



# **CHALMERS**

# **EXPERIMENTAL AERODYNAMIC INVESTIGATION OF POWERED NACELLES FOR HIGH BYPASS TURBOFAN ENGINES**

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# ITAP- Integrated Turbofan Airframe Performance

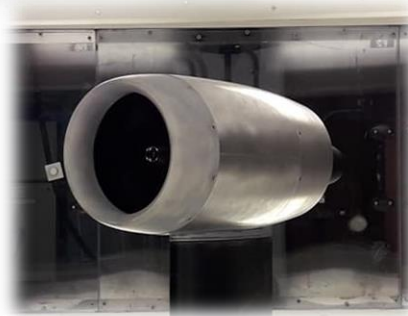
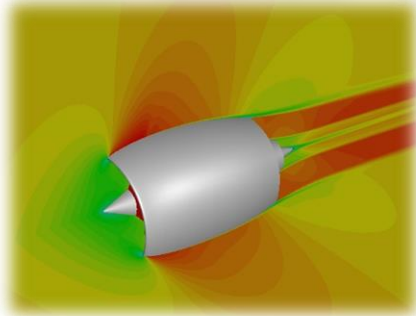
- NFFP7 Innovair Project
- Duration: 4 years
- Chalmers – GKN



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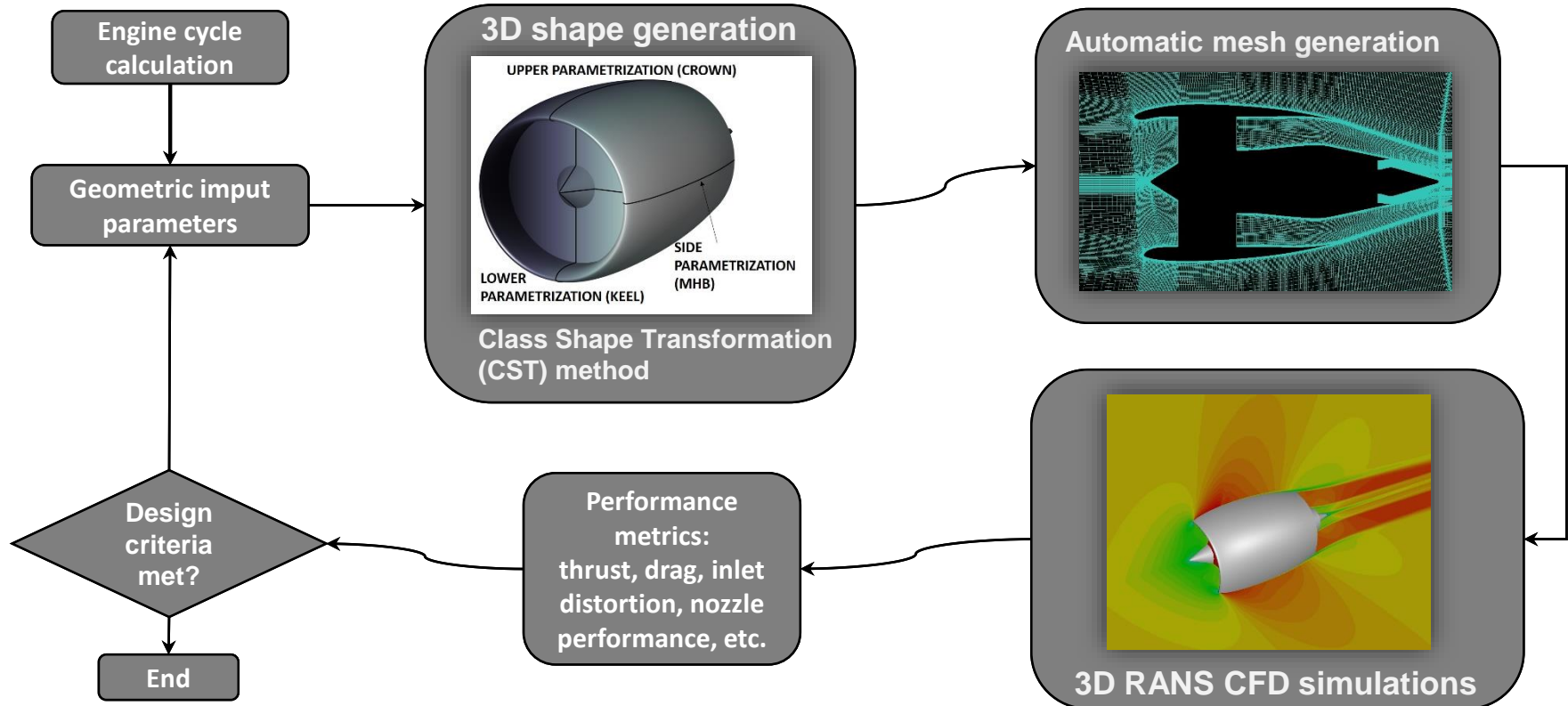
**Standalone nacelle design and experiments**  
**UHBP turbofans – Ultrashort inlets**



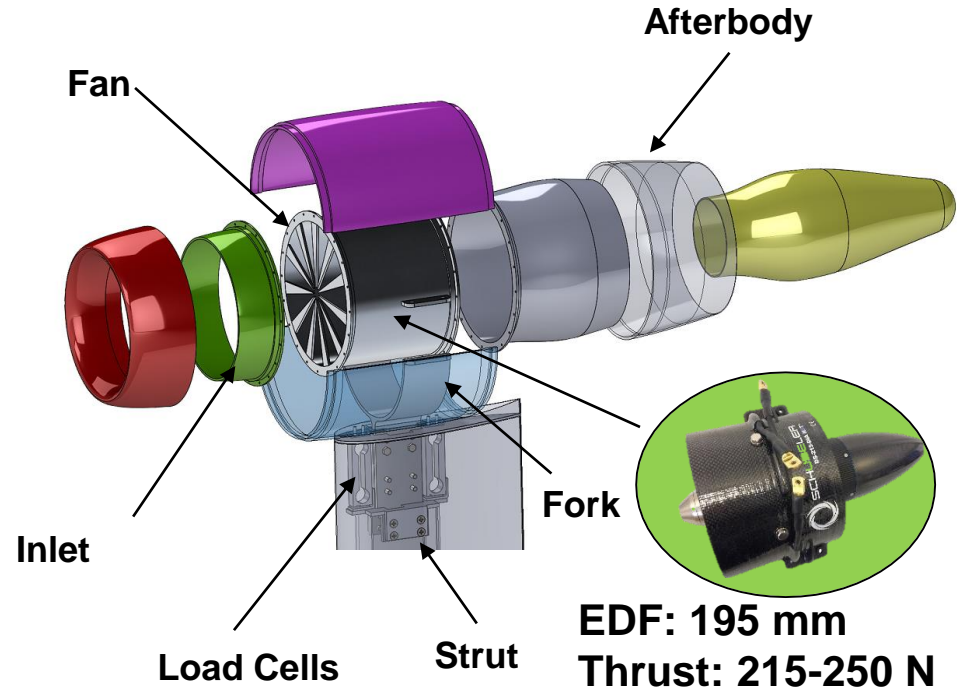
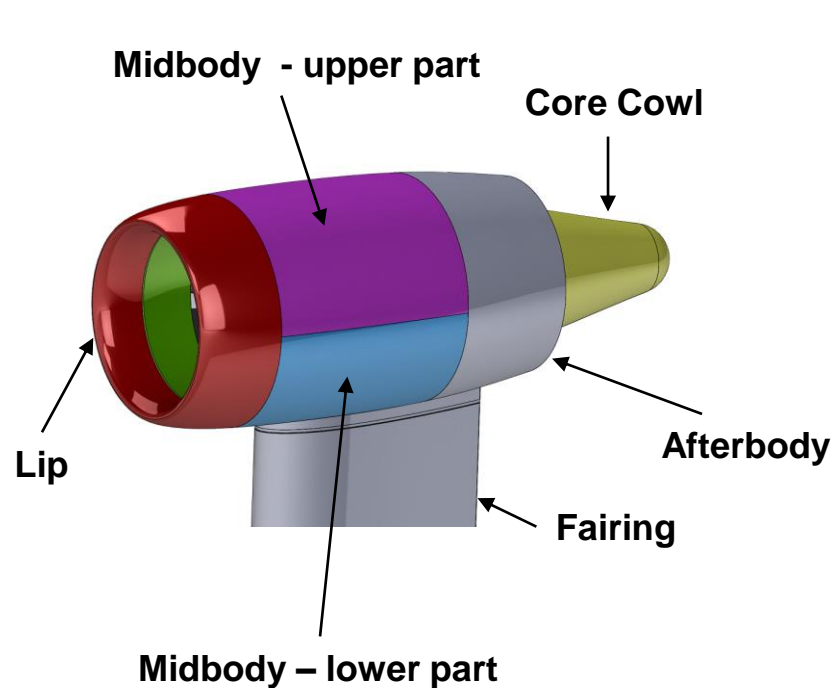
**Innovative propulsion  
integration configurations**



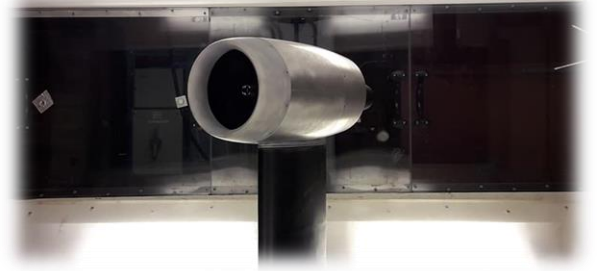
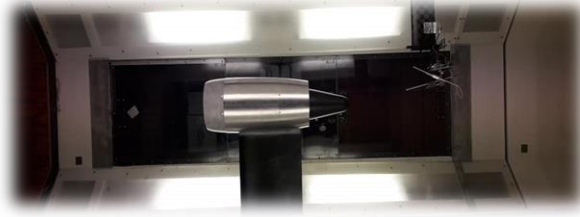
# TURBOFAN NACELLE DESIGN FRAMEWORK



# Rig design - CAD

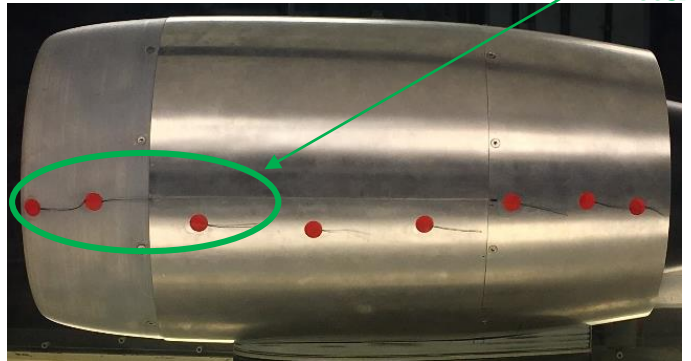
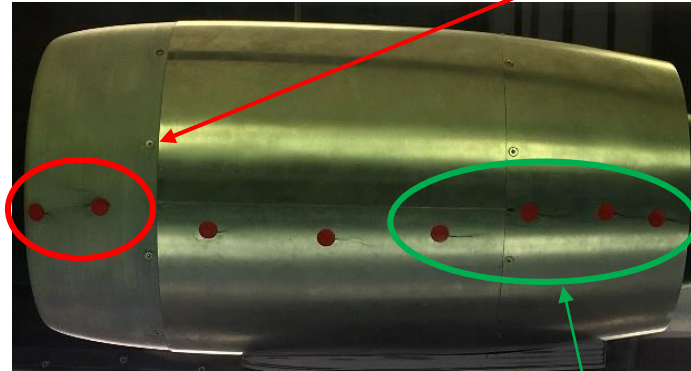


# Rig mounted in the wind tunnel

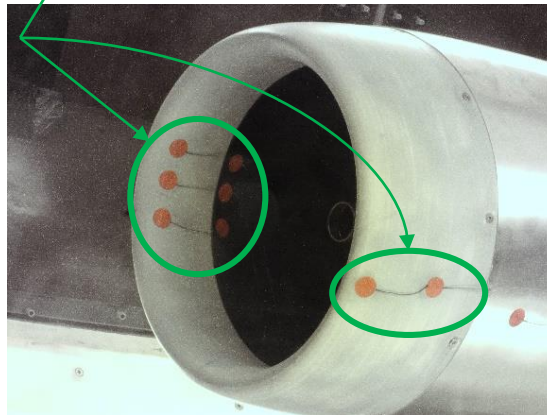
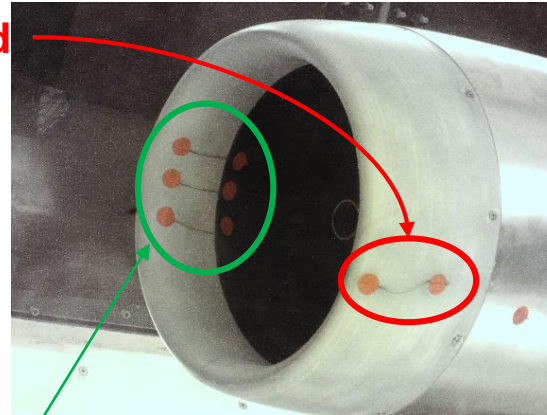




# Flow visualization



Leeward side



Leeward side (right) windward side (left)

Angle of attack = 10 deg

Wind speed = 30 m/s

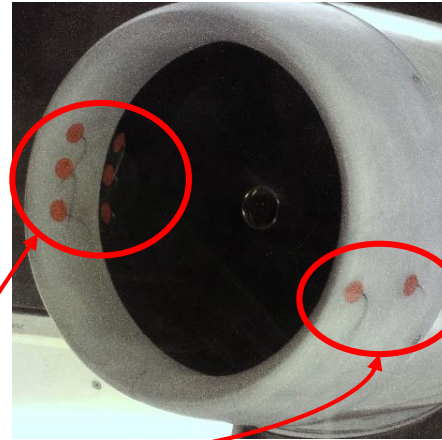
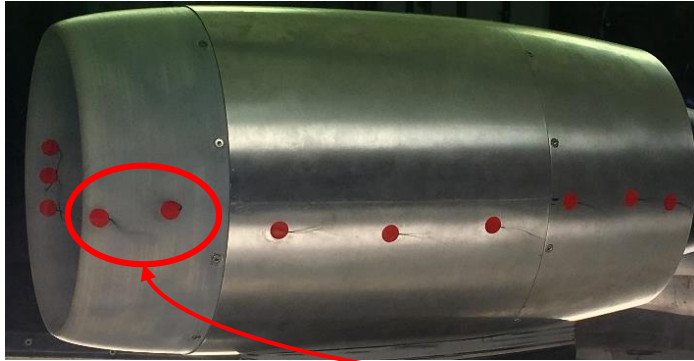
Fan Speed = 0 RPM

Angle of attack = 10 deg

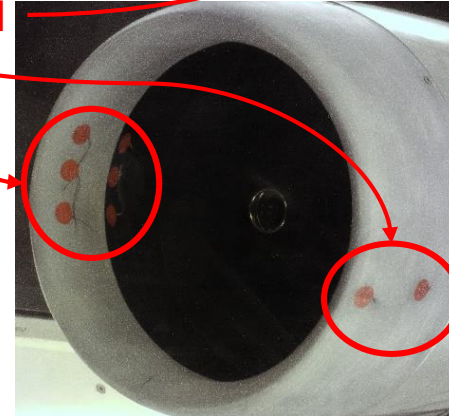
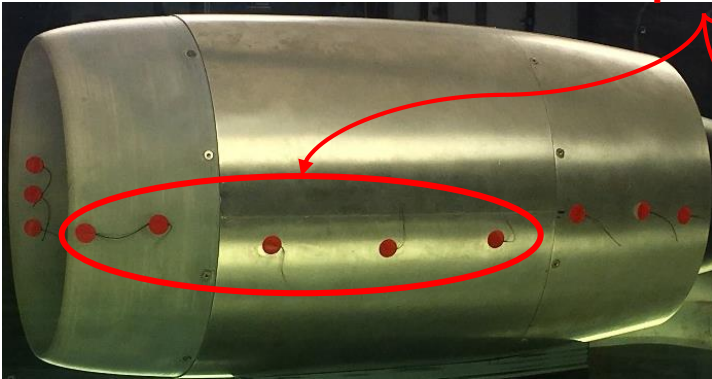
Wind speed = 30 m/s

Fan Speed = 7750 RPM

# Flow visualization



Angle of attack = 25 deg  
Wind tunnel speed = 30 m/s  
Fan Speed = 0 RPM



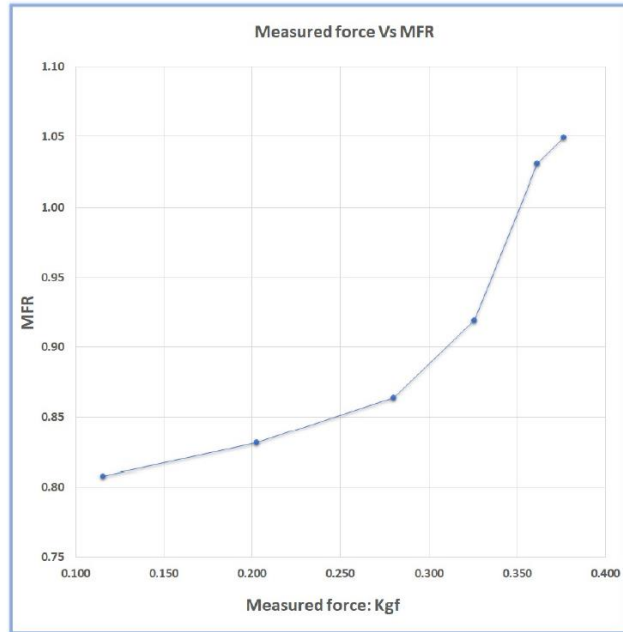
Angle of attack = 25 deg  
Wind tunnel speed = 30 m/s  
Fan Speed = 7870 RPM

Separated

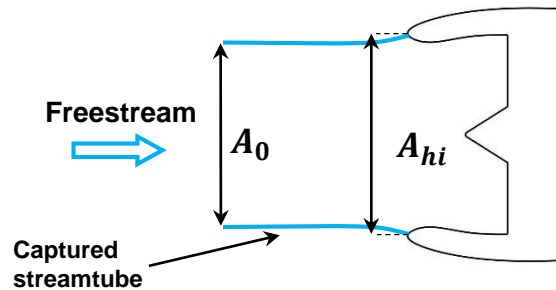
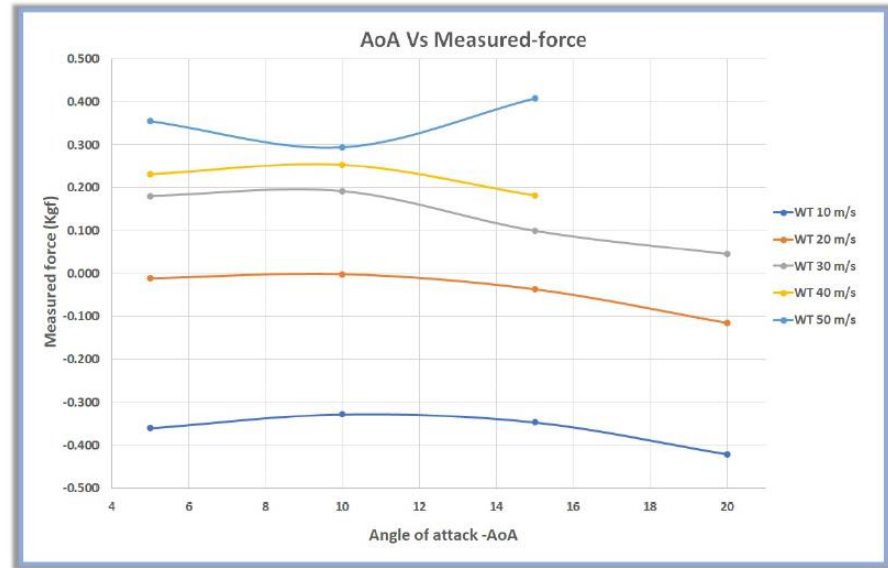
Leeward side

Leeward side (right) windward side (left)

# Preliminary results



$$MFR = A_0/A_{hi}$$





# **Future work**

- **Drag breakdown from wake surveys**
- **Studying ultra-short and asymmetric inlets**
- **Pressure taps in different circumferential Nacelle positions**
- **Infrared thermography for transition to turbulence study**
- **Validation of low speed CFD simulations.**

# THANKS FOR LISTENING!

