ACStyria - AIRTechTalk

“Als die Haie fliegen lernten - Technologietransfer vom Motorsport in die Luftfahrt”

Dr. Andreas Flanschger, CEO bionic surface technologies GmbH

bionic surface technologies

Globally active company, based in Austria.

Provides efficiency increase by use of Riblet surfaces.

3 patents about Riblet Technology and use of it

2009
Founded

20+
Employees

Biggest CFD
Office in Austria

600+
Customers/projects worldwide

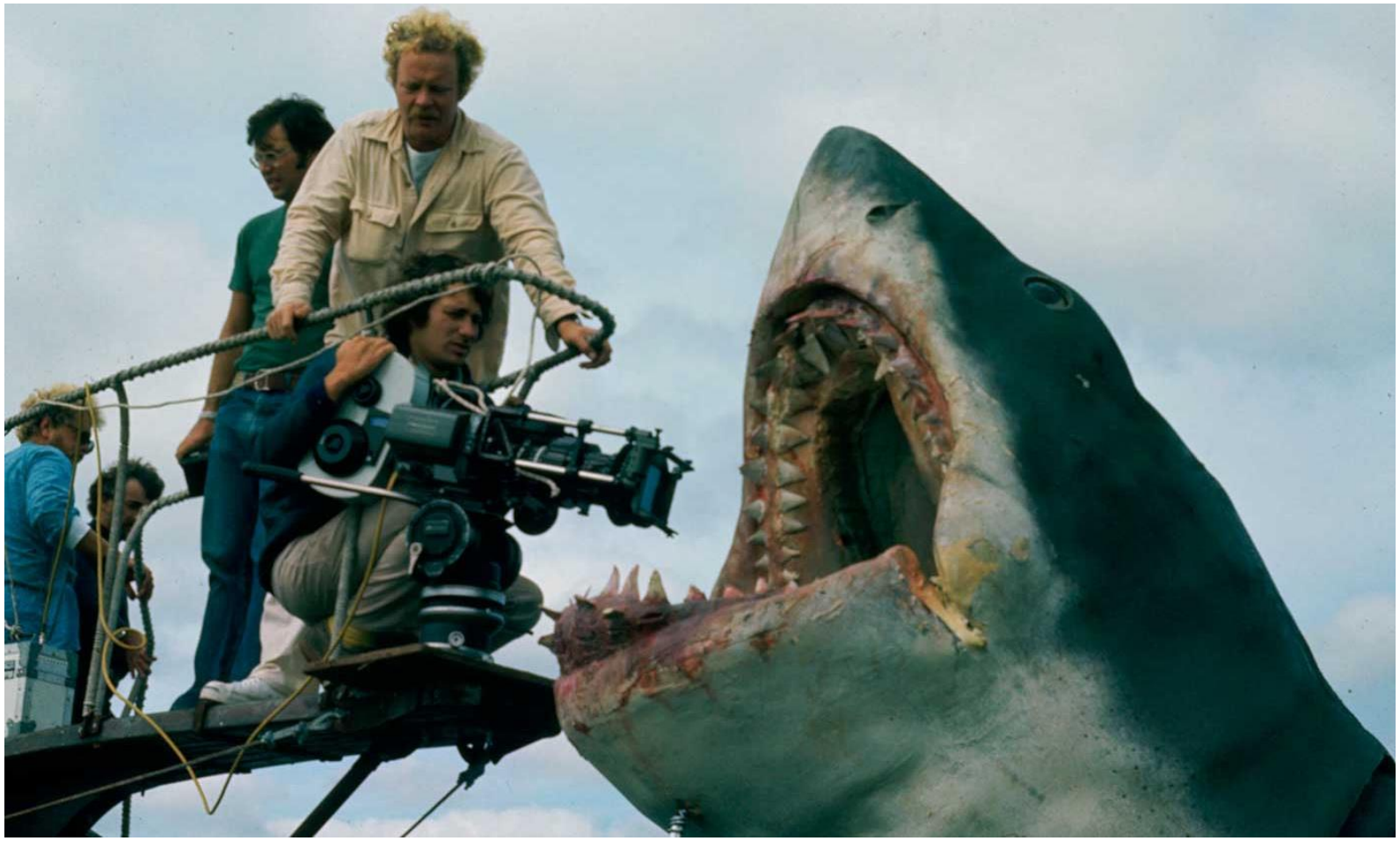
BIONIC SURFACE TECHNOLOGIES | World Leading Riblet Expert

What we do

Riblet Technology!

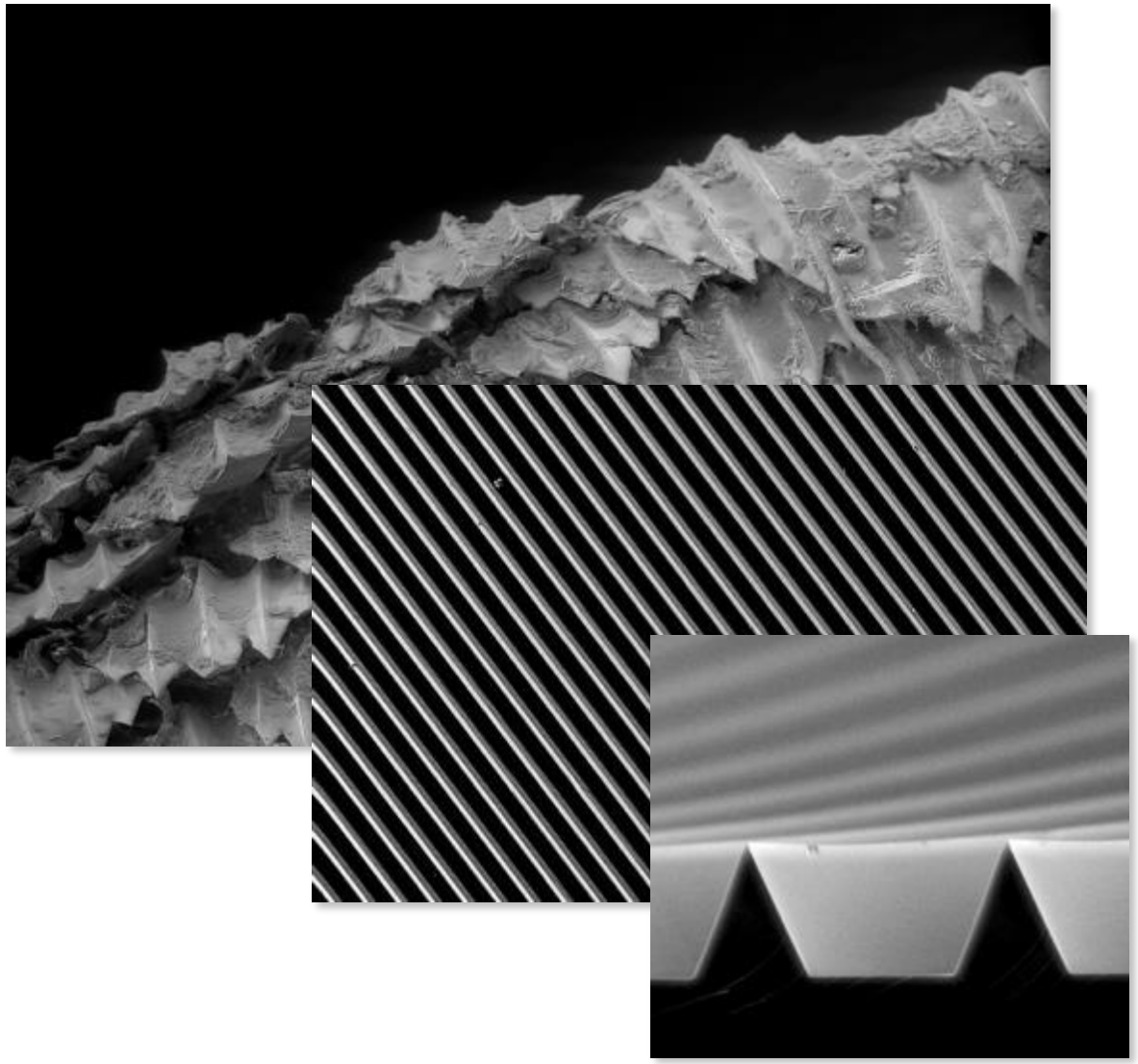
BIONIC SURFACE TECHNOLOGIES | World Leading Riblet Expert

A closer look



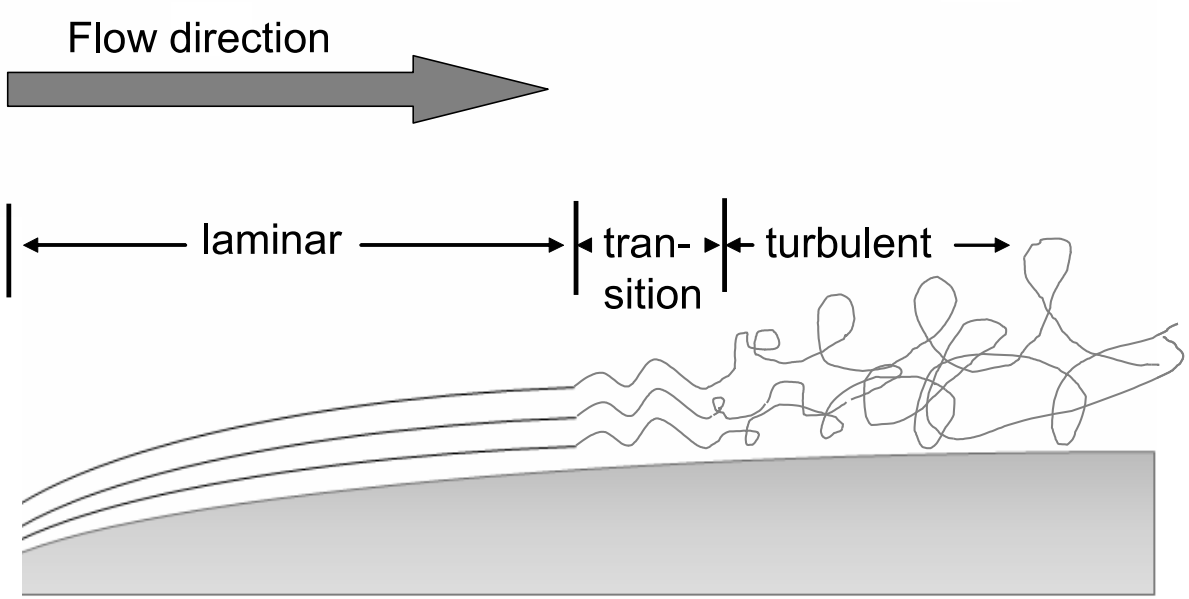
A closer look

- Like the skin of a shark, Riblets have tiny grooves arranged lenghtwise along the flow.
- **Riblets reduce the drag** at technical applications **up to 8%**
- BST's new patented **"beyond Riblets"** microstructures reduce drag **up to 13%**



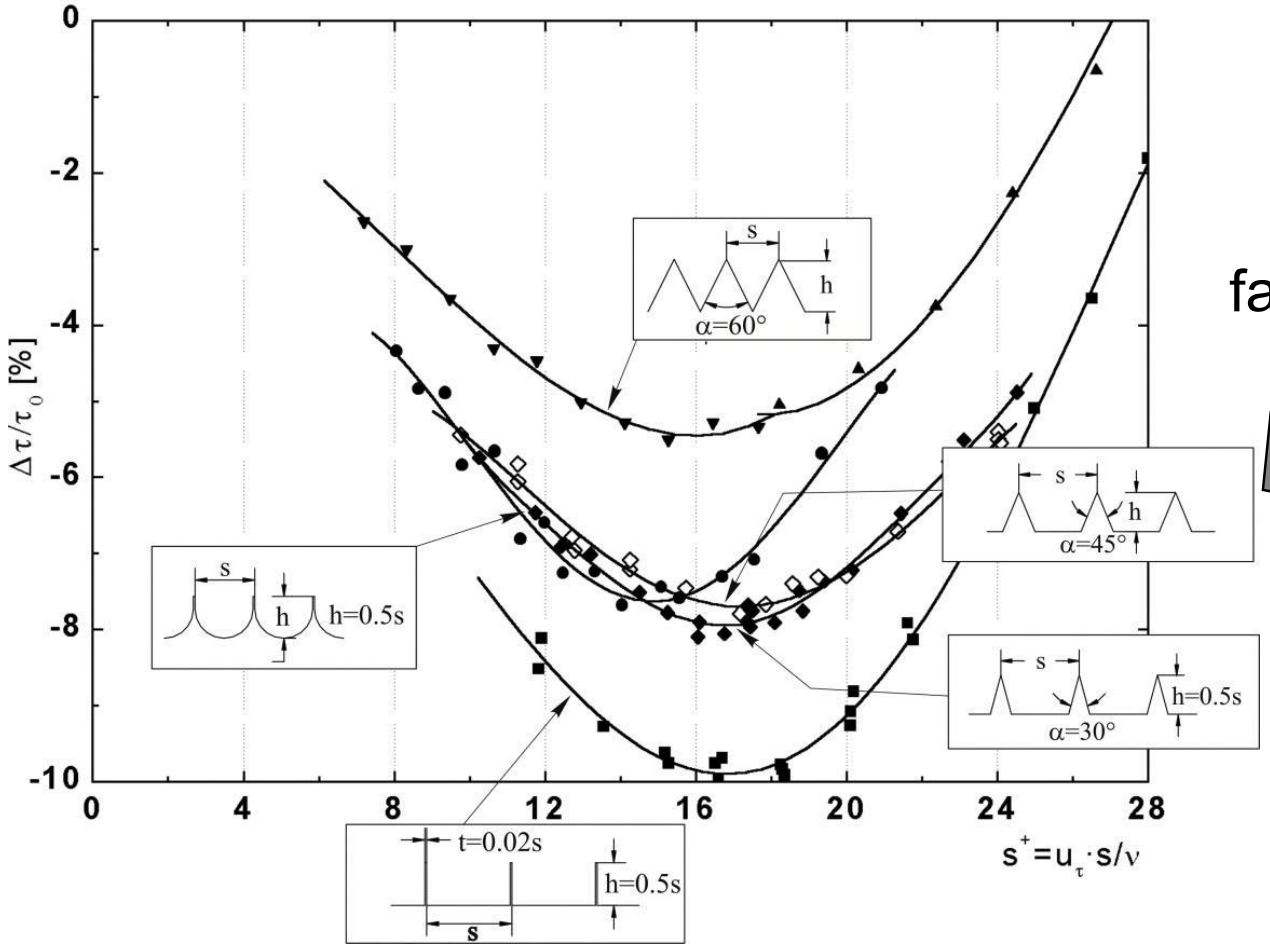
Laminar to turbulent

- Drag of laminar flow is much smaller than drag of turbulent flow. Laminar flow turns into turbulent flow at a certain Re.



Transition from laminar to turbulent flow

Sawtooth – Trapeze - Blades

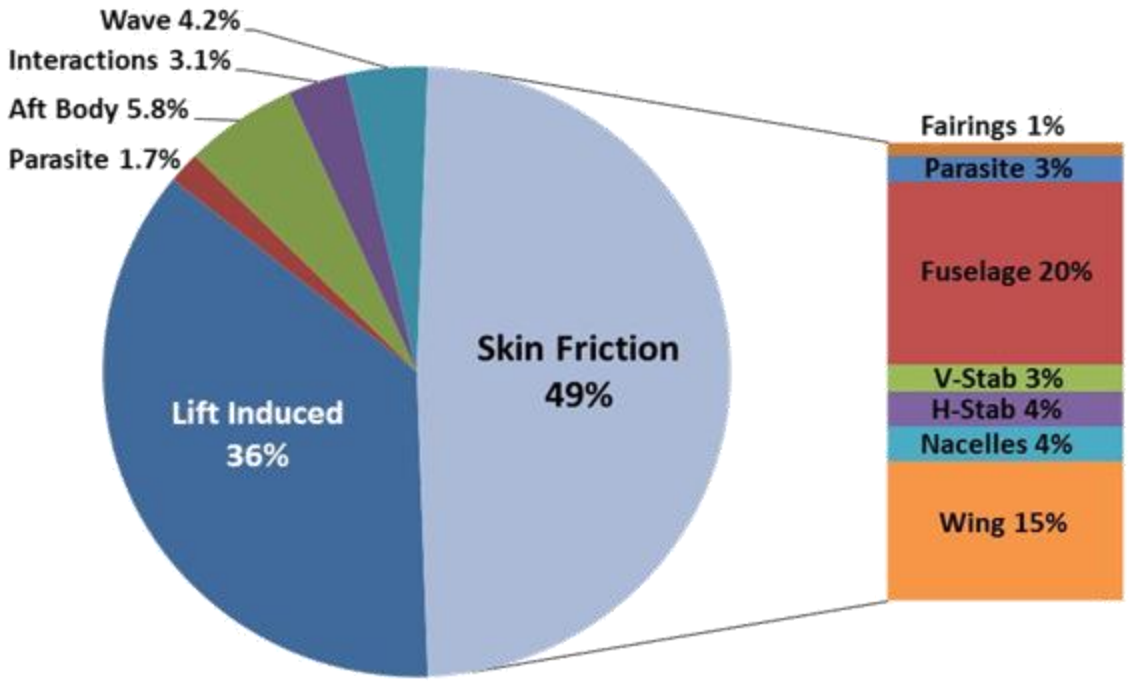


favored structure

Source: DLR (1982)

Why Focus on Skin Friction Drag Reduction?

Skin friction drag ~ ½ of drag on subsonic transports



From: Marec, J-P. *Drag Reduction: a Major Task for Research*, CEAS/DragNet European Drag Reduction Conference 2000, Potsdam, June 2000

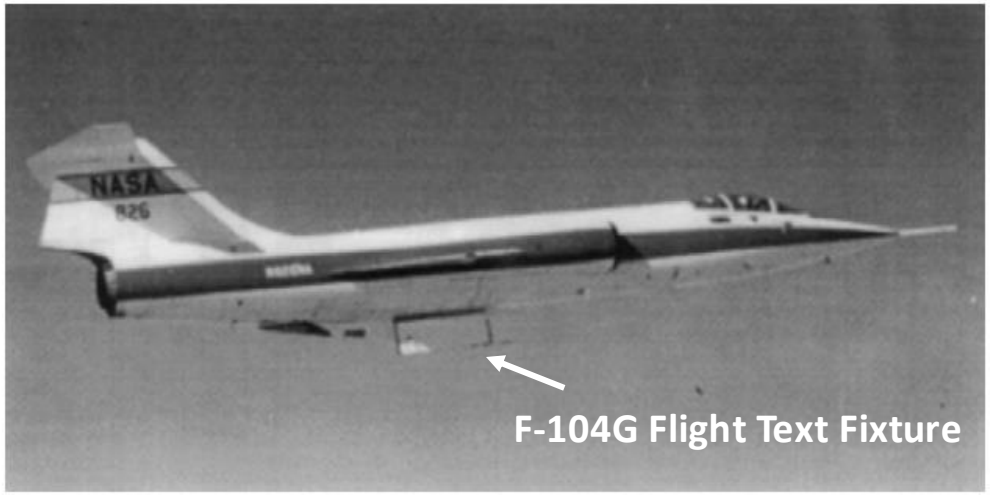
Little bid of history

Flight Test 3M film

- Airbus A320 (ca. 1990)
- 70% Surface Coverage
- 2% Fuel Savings

Szodruch J.Viscous transport a/c drag reduction, AIAA Paper 91-0685, 1991.

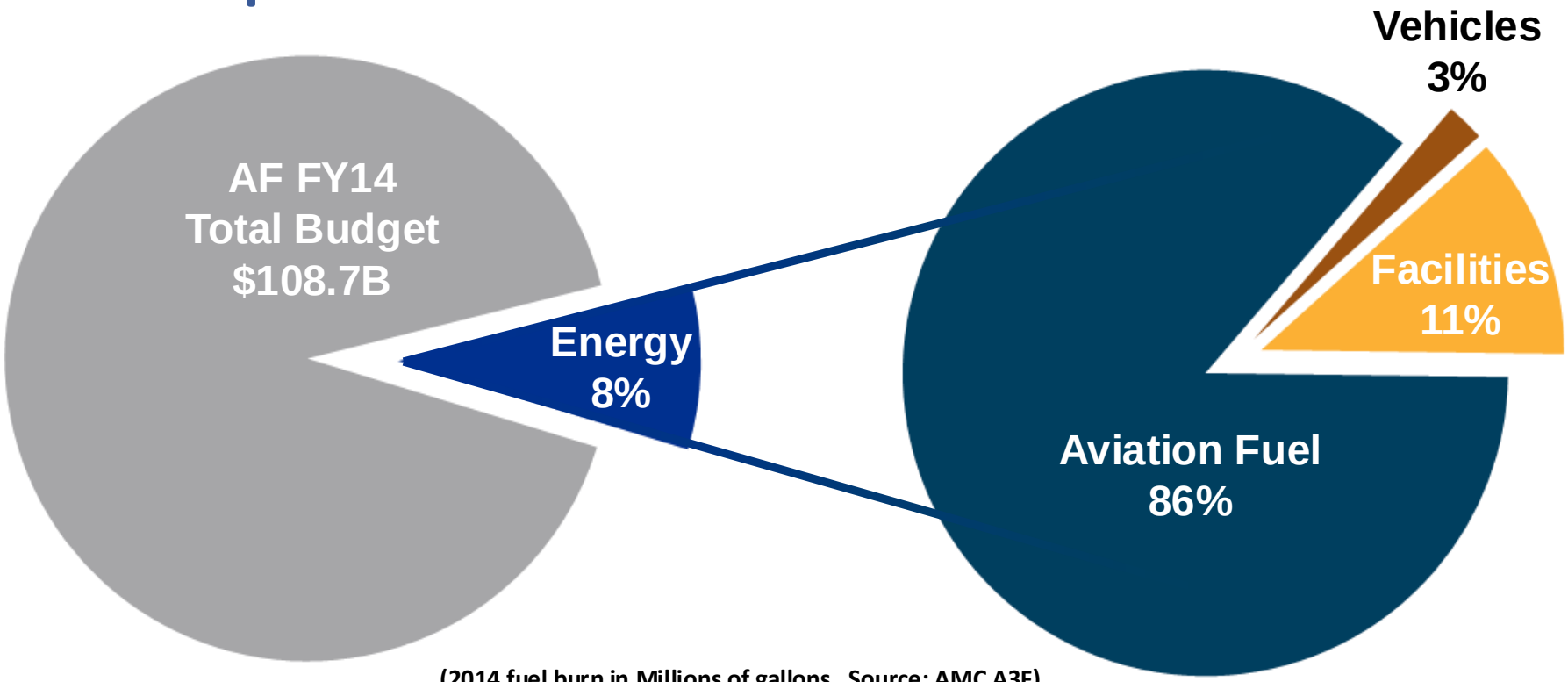
Riblet Effectiveness Validated at Reynolds Numbers up to $20x10^6$ and Mach Numbers up to 2.5 (Flight Tested to Mach 1.6)



Coustols E, Cousteix J., Performances of riblets in the supersonic regime. AIAA 1994;32(2):431–3.

Zuniga FA, Anderson BT, Bertelrud A.Flight test results of riblets at supersonic speeds. NASA Tech. Memo 4387, 1992.

Example U.S. Air Force



(2014 fuel burn in Millions of gallons. Source: AMC A3F)

461 M gal

261 M gal

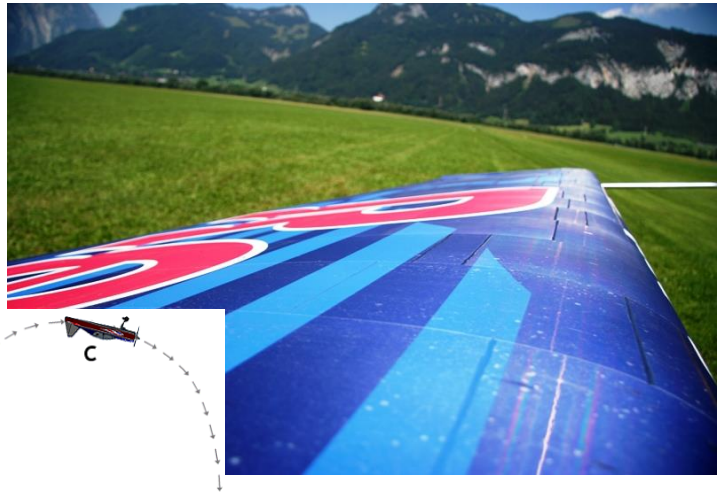
145 M gal

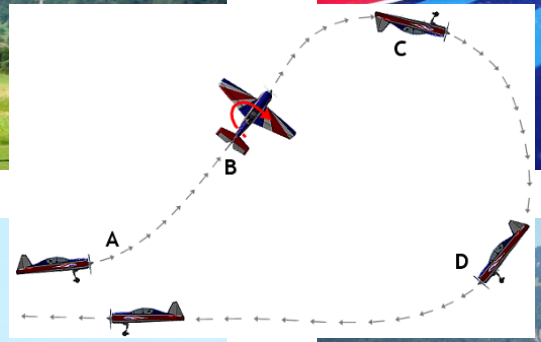
86 M gal

71 M gal

Mobility fleet uses ~60% of aviation fuel ($4.5B)

First flight tests with Trapeze Riblets in 2009





Success in Motorsports

Audi RS 5 DTM
DTM 2013

5 Edoardo Mortara (I/F)
Playboy Audi RS 5 DTM
Audi Sport Team Rosberg

6 Filipe Albuquerque (P)
Audi Financial Services RS 5 DTM
Audi Sport Team Rosberg

11 Mattias Ekström (S)
Red Bull Audi RS 5 DTM
Audi Sport Team Abt Sportsline

12 Jamie Green (GB)
Red Bull Audi RS 5 DTM
Audi Sport Team Abt Sportsline

19 Mike Rockenfeller (D)
Schaeffler Audi RS 5 DTM
Audi Sport Team Phoenix

20 Miguel Molina (E)
Audi RS 5 DTM
Audi Sport Team Phoenix

23 Timo Scheider (D)
AUTO TEST Audi RS 5 DTM
Audi Sport Team Abt

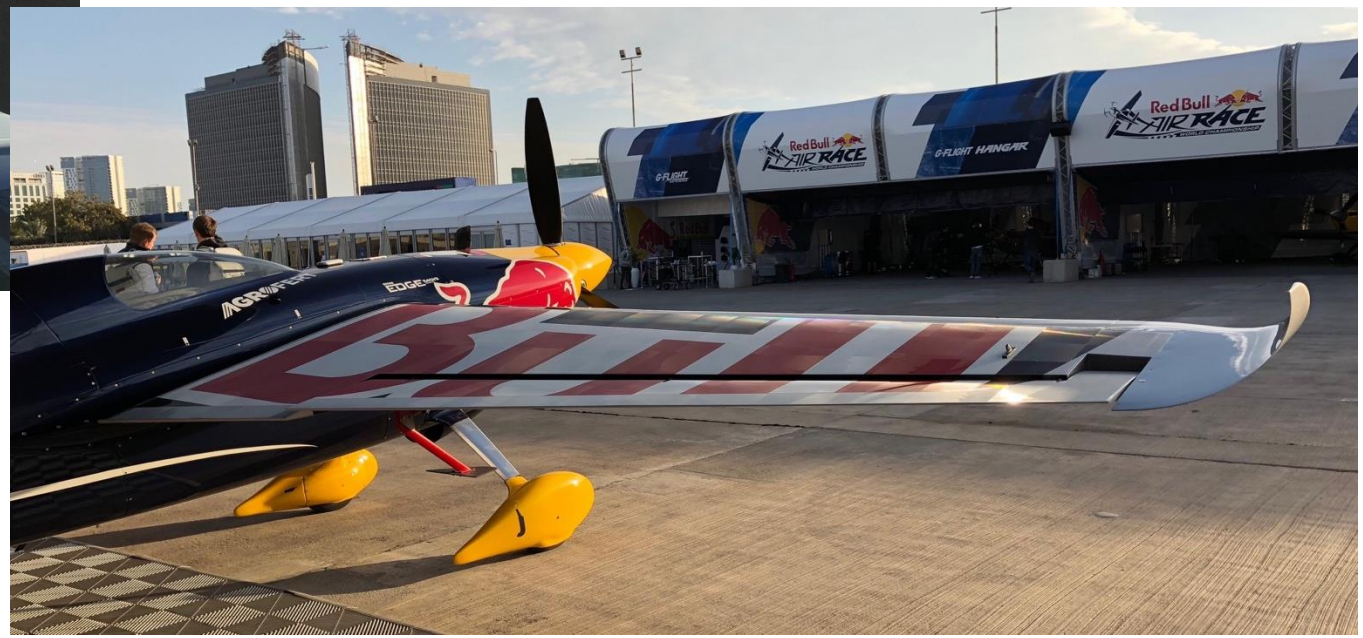
24 Adrien Tambay (F)
Audi ultra RS 5 DTM
Audi Sport Team Abt

Too much success in Motorsports

Riblets Re-loaded…2010-15

First usage in Aero-Sports

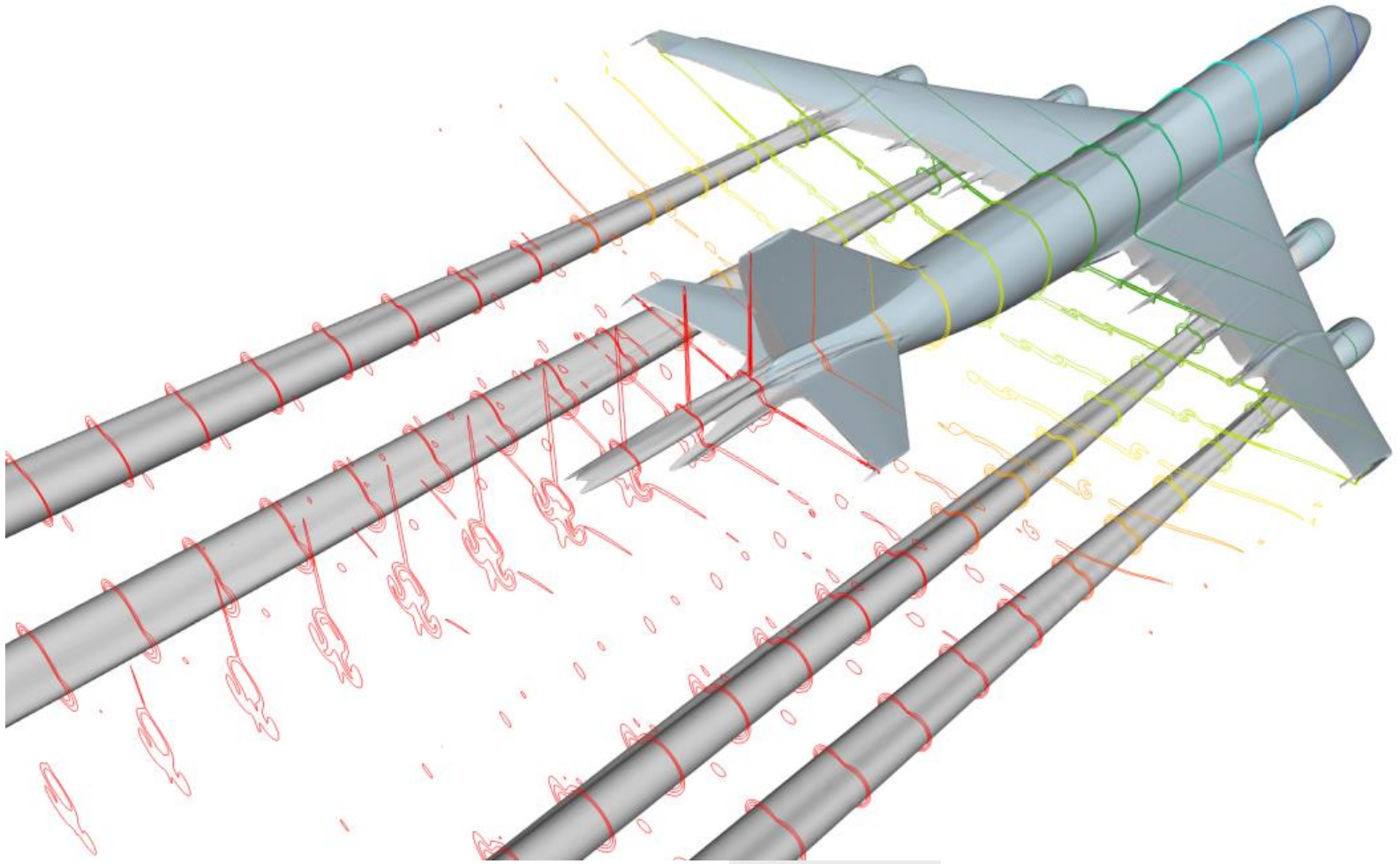
Winner Formula One Class Gold Race in Reno
with the oldest aircraft



Winning several World Championships
in Red Bull Airrace

Riblets restarted in Aviation…2015

Start of Comeback in Aviation with a 747



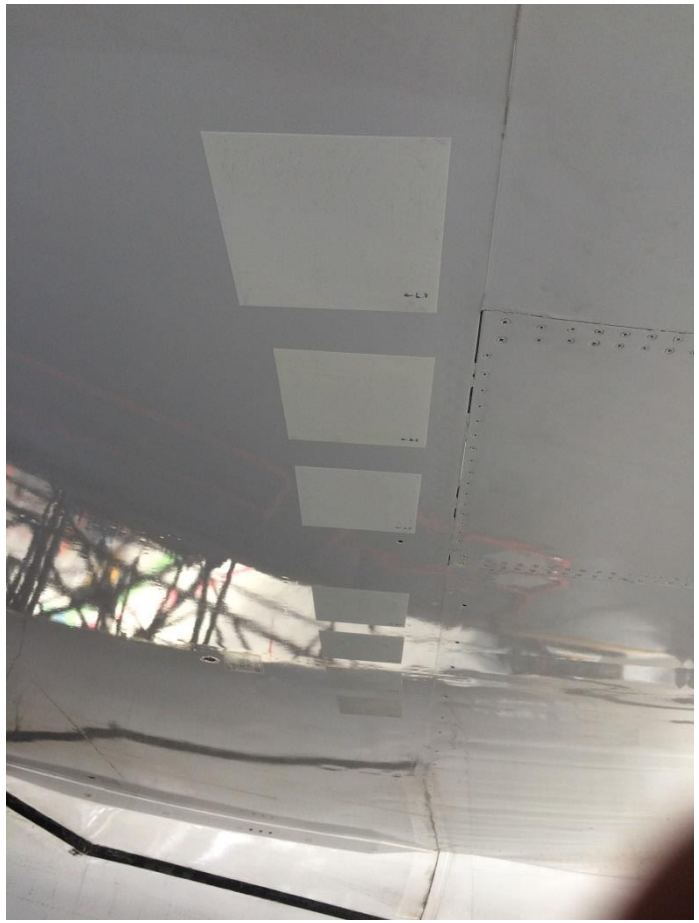
Lufthansa Technik

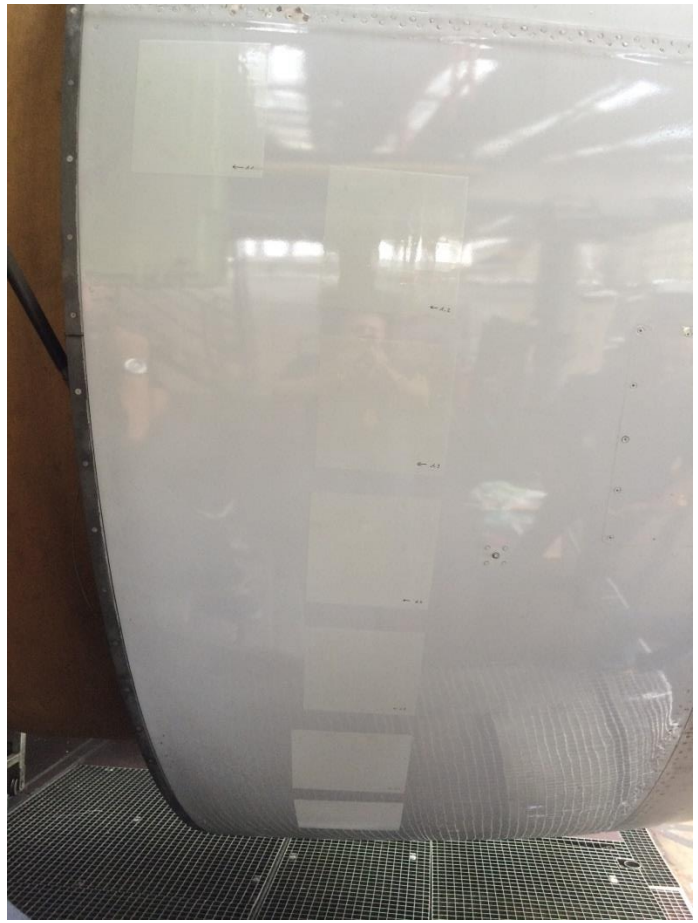
JOANNEUM RESEARCH MATERIALS

BIONIC SURFACE TECHNOLOGIES | World Leading Riblet Expert

Riblets restarted in Aviation…2015

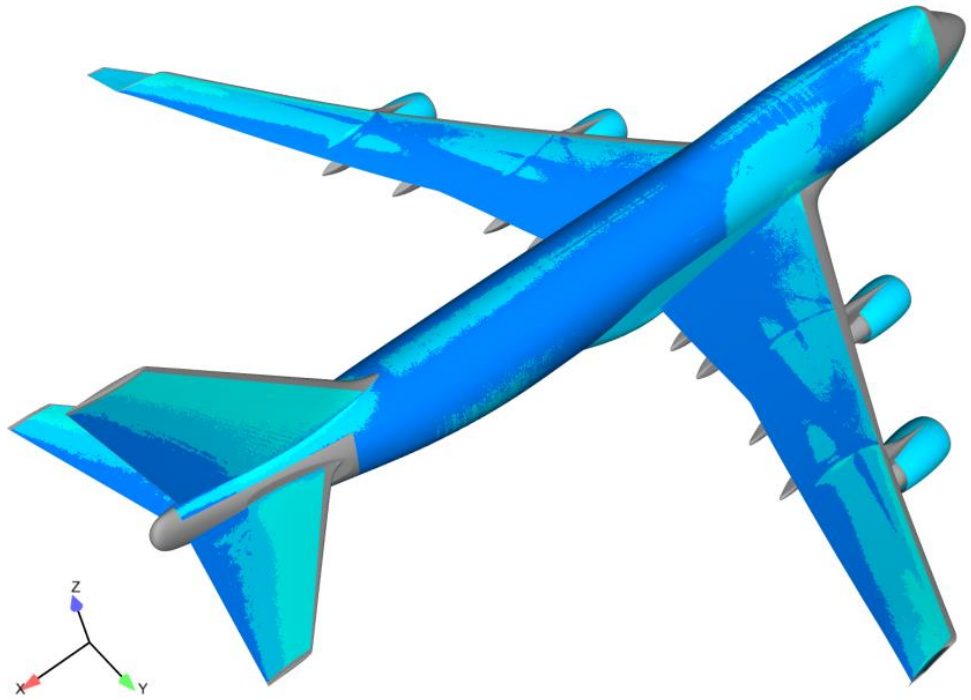
Start of Comeback in Aviation with a 747





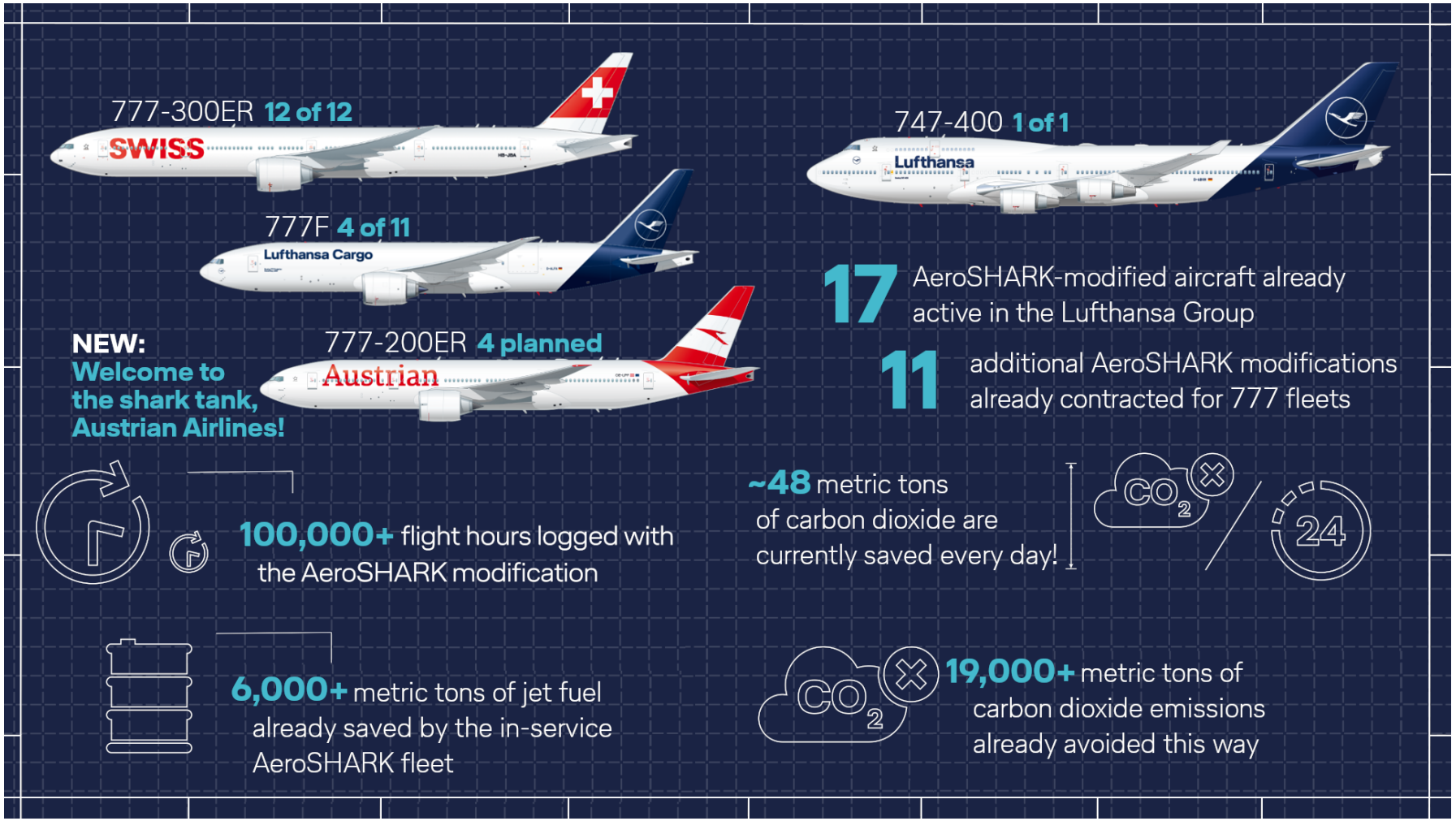
Riblets restarted in Aviation…2015

Start of Comeback in Aviation with a 747



First passenger flight: 23.11.2019

Riblets in Aviation 2024



LATAM

ANA

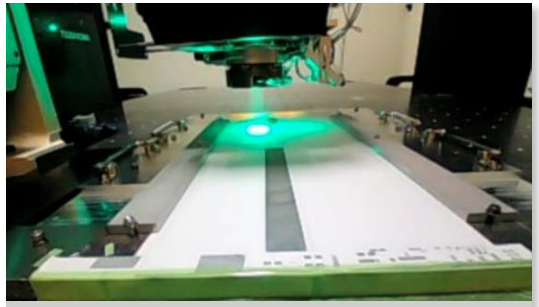
EVA AIR 長榮航空

Source: https://www.lufthansa-technik.com/en/aeroshark, 12.11.2024

Is there a future for Riblet Surfaces?!

Manufacturing Methods

For Riblet Surfaces

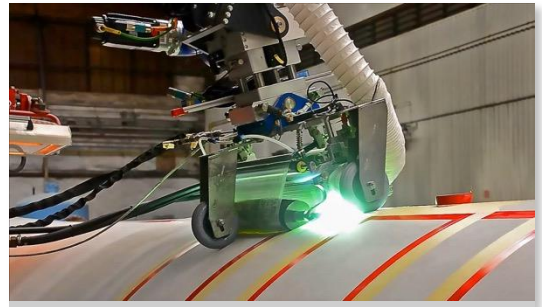


Laser

- Direct processing on metal, film or coating.
- Curved and variable Riblet sizes are possible
- TRL 7

Film

- Sticking by hand or semi-automated
- TRL 9

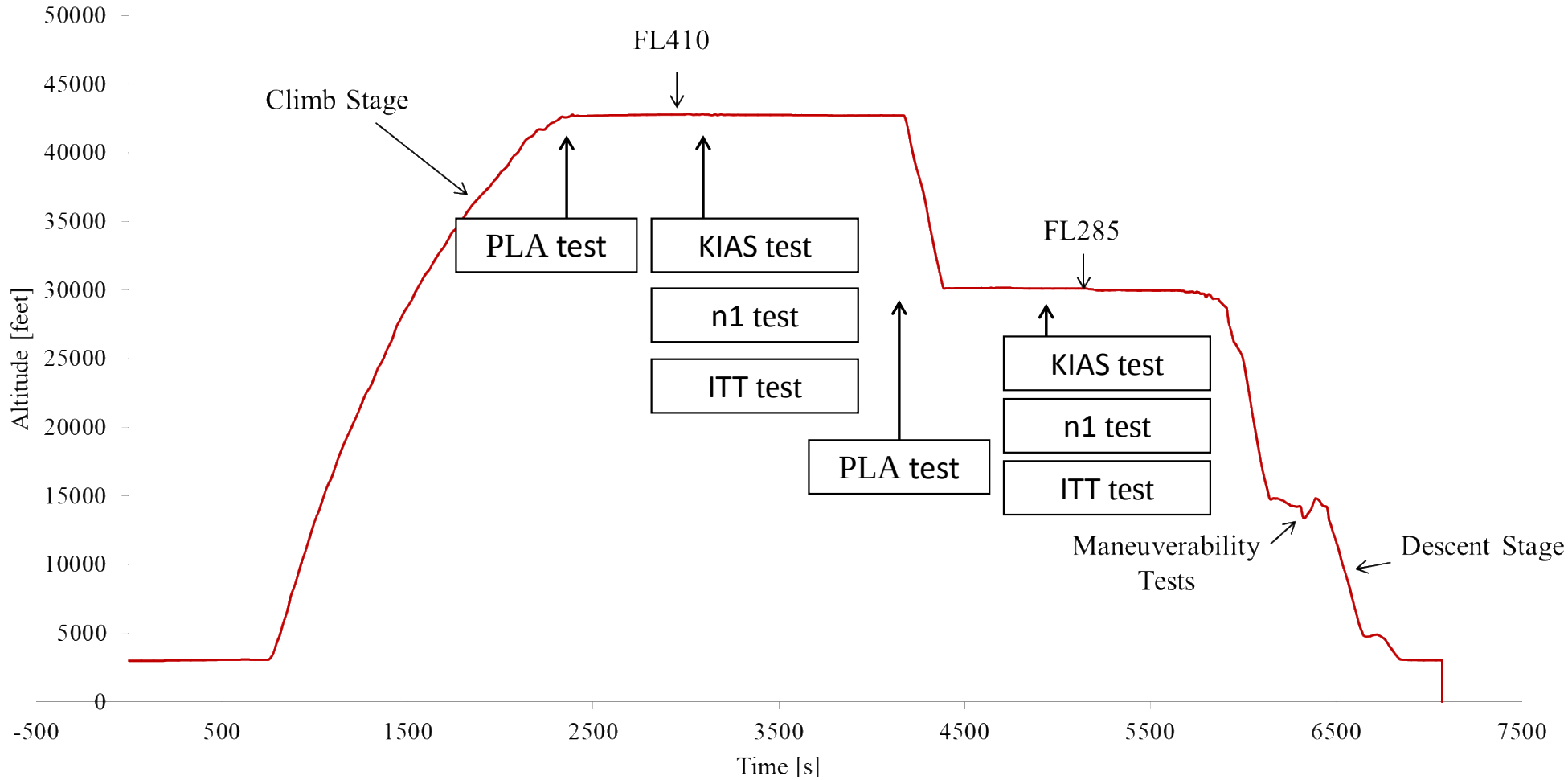


Coating

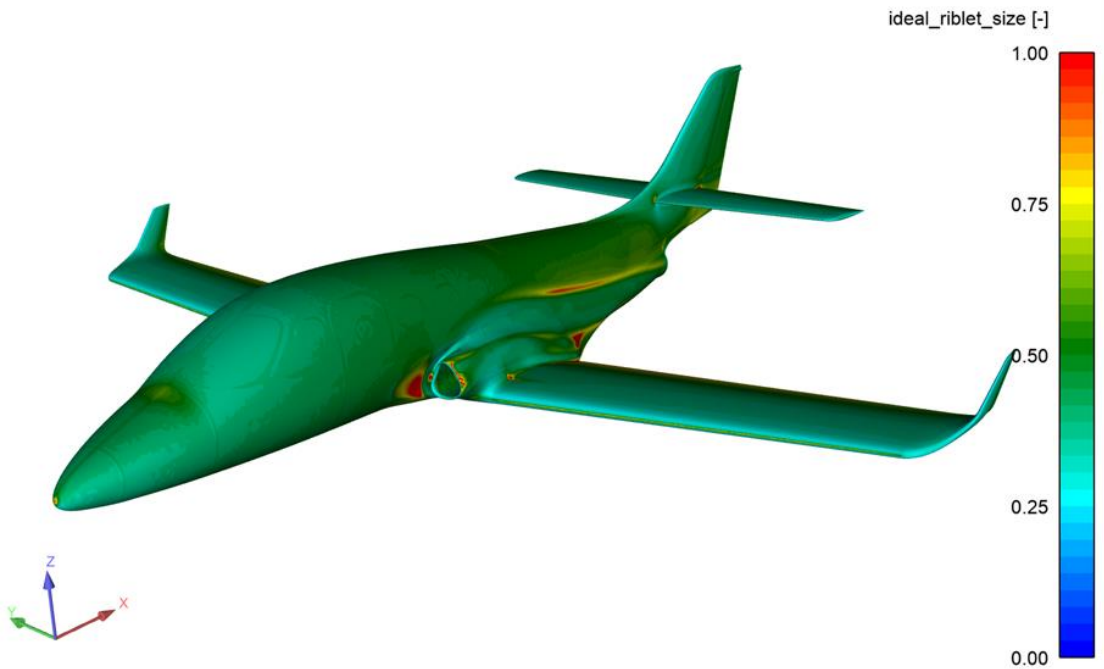
- Semi automated
- TRL 8-9

Business Jet – Stratos 716X

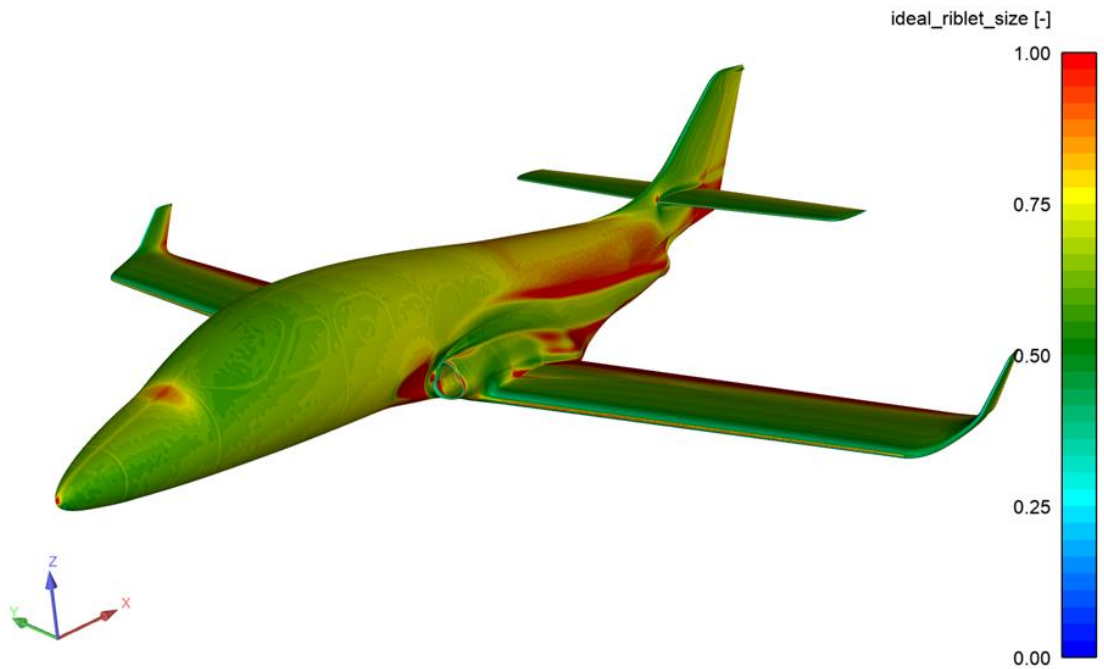
Flight Tests preparation



Riblet Simulation



FL 285



FL 410

Application Example - Business Jet – Stratos 716X

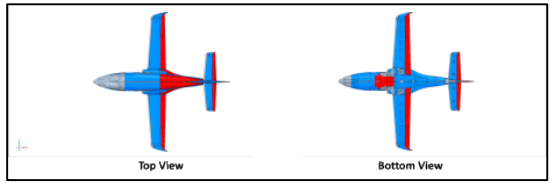
Application

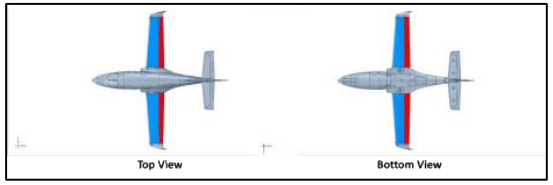
Application

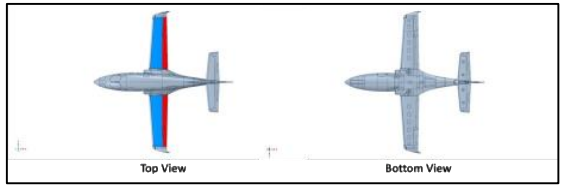
Application Example - Business Jet – Stratos 716X

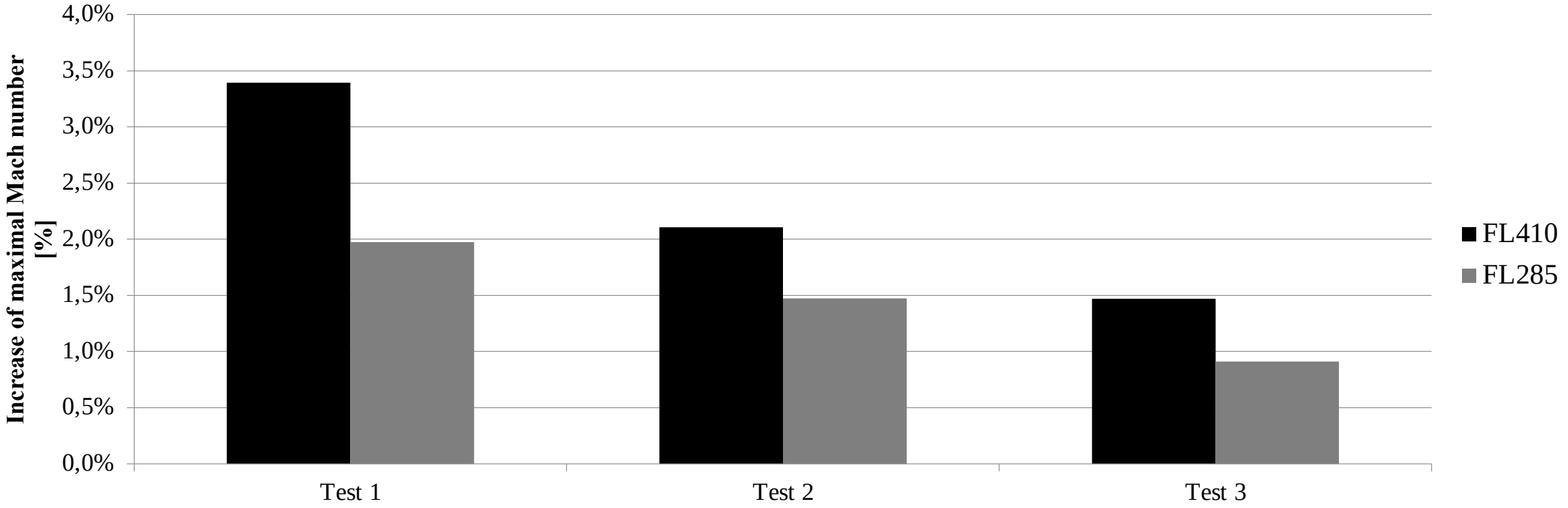
Flight Tests

Results– PLA test (Top Speed Test)

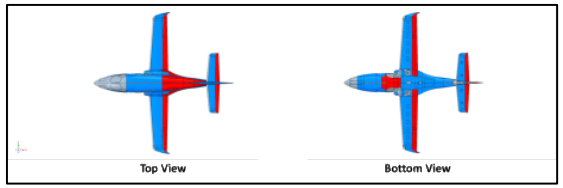


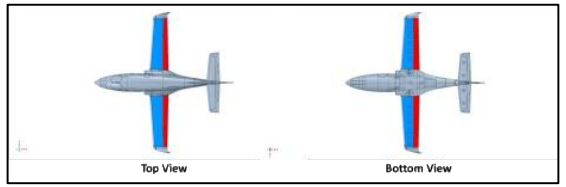


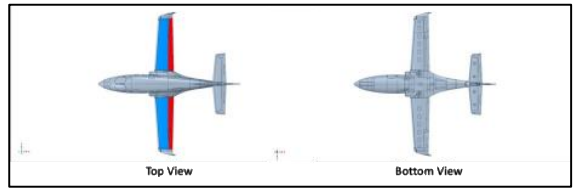


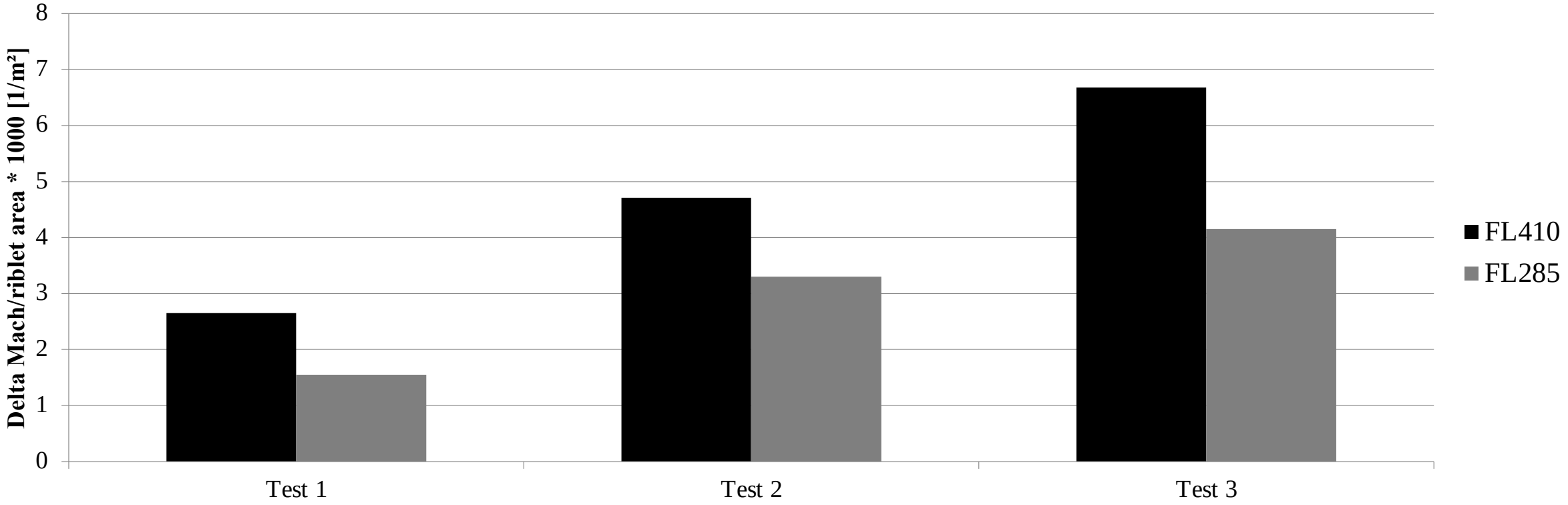


Results – PLA test (Top Speed Test)





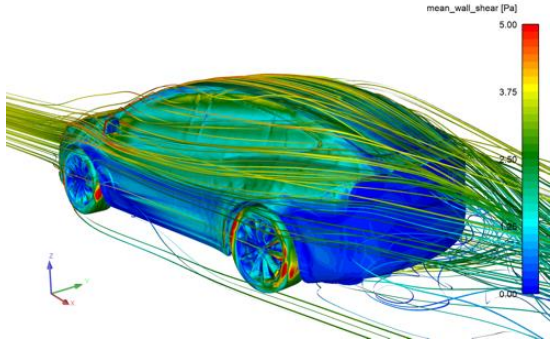




Application Example - eCar

2020-2024 feasibility study

1.) Riblet layout for a Tesla X based on BST algorithm



2.) Calculated Riblet performance increase:
Approx. 2% more range

Drag	484.72	[N]
Drag with Riblets	476.56	[N]
Density	1.225	[kg/m³]
Speed	35	[m/s]
	126	[km/h]
Area	2.797537	[m²]
Power	23091.66	[W]
Power - Riblets	22702.73	[W]
Akku	100	[kWh]
Range	545.65	[km]
Range Riblets	554.99	[km]

3.) Tests to prove the simulations

Application Example - eCar

2020-2024 feasibility study

after 98.000km

BIONIC SURFACE TECHNOLOGIES | World Leading Riblet Expert

Is there a future for Riblet Surfaces?!

6,5% higher efficiency

1-2 % more energy output

1,56 % higher top speed

Outcomes with “drag reduction”

Is there a future for Riblet Surfaces?!

16% higher efficiency

3-7 % more energy output

3,2 % higher top speed

Real measured Outcomes because of indirect/passive Riblet effects

…2024 and beyond

BIONIC SURFACE TECHNOLOGIES

World Leading Riblet Expert

www.bionicsurface.com

ACStyria - AIRTechTalk

“Als die Haie fliegen lernten - Technologietransfer vom Motorsport in die Luftfahrt”

Dr. Andreas Flanschger, CEO bionic surface technologies GmbH