III CONSORTIUM – Safran Nacelles – LEAD Project

November, 16th 2022

PUBLIC PRESENTATION



# Agenda

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**01**

Company overview

**02**

LEAD project overview

**03**

Project main accomplishments and  
next steps

**04**

Questions



01

# Safran Nacelles overview





# Safran - An industrial high technology group

76,800

employees

€15.3

billion in revenues  
in 2021

125 years

of history:  
the oldest aerospace  
manufacturer  
in the world

No.3

aerospace company  
worldwide (excluding  
aircraft manufacturers)

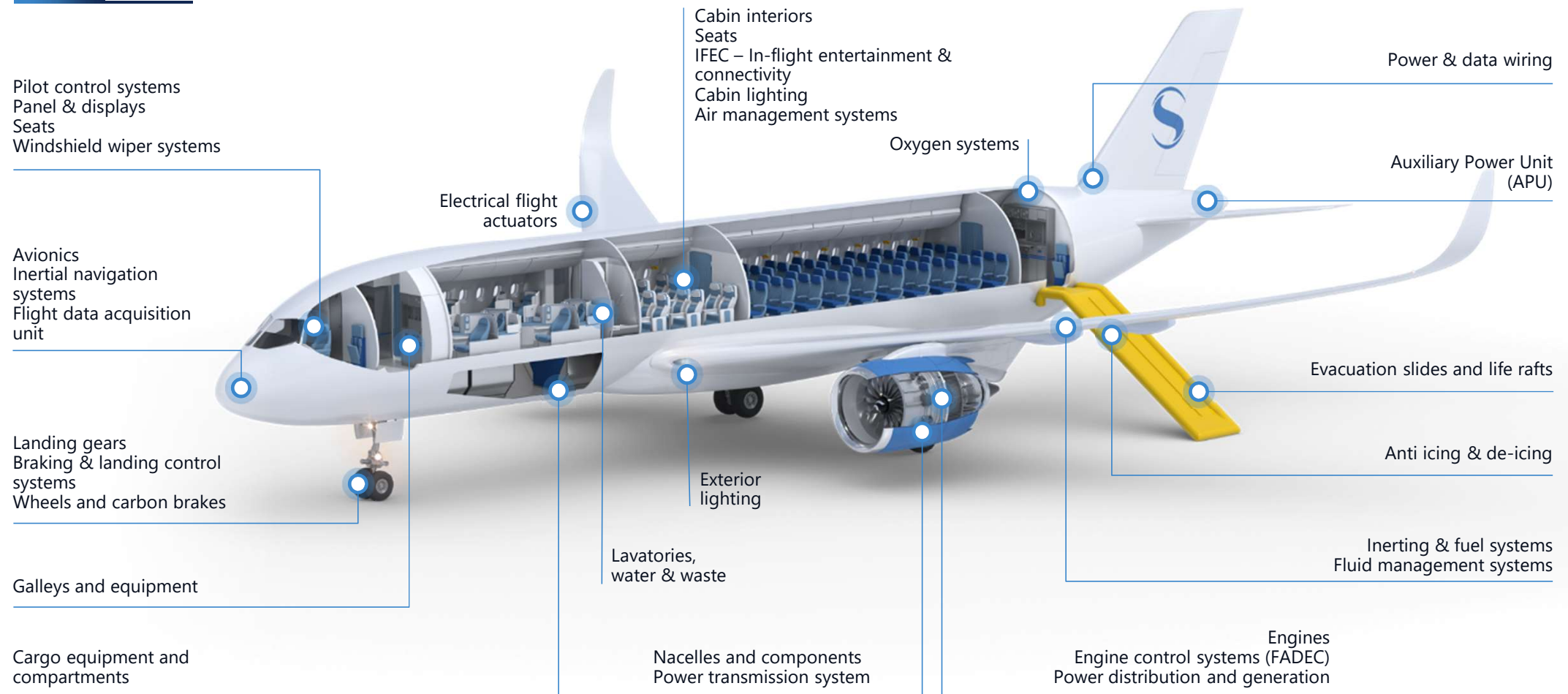


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## 23 States



# A comprehensive range of aircraft systems and equipment



# Safran Nacelles



**3,500**  
employees



**13 sites**  
in **8 countries**



**Nacelles for every type of aircraft:** regional and business jets, single and twin-aisle commercial airliners

**Maintenance, repair and associated support services**

**Composite materials** for aerostructures with acoustic treatments



## Areas of Expertise



### Composites & Assembly

Casablanca  
Florange  
Le Havre  
Burnley



Podding  
Hamburg  
Mobile  
Toulouse

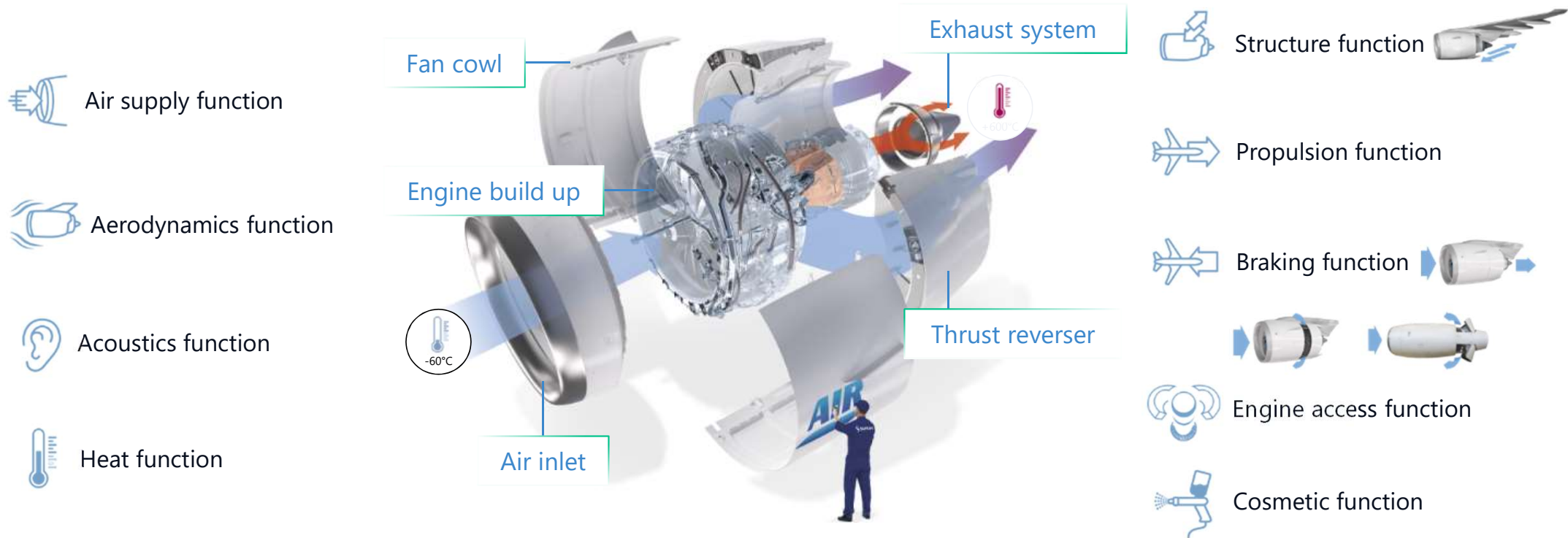


Sheet metal  
(Titanium, Aluminum)  
Burnley

Exhaust systems  
(Titanium, acoustic)  
Le Havre



# The nacelle - A major, high-tech system at the interface between the engine and the aircraft



**Our nacelle is a key system for performance and operating cost**

# Driving innovation for sustainable growth



€1.43

billion invested  
in R&D in 2021

12,000+

employees  
involved in R&D



75%

of Safran's R&T investment goes  
to reduce the environmental  
impact of air transport

1,176

patent applications filed in 2021  
worldwide

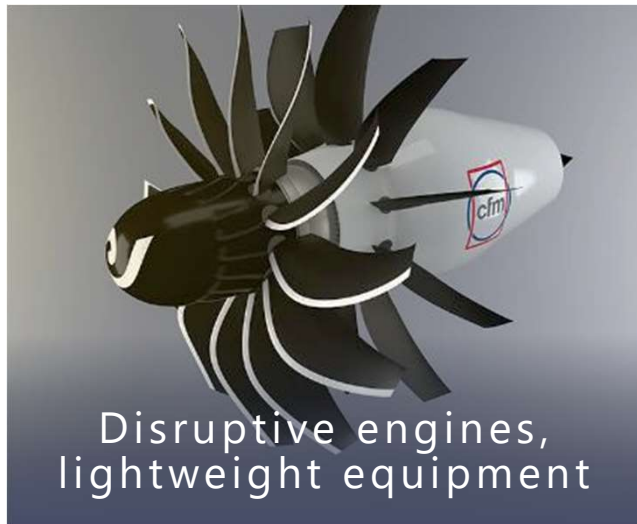
(Safran, **No. 1 in France**  
**for patents filed** – 1,037 applications)



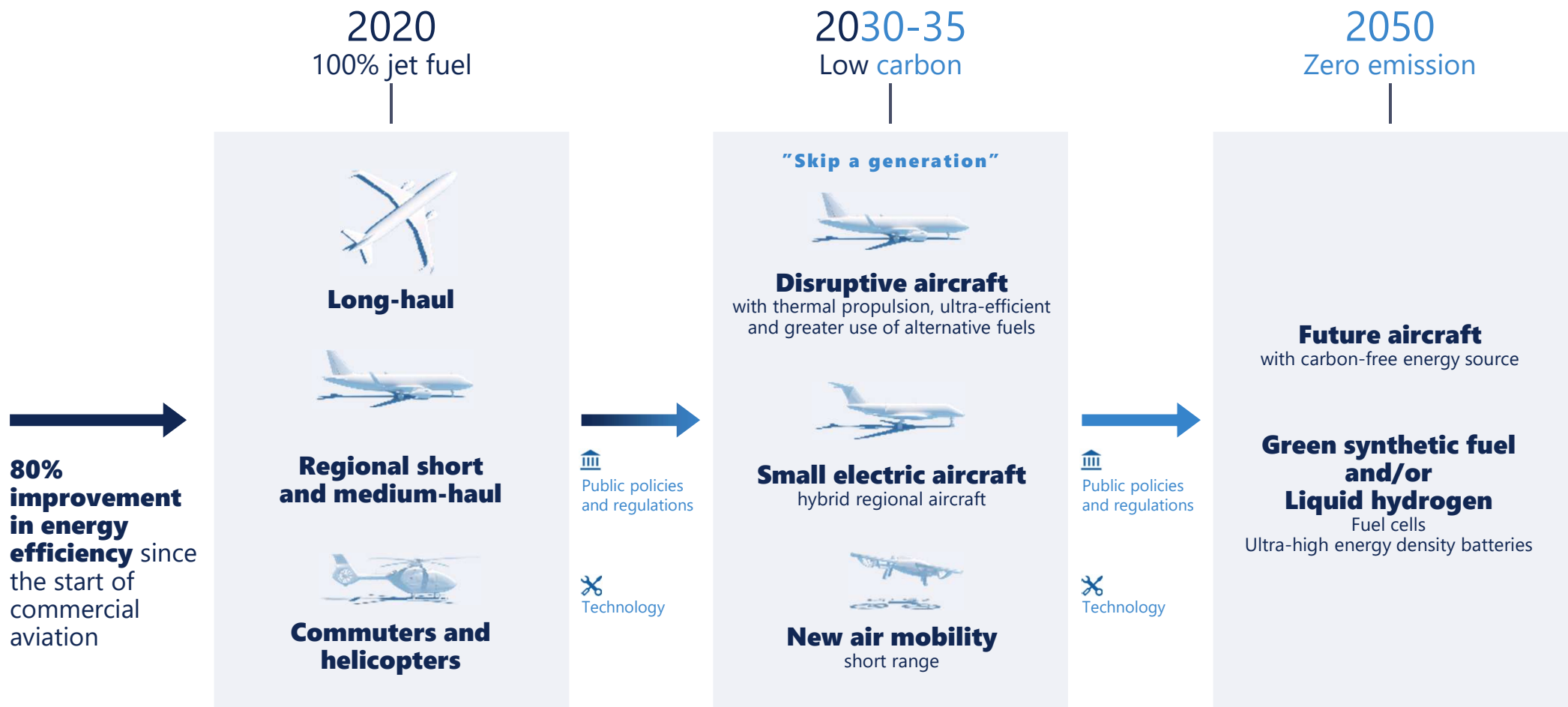
# Decarbonizing aviation, our strategic priority

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**Innovative technologies**  
to contribute to a “zero emission” aviation by 2050



# The path to successful decarbonization





# Innovation axes to imagine new high-added value products and services

## ARCHITECTURE

- Optimum propulsion to aircraft integration to reduce fuel burn



Open Rotor

## NEW SOLUTIONS

- More light-weight
- More resistant to high temperature exposure
- Quieter (noise reduction)
- More electric
- More predictable (maintenance)



Active acoustics

## ADVANCED MATERIALS & PROCESSES

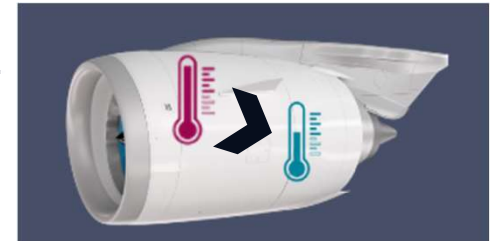
- Non-destructive testing solution using infrared thermography and augmented reality with [IRIS](#)



Infra Red Inspection System (IRIS)

## NEW FUNCTIONALITIES

- New functions meeting new architectures



Heat-exchange nacelle



02

## LEAD Project overview



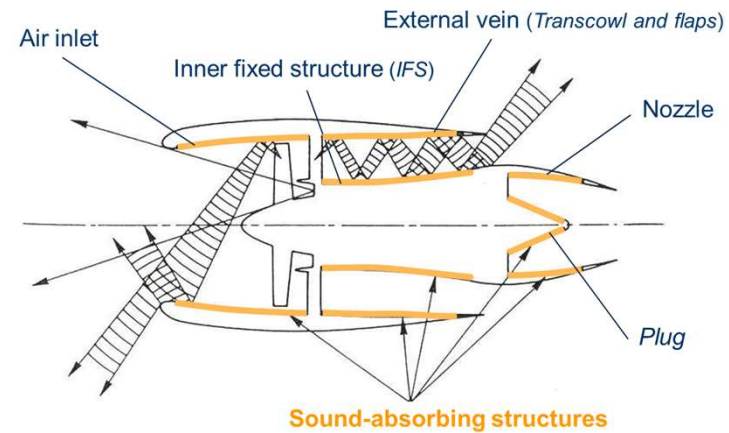
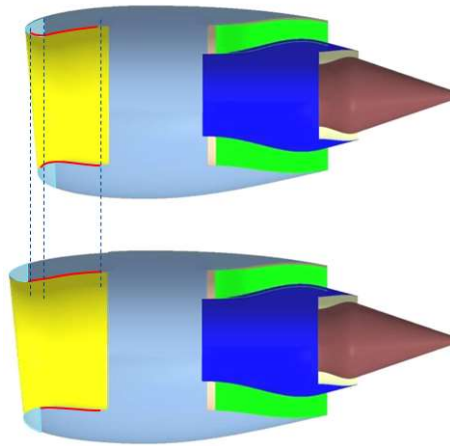
# Context

- Fuel reduction and new engine architectures
- Higher requirements of noise reduction



**Shorter nacelles**

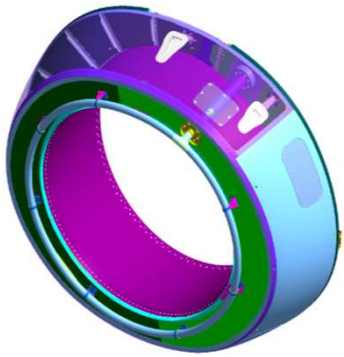
**More acoustic treated surface**



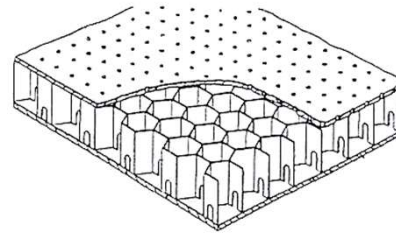
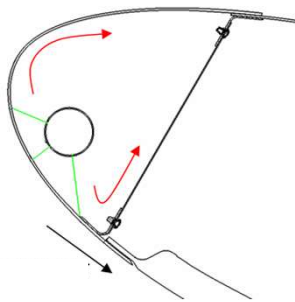
**Need to add acoustic liner to new nacelles parts**

# Purpose

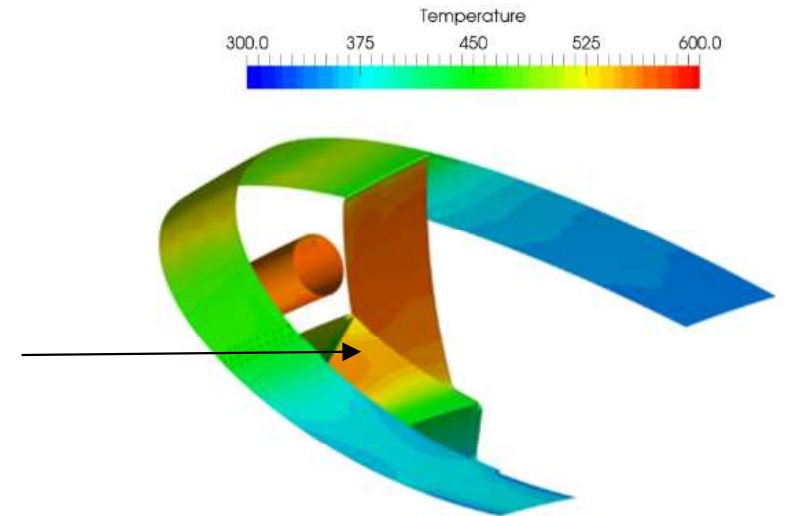
## Adding acoustic liner to inlet lip



- Standard inlet with piccolo anti-icing



Acoustic liner



- The acoustic liner becomes a thermal insulator for the anti-icing system

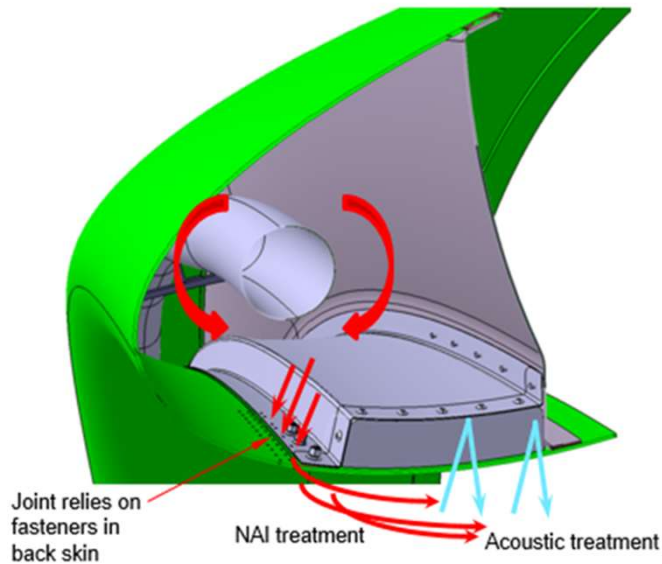
Technical challenge: secure anti-icing function



# Concept

## LeAD (Lèvre Acoustique Dégivrée) – Anti-icing Acoustic Lip

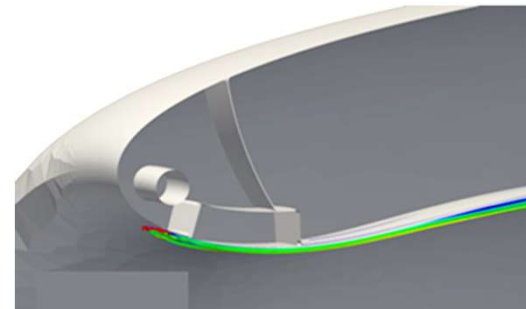
- Bleeding piccolo hot air to prevent ice formation



### Benefices:

- Significant Fuel Burn reduction (shorter inlet)
- Opportunity to increase nacelle's acoustic performance
- Quick development as based on mature technologies
- Can be deployed on standard inlet designs

Hot air bleed simulation:



# LEAD Project - Objectives

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- **Concept / functionality**

- Demonstrate the performance of anti-icing by heating air film
- Demonstrate the acceptability of heating air film in the engine operation
- Demonstrate the acoustic performance

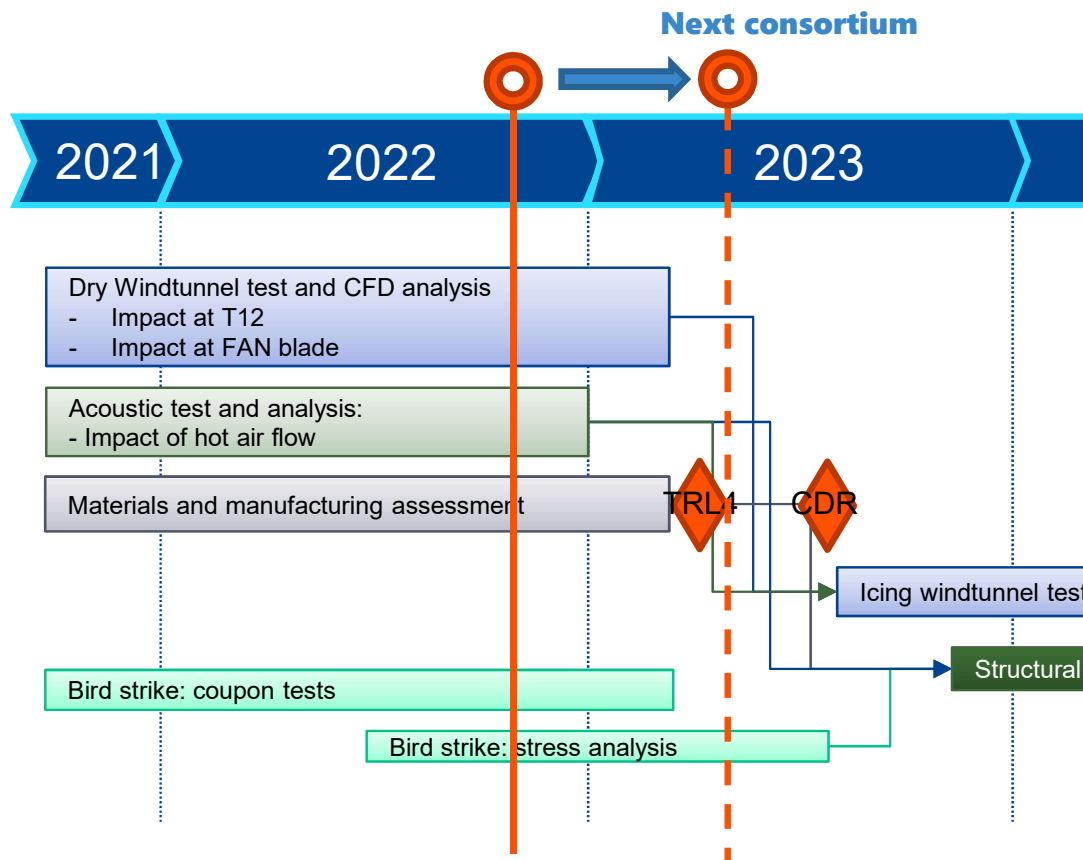
- **Design tools & methods**

- Structural design of a LEAD inlet

- **Manufacturing materials & processes**

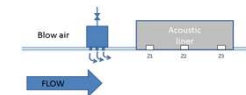
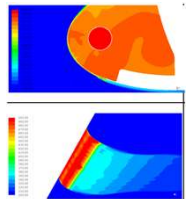
- Demonstrate LEAD inlet manufacturability

# Project Schedule – next steps



## Accomplishments

- ◆ Wind tunnel test equipment final design
- ◆ simulation of wind tunnel testing
- ◆ Acoustic tests results



## Upcoming

- ◆ Wind tunnel results
- ◆ M&P assessment
- ◆ Manufacturing preliminary tests
- ◆ Bird strike coupon tests and first analysis

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**POWERED  
BY TRUST**

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