

Aviation Forum 2019: Innovationspfad Produktionsprozesse

WIE ÖSTERREICH TECHNOLOGIETREIBER FÜR LUFTFAHRT-PRODUKTIONSPROZESSE WURDE

**BERNHARD RITTENSCHOBER
HEAD OF R&D**

Innovationspfad Bauteile und Produktionsprozesse

[HTTPS://OPEN4AVIATION.AT/DE/INNOVATIONSPFADE/TOOLING/#SCHL1](https://open4aviation.at/de/innovationspfade/tooling/#SCHL1)

Innovation Booster

Industrialisierung von Fertigungsprozessen



(ALPEX Technologies)

Der zivile Luftverkehr wird sich voraussichtlich innerhalb der nächsten 15 Jahre verdoppeln. Die Industrie versucht in gleichem Maße die Produktivität bei der Herstellung von Luftfahrzeugen zu steigern, und zwar vor allem durch industrialisierte und intelligente Produktionsprozesse.



**WELCOME
TO ALPEX TECHNOLOGIES**

TOOLING FOR COMPOSITES AEROSPACE & AUTOMOTIVE

 www.alpex-tec.com

KEY FACTS

Tooling Systems for Composites

- Design and Manufacturing of production & tooling systems for composite applications
- Strong R&D focus on new manufacturing & tooling technologies
- Deep process Know-How
- 70 skilled employees
- More than 15 years experience in the composite industry



ALPEX SITES

Global Presence

▶ HEADQUARTER AUSTRIA

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T: +43 (0) 5223 46664 | M: info@alpex-tec.com

▶ ALPEX USA

ALPEX Technologies LLC | 5959 Ford Ct | Brighton, MI 48116

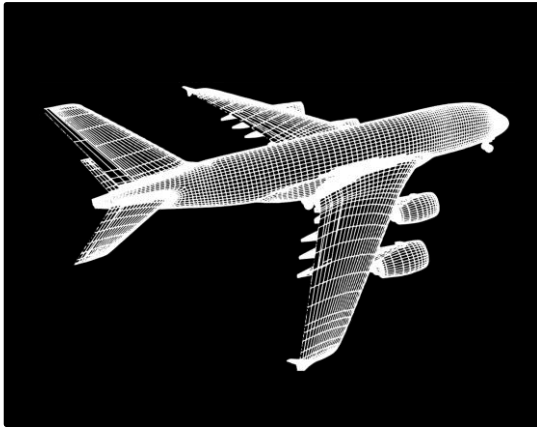
▶ ALPEX CHINA

ALPEX China | National High-tech industrial No. 58 Huangshan Road | Changshu



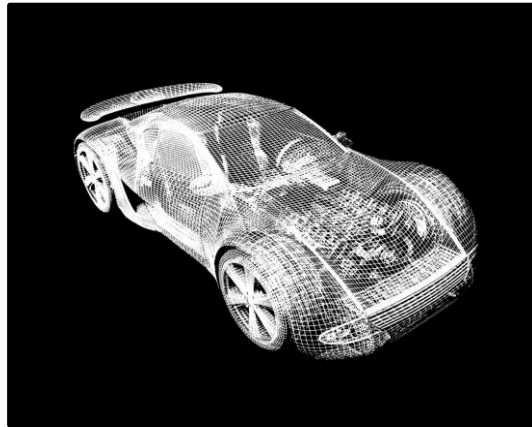
AUTOMATED TURN-KEY SOLUTIONS

01 TOOLING SYSTEMS AEROSPACE



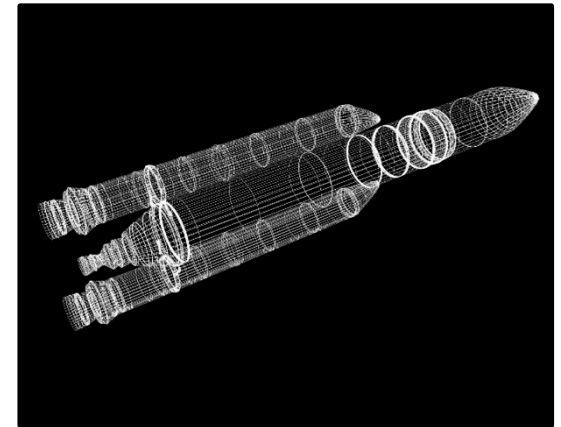
- Preforming
- Prepreg curing
- Infusion curing
- RTM
- Trimming
- Assembly

02 TOOLING SYSTEMS AUTOMOTIVE



- Preforming
- HP-RTM
- Liquid Compression Moulding
- Prepreg Compression Moulding
- C-SMC Moulding
- Trimming

03 TOOLING SYSTEMS SPACE



- Preforming
- Filament Winding
- Prepreg curing
- Infusion curing

CAPABILITIES & SERVICES

One-Stop-Shop for Turn Key Projects

Development

- Research & Development
- Concepts & Studies
- Engineering & Design
- Simulation



Manufacturing

- Project management
- CNC-Machining up to 20m
- INVAR specialists
- Assembly
- Quality inspection

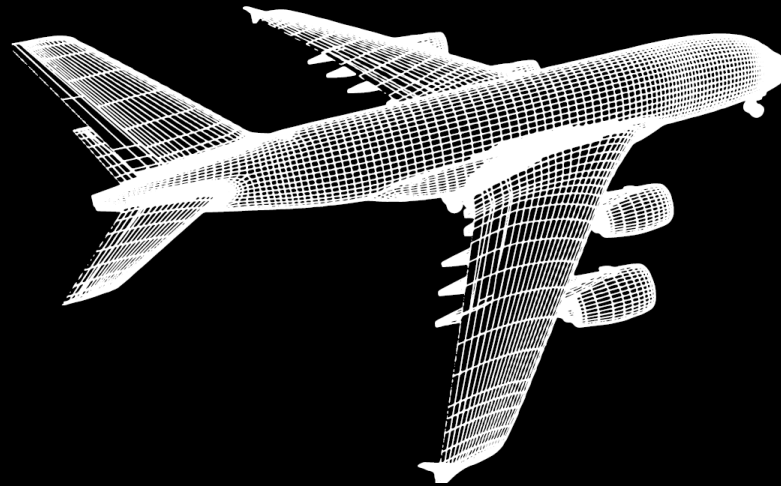


Support

- Commissioning support
- On-site support

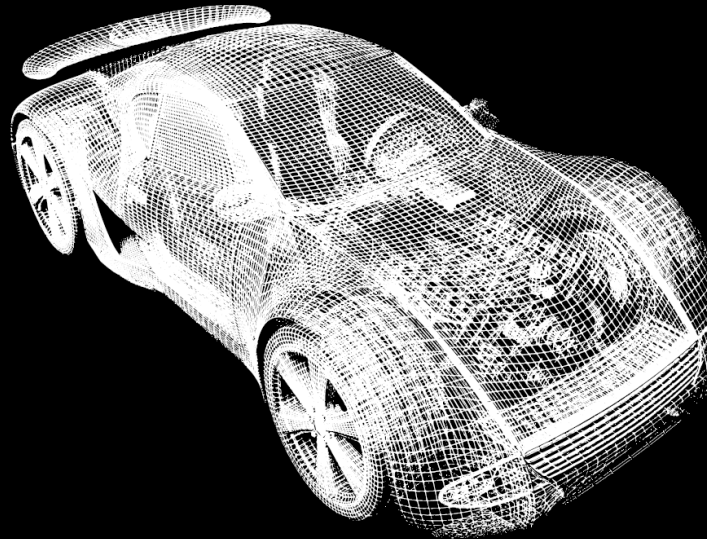
REFERENCES



DEVELOPMENT AT ALPEX IN TAKE OFF CONTEXT

ALPEX TECHNOLOGIES



Take Off: Erste Projekte 2005-2009

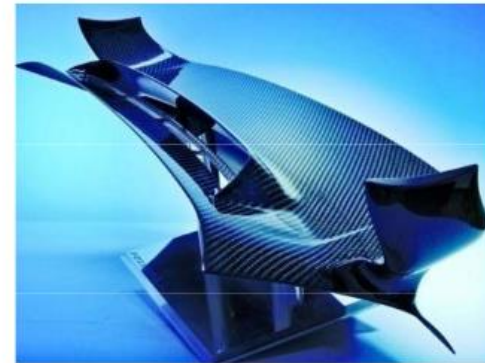
TAKE OFF Ergebnisse



REDUX Ergebnis

- Automatisierte RTM Werkzeugtechnologie
- Demonstrator Heckspoiler

TAKE OFF



Facts:

- RTM tool for CFRP rear spoiler
- Material: Aluminum EN-AW 5083
- Size: approx. 2.000 x 600 x 800 mm
- Automated RTM technology
- Interaction of 7 sliders
- New sealing technology

FP7: Erste eigene Konstruktion

Work performed (resp. WESTCAM)
- frame and beam curing tooling

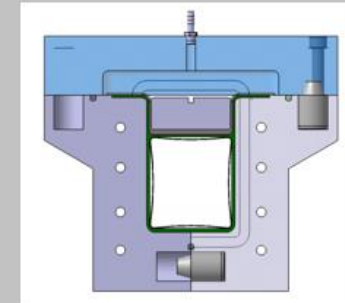
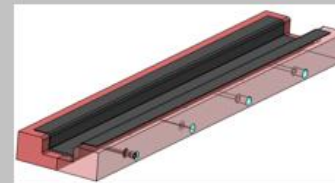
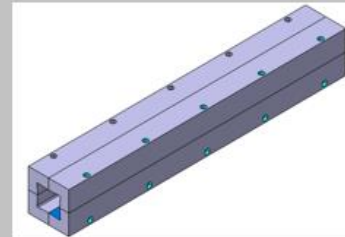


Task Status (Presented by Westcam)

Progress in WP 4.2.



- Manufacturing of C-Beam- and Plate- tool
- Concepts for JF-Tool, FX-Core tool and tool for pressure pad with RUAG and FHNW - completed
- Concepts for braiding mandrels and fixation with FHNW and Kümpers - completed
- D-51 C-Beam/Plate tool delivered



Take OFF: Erste eigene Einreichung



MARCO Tooling

Microwave Advanced Research For Composite

- Tooling Development -

D/A – Verbundprojekt (FFG)

Laufzeit: 2 Jahre

01.04.2010 bis 31.03.2012

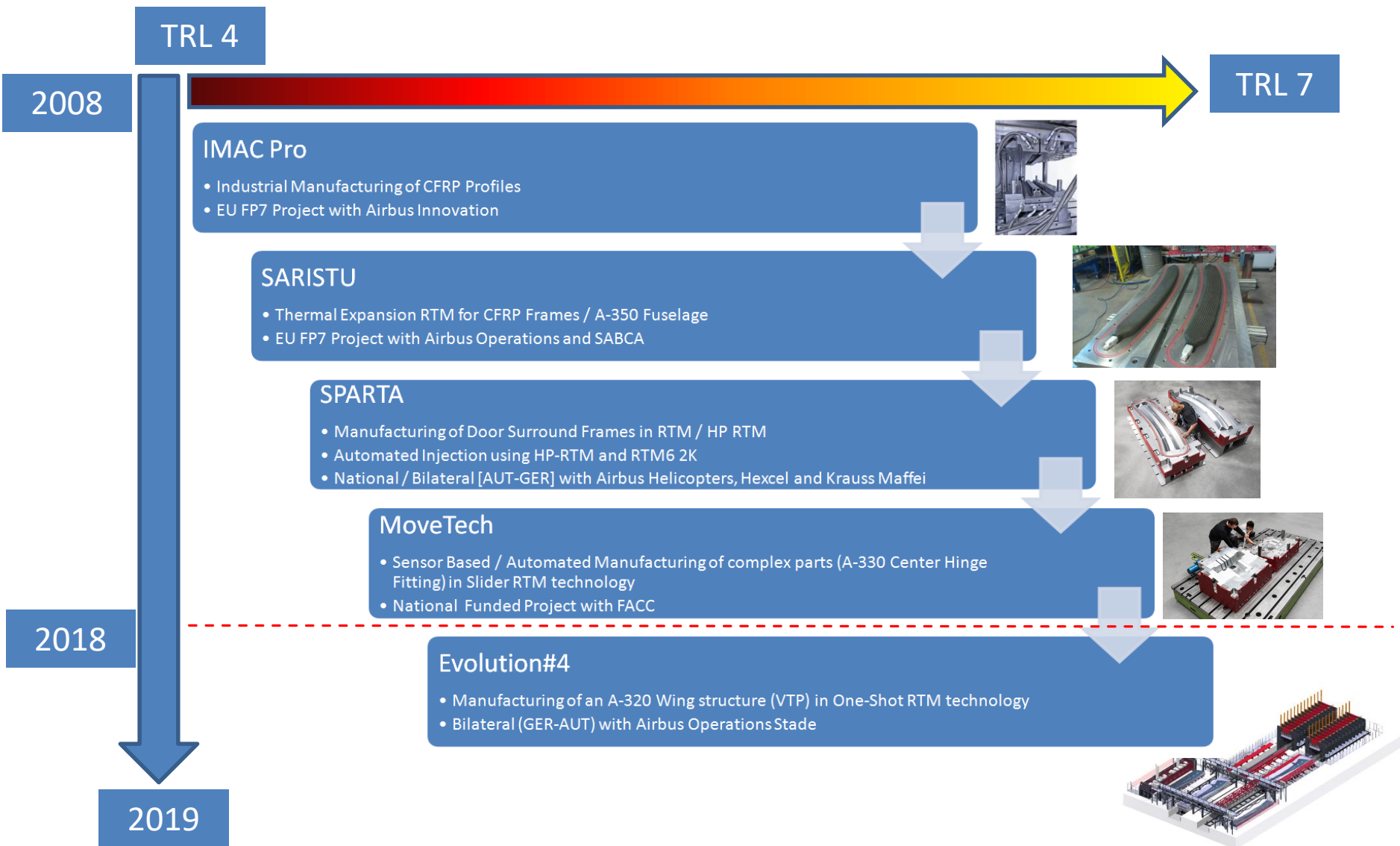


WESTCAM Fertigungstechnik GmbH



**GKN Holdings Deutschland GmbH
Aerospace Werk München**

AEROSPACE Technology: 10 Years of R&D

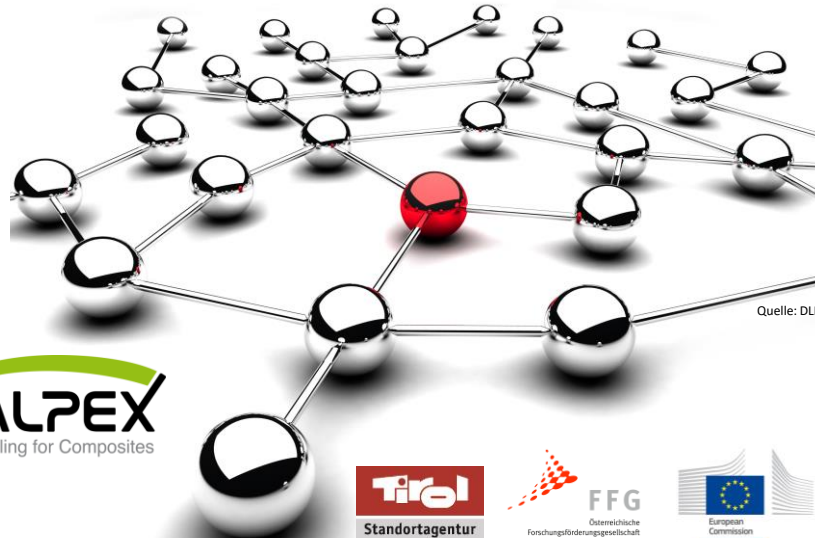


Projektkooperationen in der F&E

TOOLING FOR COMPOSITES AEROSPACE & AUTOMOTIVE

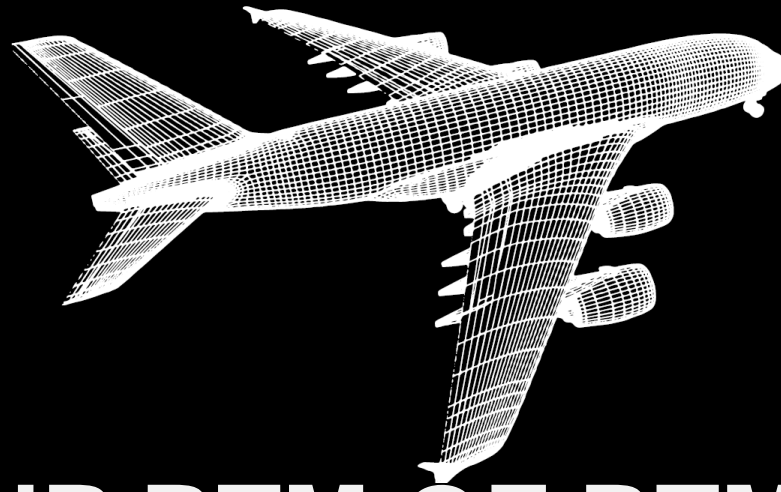


KNOWLEDGE & NETWORKING
DEVELOPING THE COMPOSITES INDUSTRY WORLDWIDE



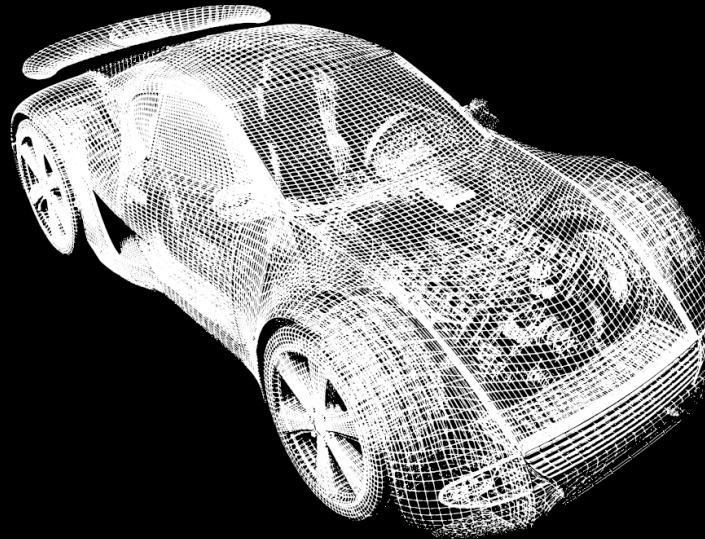
Quelle: DLNA





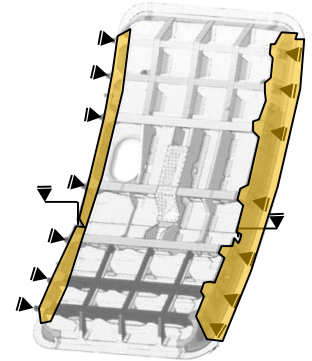
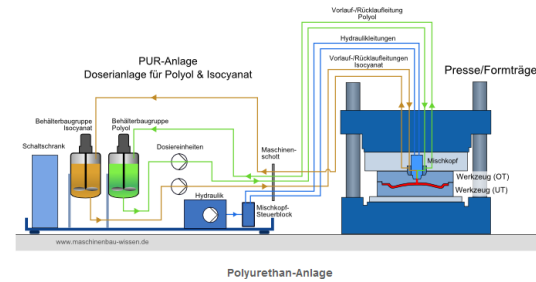
HP RTM OF RTM6 SPARTA

ALPEX TECHNOLOGIES



R&D AEROSPACE

HP-RTM Tooling | Hexflow RTM6 2K process



BENEFITS

- Fully automated process
- High volume production
- Manufacturing of complex shaped Aerospace CFRP parts
- Technology transfer from Automotive
- Curing of 2K Aerospace resins (RTM6)
- Automated high pressure mixing technology for excellent resin properties
- Automated vacuum shut-off
- Integrated heating system
- Expertise proven with Demonstrator Aerospace CFRP part – A350 Door Edge Member

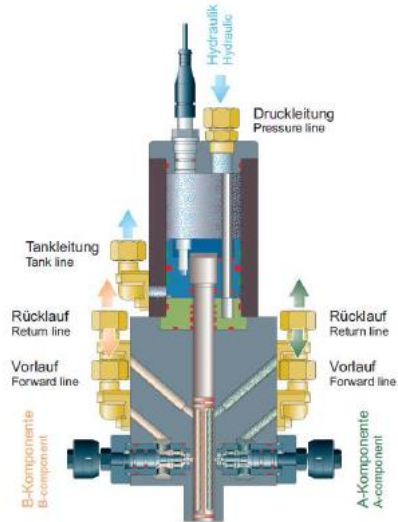
AERONAUTIC HP-RTM

Automated mixing High Pressure Technology

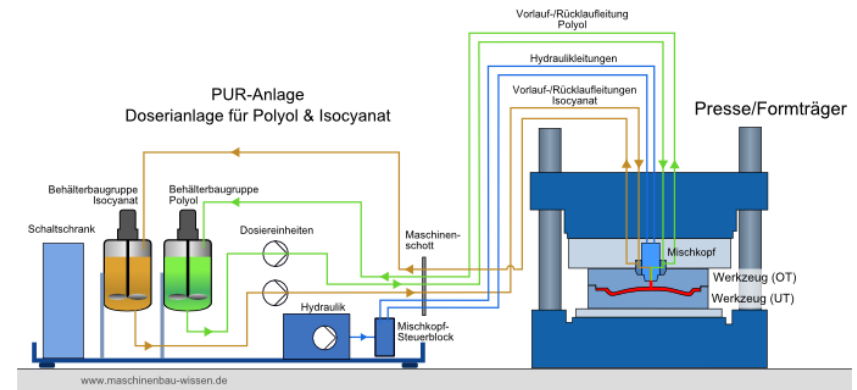
- Collaboration with Hexcel
- High Pressure “Reaction injection molding” mixing head technology learned from automotive

High Pressure RTM for Aerospace Application

- Fast impregnation → long injection lines possible
- Compression RTM
- High resin pressure
 - reduced void content
 - reduced shrinkage
 - better quality









Kreislaufstellung
Circulation position



Polyurethan-Anlage

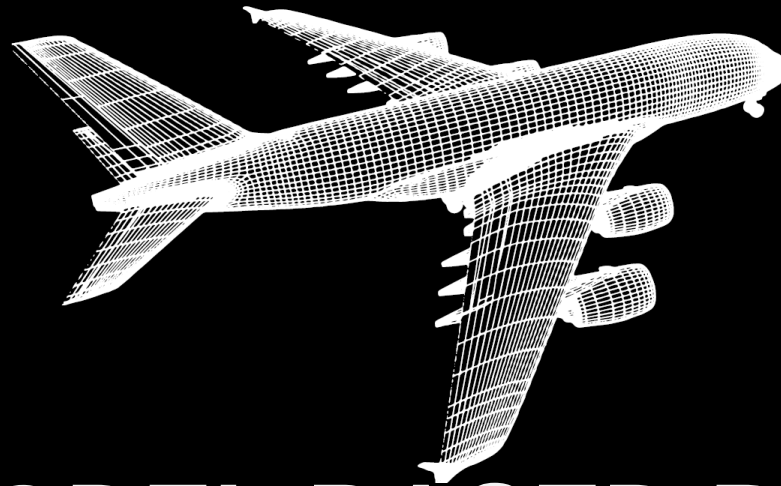
AERONAUTIC HP-RTM

General Features

		HexFlow® RTM6 Mono-component	HexFlow® RTM6-2 Bi-component
Transport		<ul style="list-style-type: none"> Road transport at 18°C Air shipment forbidden Sea shipment at -18°C with double refrigerator unit 	Before mixing : <ul style="list-style-type: none"> Road, air and sea transport at RT (less than 10days) Transport at -18°C/+5°C
Storage		<ul style="list-style-type: none"> 9 months at -18°C 15 days at RT 	Before mixing : <ul style="list-style-type: none"> 12 months at +5°C 1 month at RT
Volumes		Limited volumes (10kg and 25kg)	<ul style="list-style-type: none"> 45kg standard kit Larger sizes possible (200kg drums)
Pre-processing		No resin pre-processing : <ul style="list-style-type: none"> Ready for use Already degassed 	Pre-processing : <ul style="list-style-type: none"> Mixing the two parts Degassing is recommended
Processing		Same injection/infusion process	
Mechanical Properties		Equivalent mechanical properties	

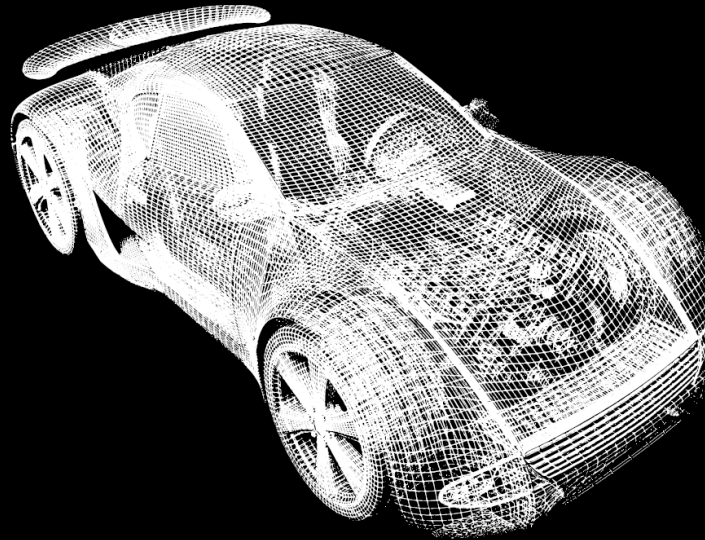
Part A + Part B = RTM6





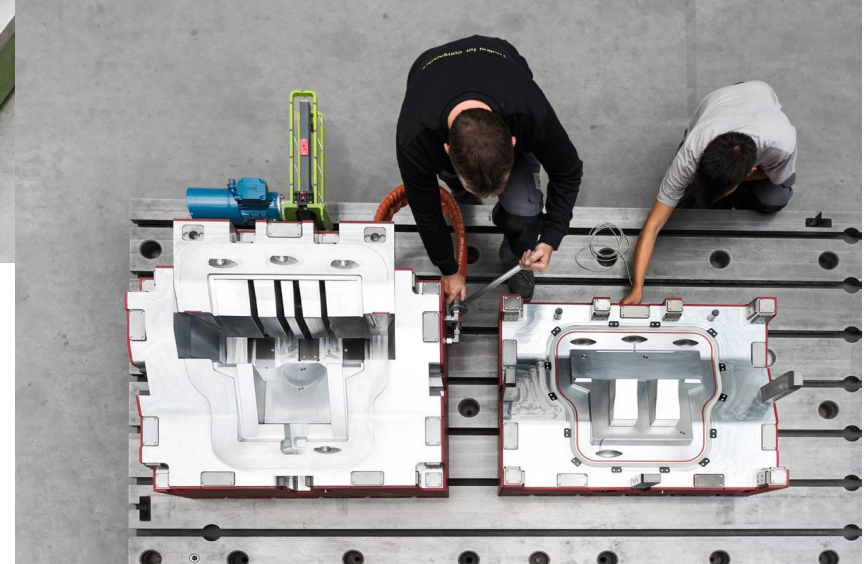
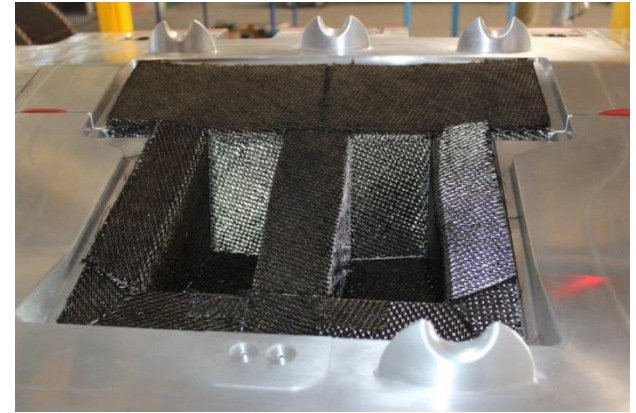
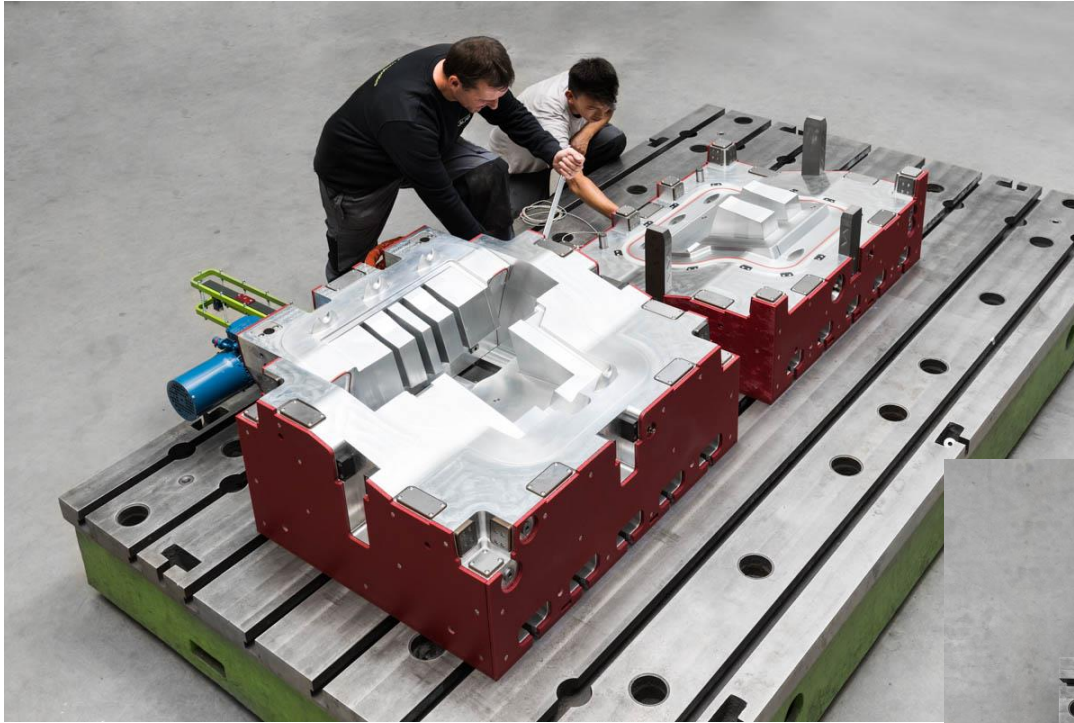
MODEL BASED RTM TECHNOLOGY

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AEROSPACE: LP-RTM

Automated Integral CFRP Production with RTM

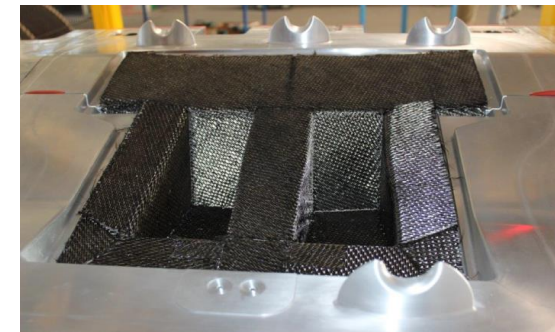
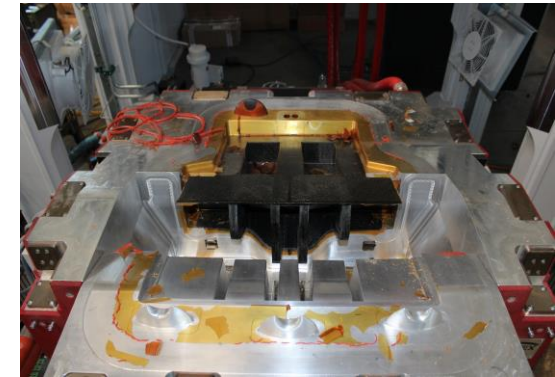
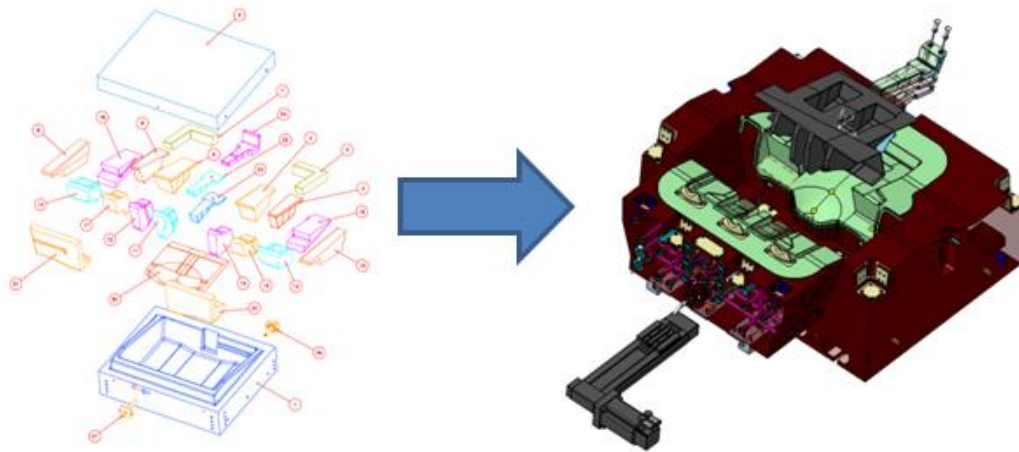


Facts:

- ▶ A330 Spoiler Hinge Fitting New automated RTM tooling concept
- ▶ Electric sliders for molding of complex undercut geometry
- ▶ Clean room applications

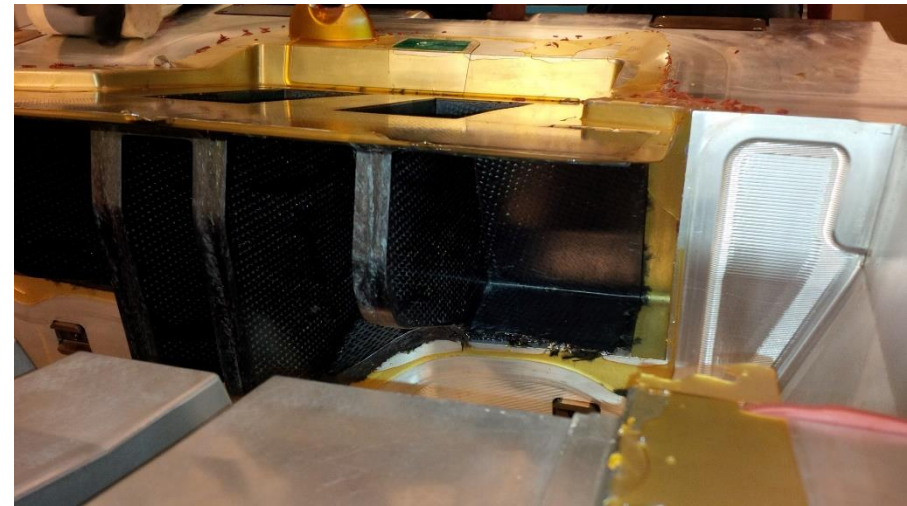
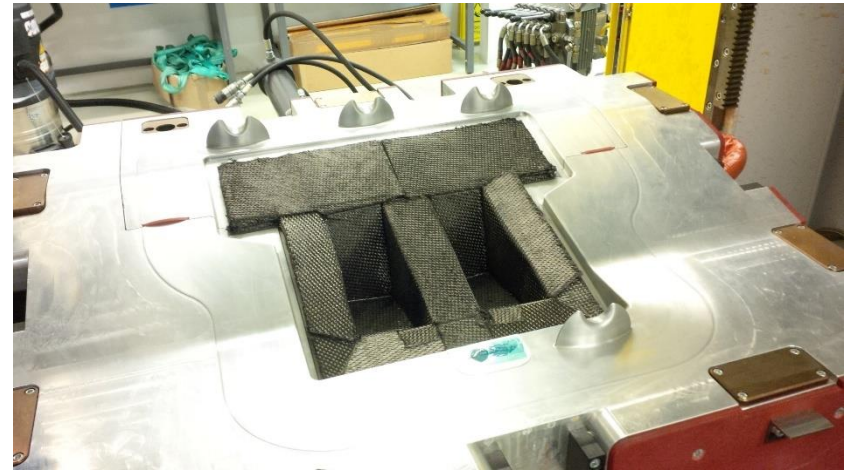
“Modellbasierte Verarbeitungs-Technologie zur Herstellung hochwertiger FVK Strukturen”

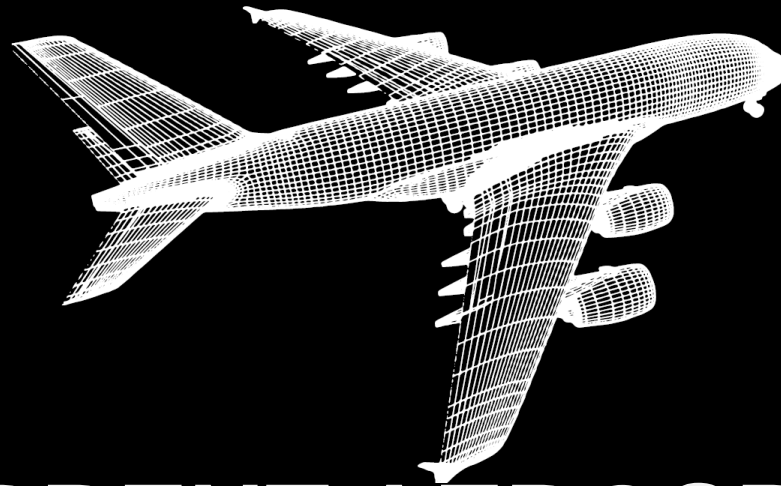
- ▶ Automated Manufacturing of complex / undercut structures using slider technology RTM processes
- ▶ Design to manufacture of too complex parts of the past



MOVETECH

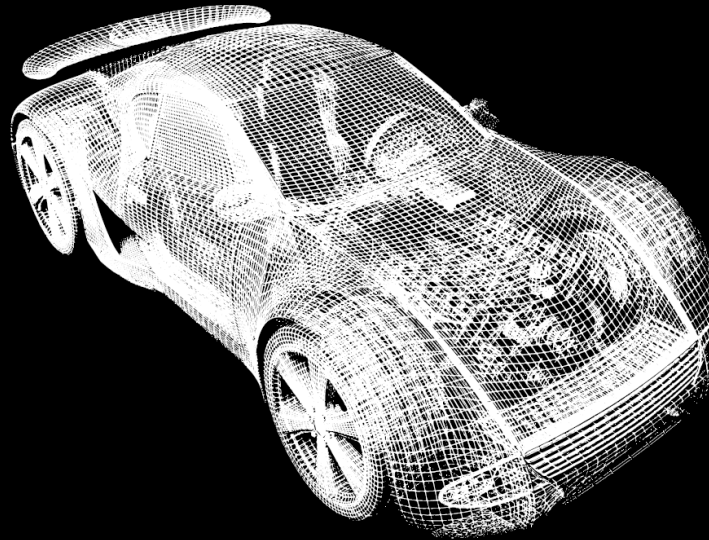
- ▶ Model Based...
 - ▶ Development of a integrated model based injection process
- ▶ Digitalisation / I 4.0
 - ▶ Development of numerical basis of a digital process twin / digital tooling twin
- ▶ Automation:
 - ▶ Development of sensor concept for data acquisition of tooling/press/process





CURRENT AEROSPACE TOPICS

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STRATEGIC R&D APPROACH

Industrialisation of composite manufacturing technologies
“Wing of Tomorrow” production technologies

Automation / High Volume Production

AUTOMOTIVE

AEROSPACE

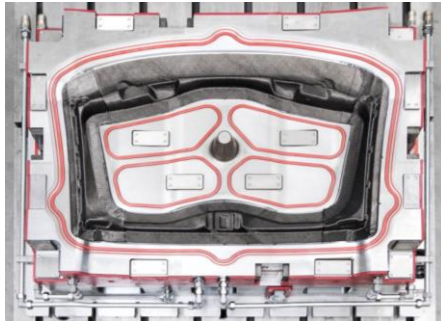
Composite Know How

High volume serial production

Automated Preforming

Manufacturing of large & integrated CFRP structures

Turn key production systems



TOOLING FOR COMPOSITES AEROSPACE & AUTOMOTIVE

STATE OF THE ART

Status of the sustainable manufacturing technologies for Future CFRP parts in Airplane Manufacturing

- ▶ State-of-the-Art manufacturing for the A-350 is dominated by:
 - ▶ Prepreg manufacturing technology
 - ▶ Autoclave processing
 - ▶ Manual operations and highly qualified workforce structure

- ▶ Resulting in:
 - ▶ Lower than needed production rates
 - ▶ Higher than expected production costs

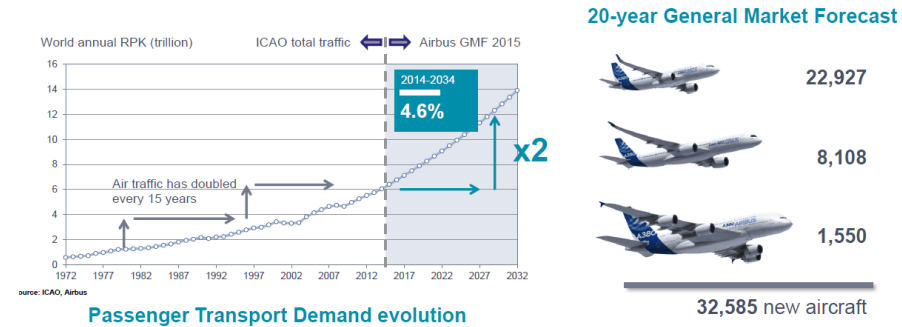
- ▶ Hindering:
 - ▶ Upscale and Production Rates for 100+ AC/month



MARKETS

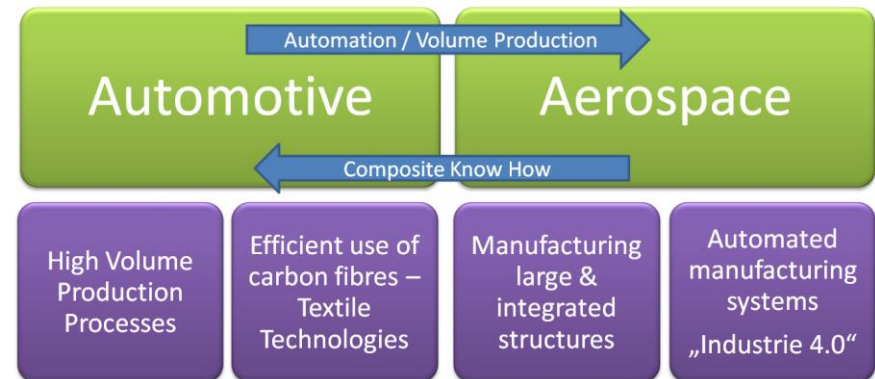
Industrialization of CFRP series production

- ▶ The manufacturing of economic successful CFRP parts relies on 4 objectives
- ▶ High Volume capable processes
- ▶ Efficient use of carbon fibres and resin
- ▶ Integrated Manufacturing of composite design / large structures
- ▶ Reliable Processes: Online Monitoring and intelligent automation: Internet of Things



> Potential for more than **32,600** deliveries in the next 20 years

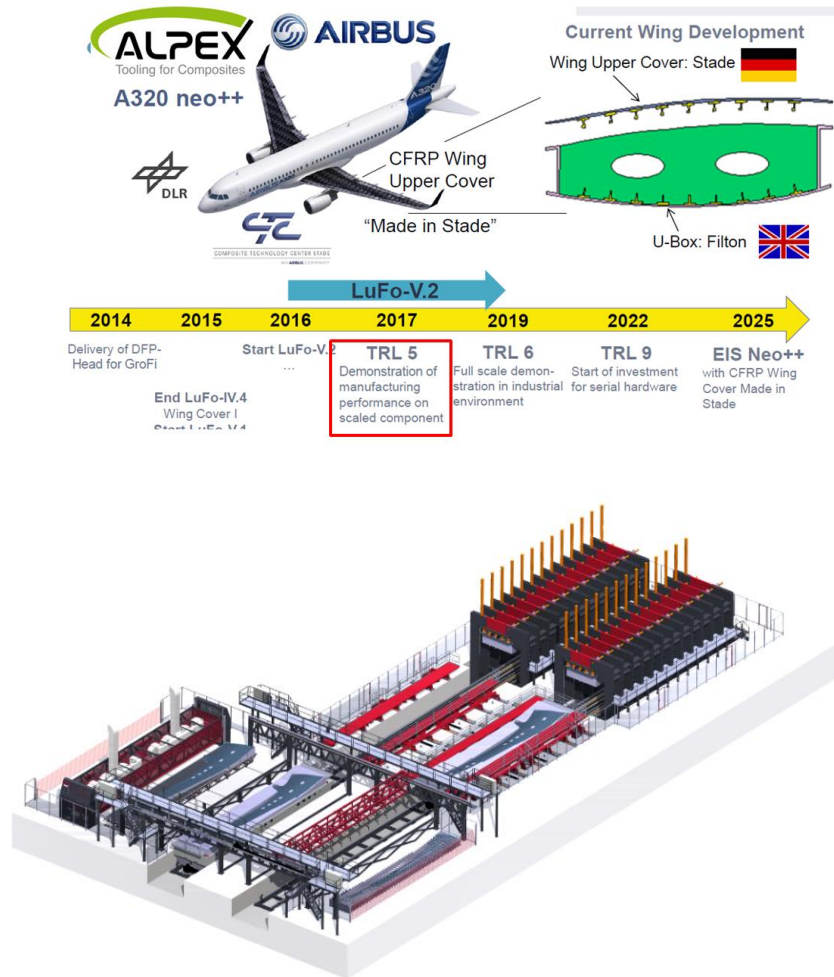
Industrialization of CFRP part production



LARGE SCALE INTEGRATED TOOL SYSTEMS

Evolution#4 Wing Cover:

- Integrated, one-shot, netshape large scale RTM applications
- Joint Technology Development Project LuFo (GER) TakeOFF (AUT)
- High production rate, automated tooling and manufacturing systems for wing covers

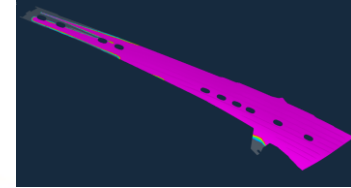


“WING OF TOMORROW” INTEGRATED SKIN MANUFACTURING

RTM | Automated Integral CFRP Production

- ▶ Manufacturing system for A-320 like integrated wing skins
- ▶ Fully automated production line for high production rates (target: 100AC/month)

Resin Transfer Molding



Net Shape Cutting and Inspection

Hot Draping of Skin Preform

Pre-Compacted Stringer Pick and Place

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