

FIRST WORKSHOP

Overview on the HLFC Activities in AFLoNext and beyond



AFLoNext

2ND GENERATION
ACTIVE WING

Delft, September 10, 2015
Presenter: Geza Schrauf (Airbus Operations GmbH)



The logo for AFLoNext, featuring the text 'AFLoNext' in a sans-serif font. The 'o' is lowercase and has a green underline that extends to the right. The background of the slide is a light blue gradient with a diagonal cut in the top right corner showing a blue sky with white clouds.

AFLoNext

OVERVIEW OF THE HLFC ACTIVITIES IN AFLONEXT AND BEYOND

Drivers for Performance Improvement

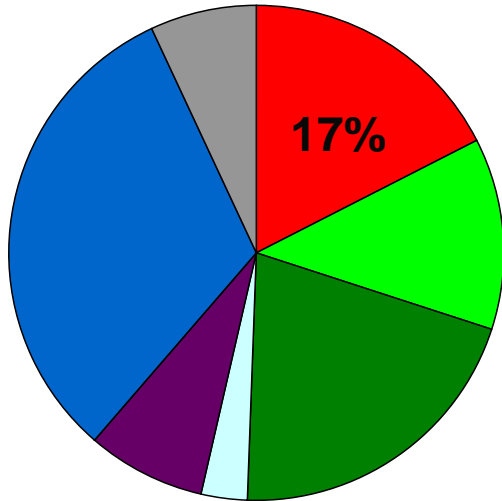
Environment => VISION 2020

- **50% reduction of fuel consumption**
- **80% reduction of NO_x**

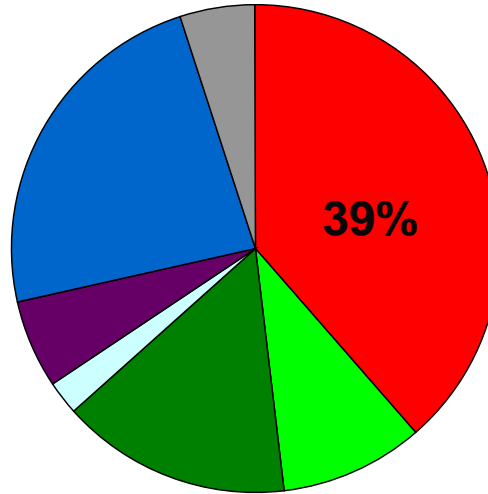
Economics => reduction of fuel cost



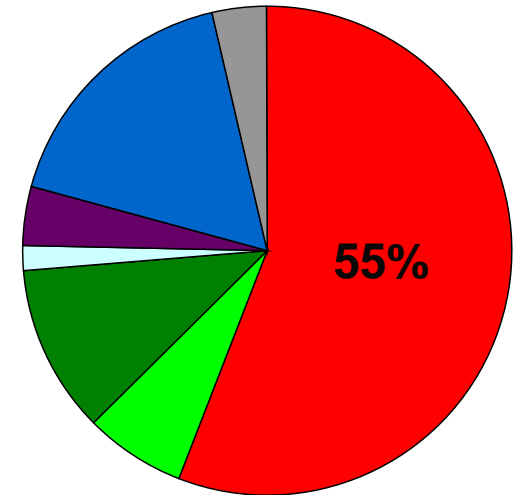
DOC Shares for 4000nm Mission with A330-300



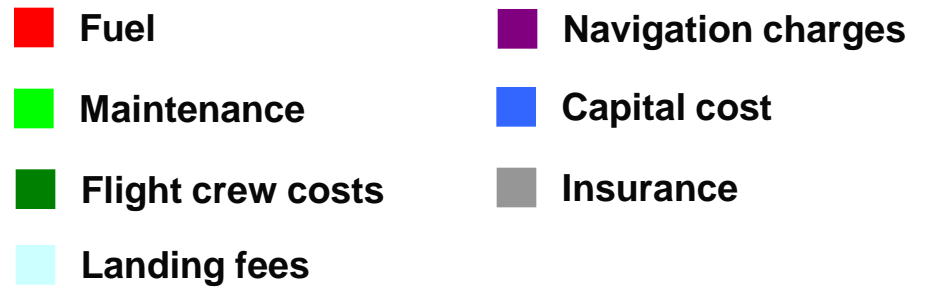
60 US-ct / US-gallon



180 US-ct / US-gallon



360 US-ct / US-gallon



Status: July 2008

Specific Range as Performance Measure

Specific range SR measures performance of aircraft

Lift = Weight
Drag = Thrust

$$SR = \underbrace{1/TSFC}_{engine} \cdot \underbrace{V \cdot L/D}_{aerodynamics} \cdot \underbrace{1/W}_{structure}$$

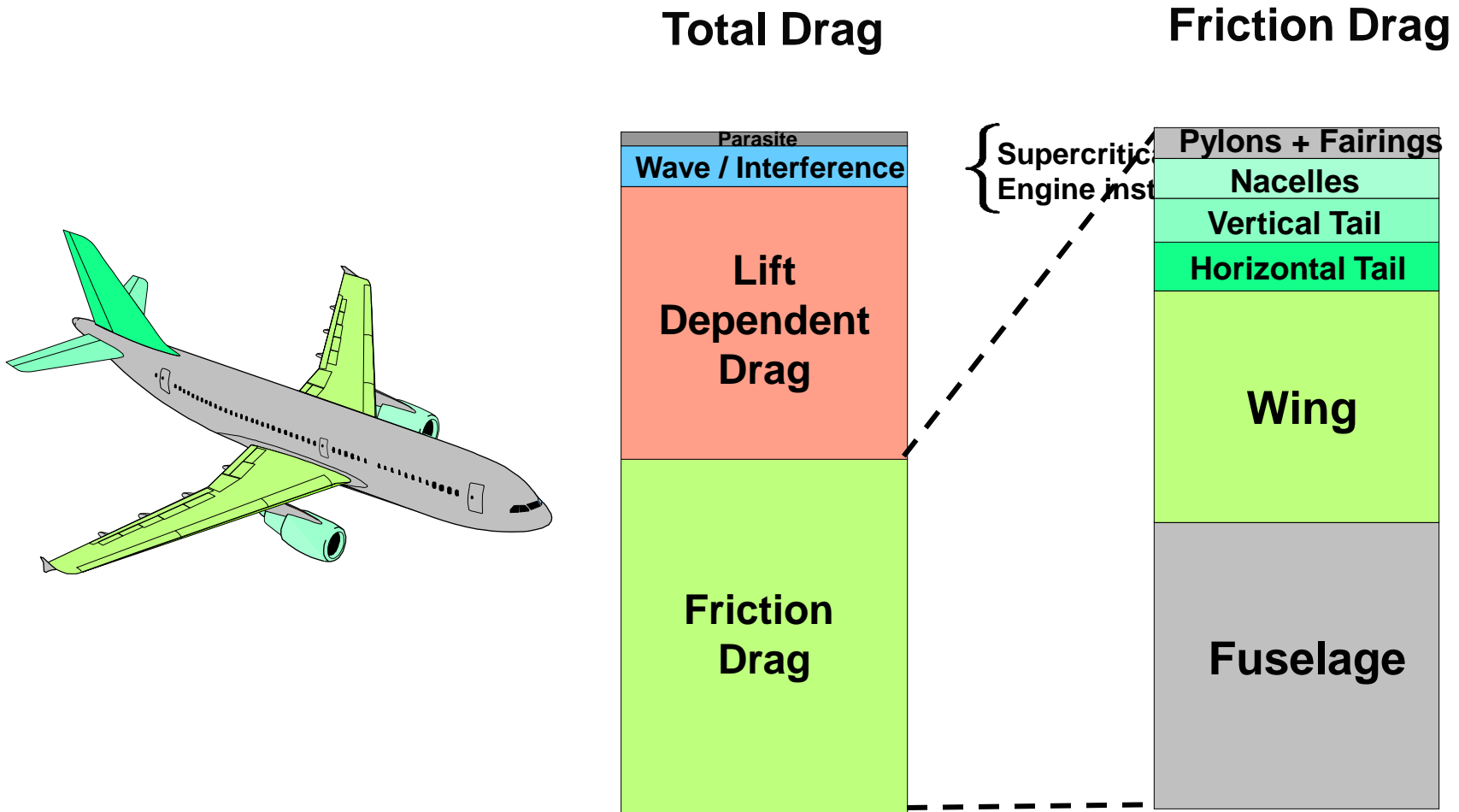
more efficient engine \Rightarrow increase bypass ratio, intercooler, ...

lighter structure \Rightarrow advanced materials

better aerodynamics \Rightarrow improve $M \cdot L/D$

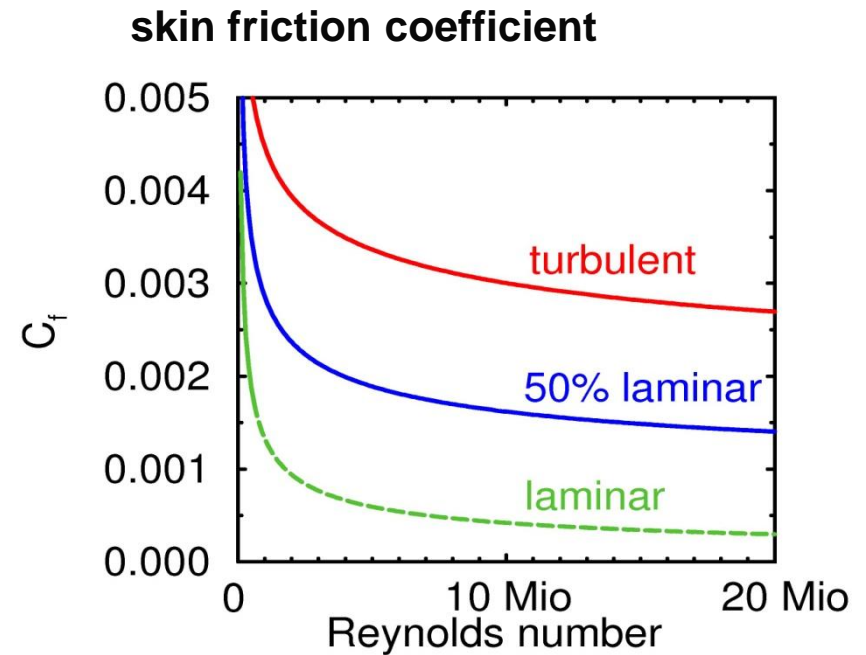
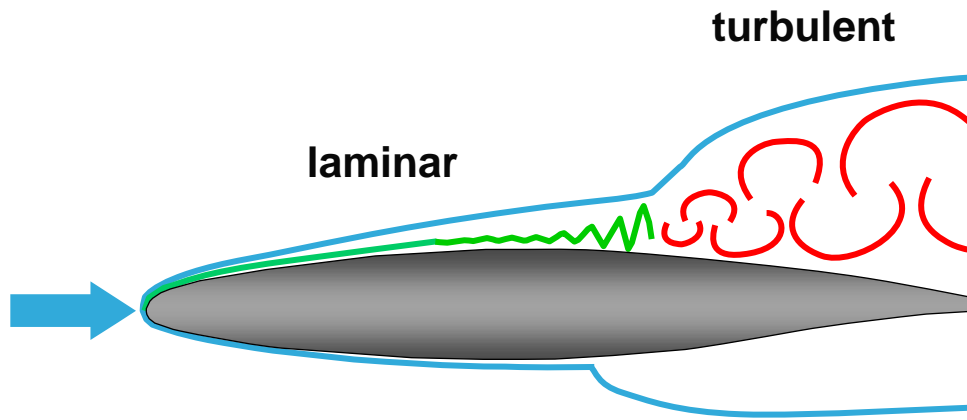
\Rightarrow reduce drag

Drag Breakdown of a Typical Transport Aircraft



Laminar Flow

Laminar boundary layer has much lower friction drag

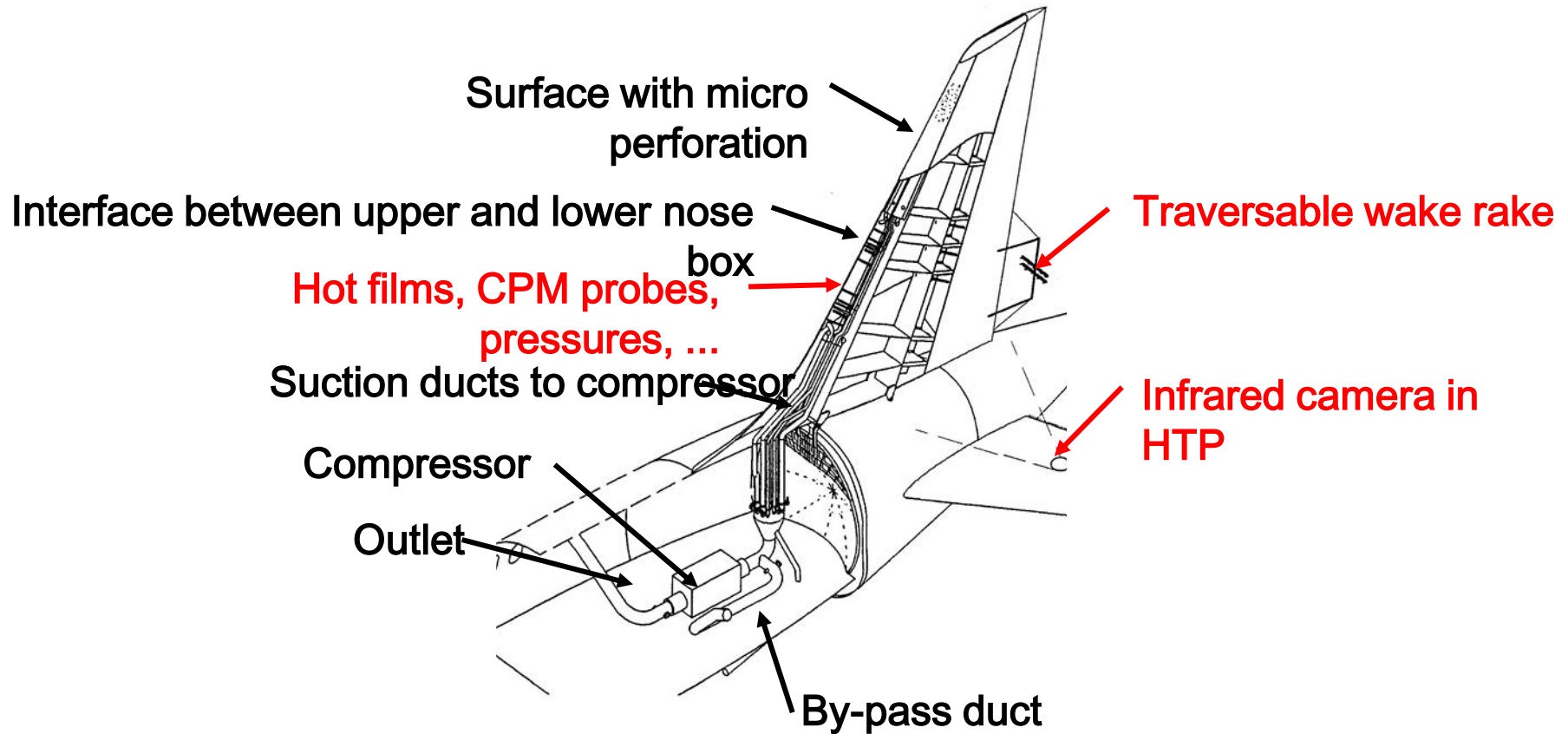


Large profile drag reduction, even if only part of the surface is laminar

Previous Experimental HLFC System



Previous Experimental HLFC System



Previous Experimental HLFC System



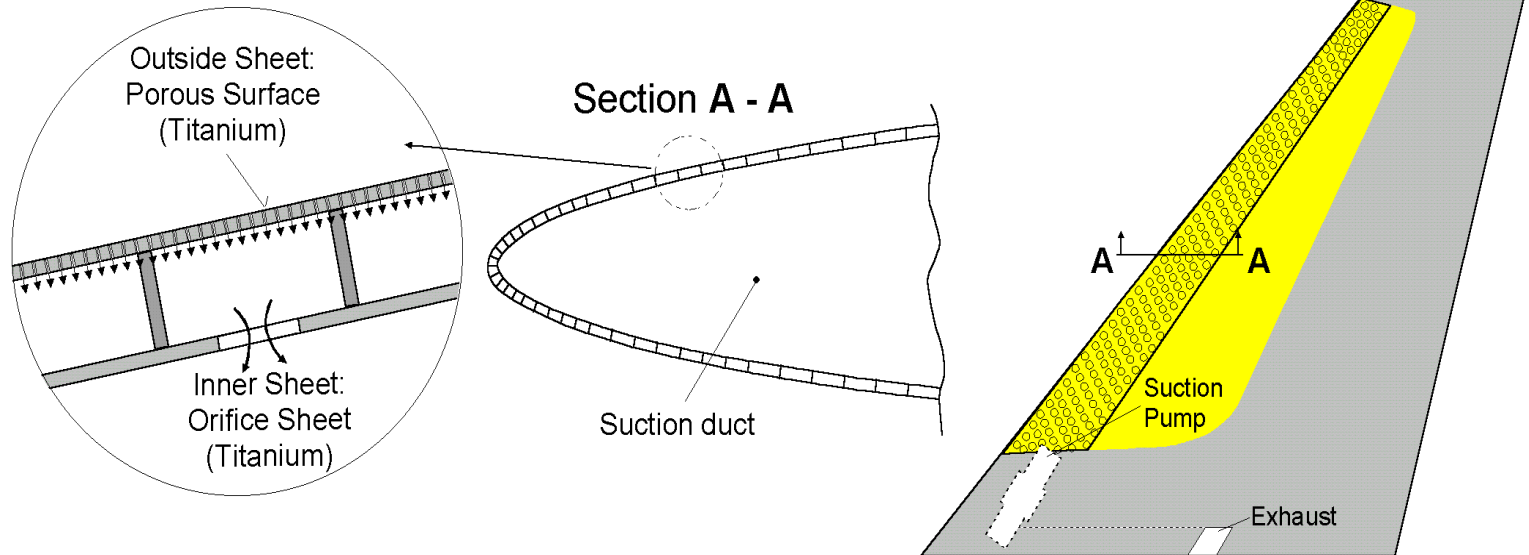
Feasibility for the application of HLFC technology was proven by flight tests with HLFC fin (1998; LaTeC, HYLDA, 3E)

→ **Simpler and lighter system needed to obtain overall benefit**

Simplified HLFC - The ALTTA System

Simplified HLFC Systems – ALTTA System

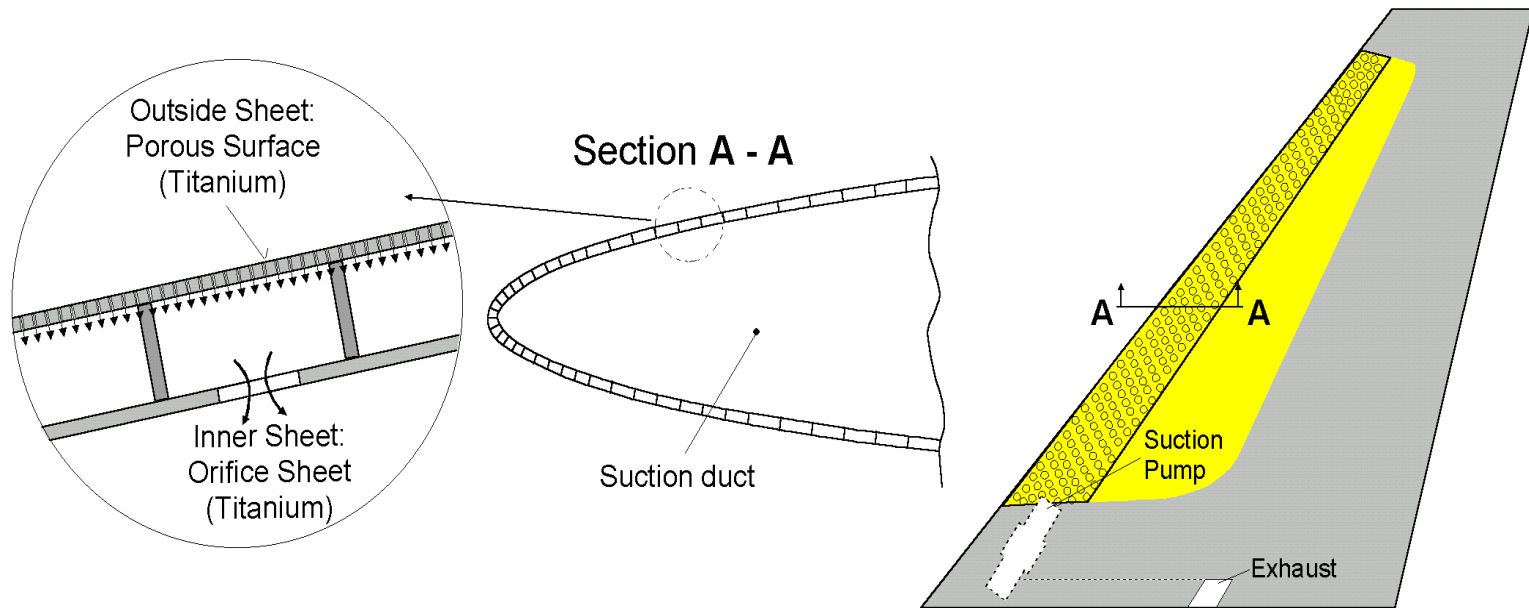
K. H. Horstmann: ALTTA TR 23



Inner skin has two functions:

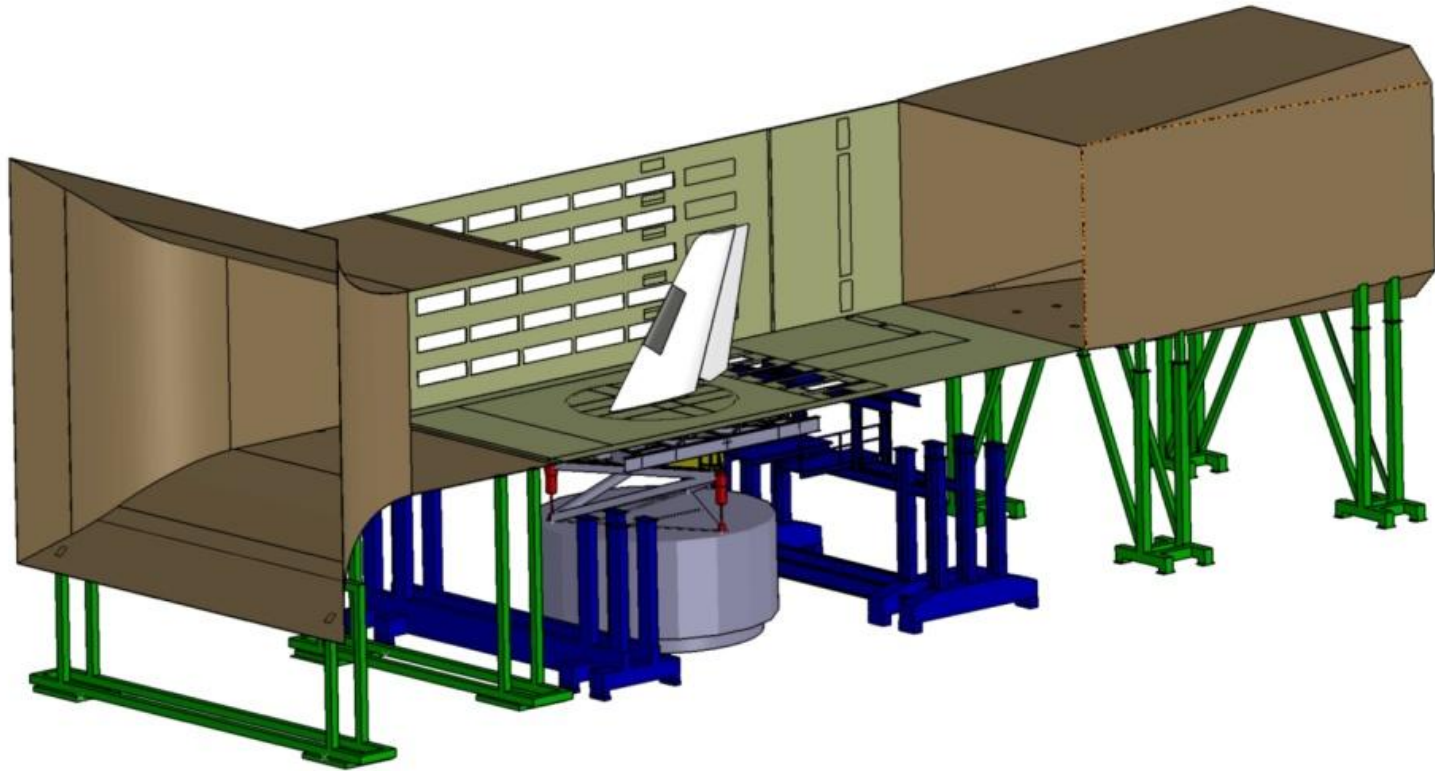
- **Support the micro-perforated outer skin**
- **Generate adequate pressure on the inside of the outer skin**

Simplified HLFC Systems – ALTTA System



- No suction chambers below double skin → weight reduction
 - No ducting to collector → weight reduction
 - No vents in ducts to regulate mass flow → weight reduction
 - No mass flow control/regulation for each suction chamber
- The suction distribution must be adequate for the whole flight envelope

Validation of Simplified HLFC in Wind Tunnel



**Validation of active and passive simplified HLFC
in DNW-LLF wind tunnel in November 2014**

Next Steps: AFLoNext & CleanSky2

AFLoNext: In-flight demonstration of simplified HLFC on the VTP of an A320 aircraft

Design and manufacturing of an HLFC leading edge for a long-range transport aircraft



CleanSky 2: Application of simplified HLFC on tail surfaces of long-range aircraft



Presentations of Technology Stream “HLFC on wing and fin”

**Aerodynamic design of an HLFC leading edge for a VTP
Heiko v. Geyr, DLR**

**Structural design of an HLFC leading edge for a VTP
Stéphane Debaisieux , Sonaca**

**Integrated HLFC design for the leading edge of a wing
James Aldermann , AGI & Alan Mann, Airbus**

**Preliminary Krüger design for an HLFC wing
Jochen Wild, DLR**



Thank you !

For more information

Contact :

\ Geza Schrauf; geza.schrauf@airbus.com

\ Airbus, Airbus Allee 1, 28209 Bremen, Germany

Or Contact@AFLonext.eu



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No 604013, AFLONEXT project.

