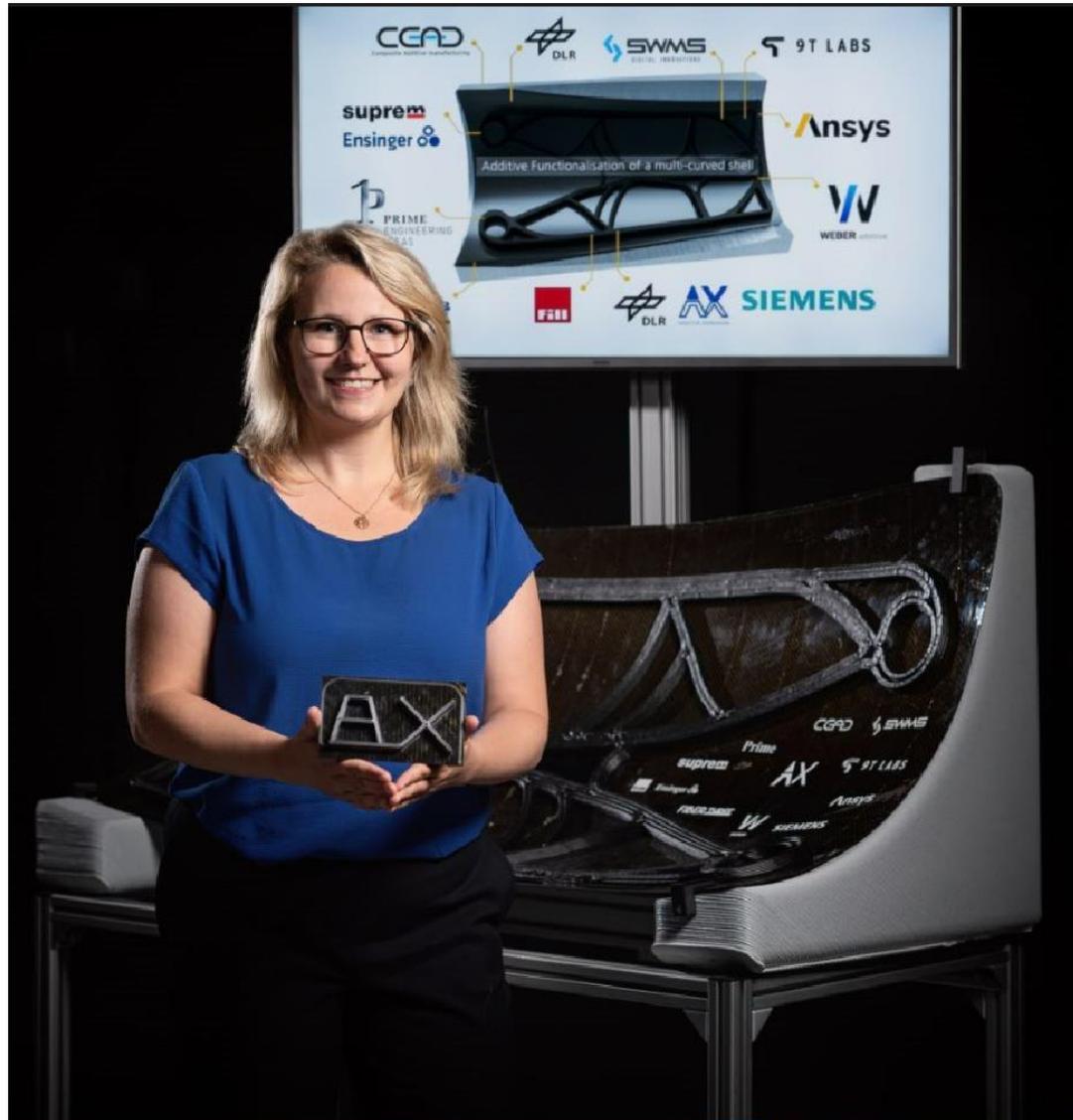


EmpowerAX - A collaborative environment for the transfer of fibre-reinforced 3D printing

The Speaker

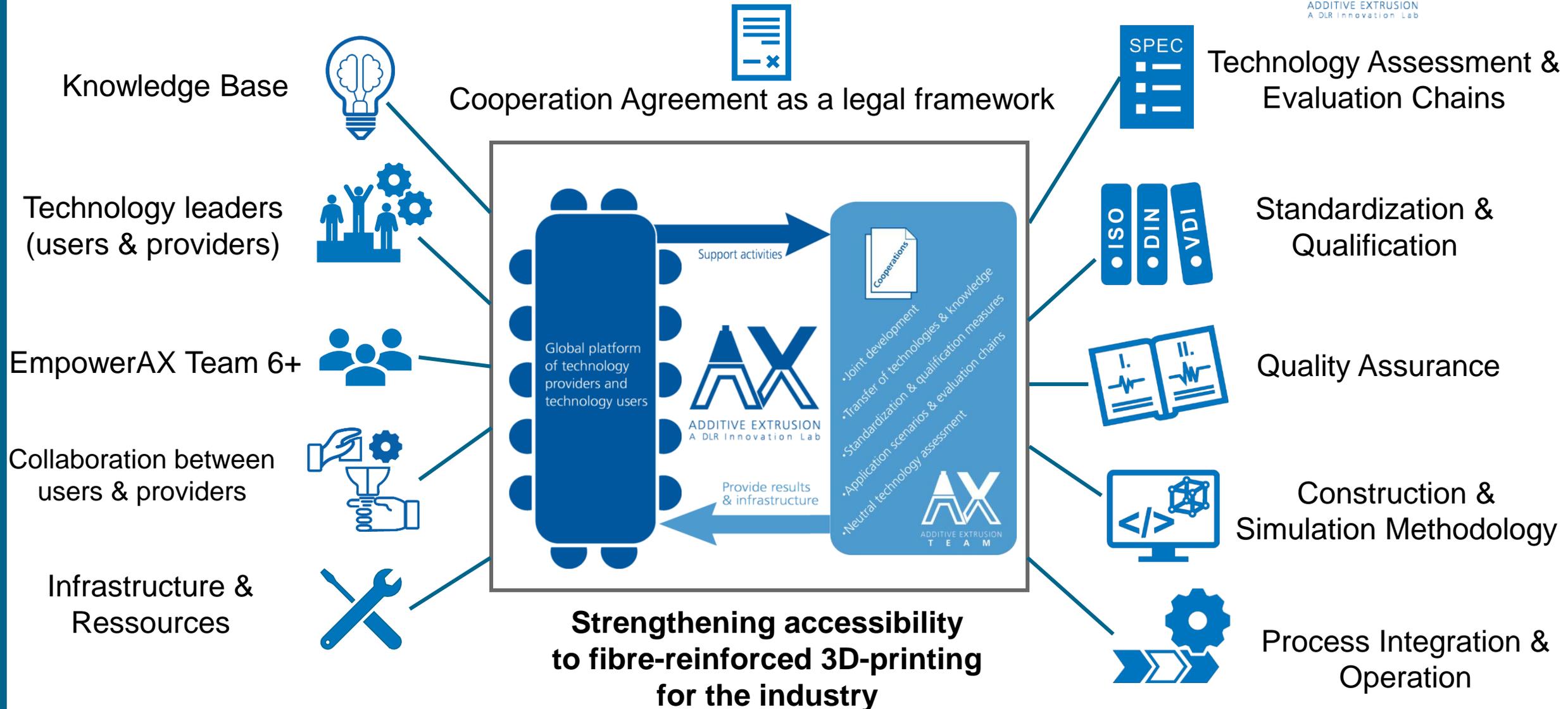


Xenia Stumpf

Lab Managerin
DLR Innovation Lab EmpowerAX

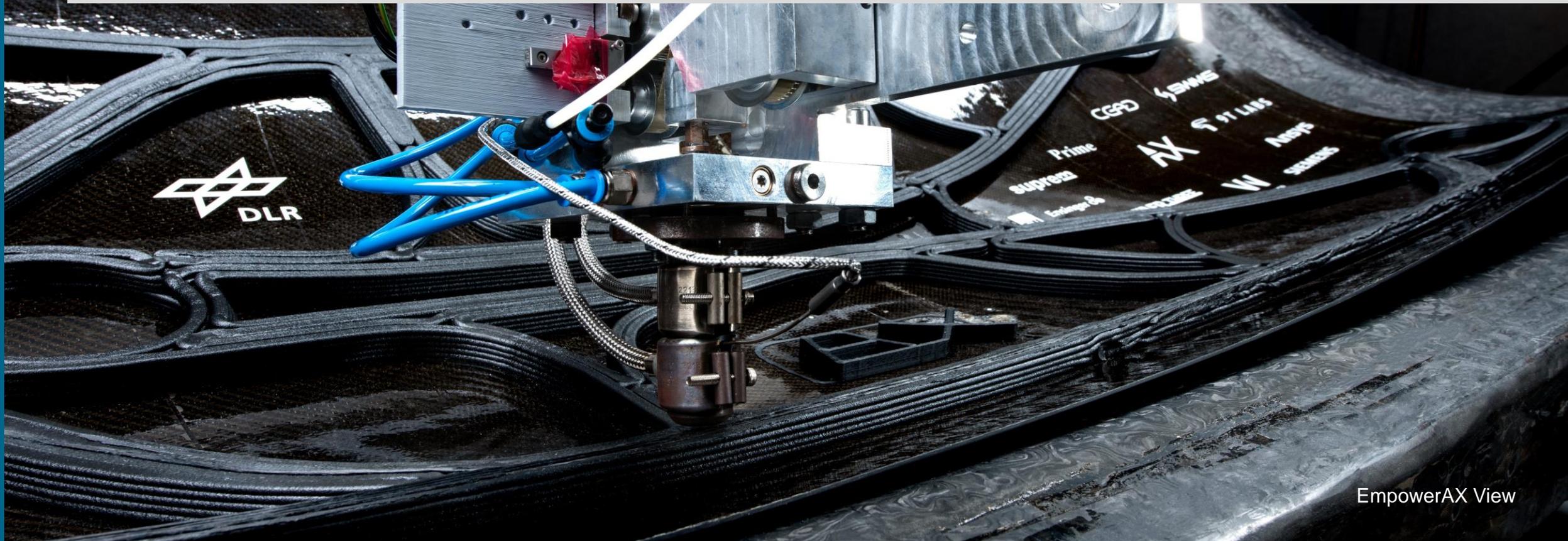
DLR Brunswick, Germany
Institute of Lightweight Systems

DLR Innovation Lab EmpowerAX – An overview



“The real value of Additive Manufacturing is not in replacing all conventional composites manufacturing processes –

The real value of Additive Manufacturing is in developing the right combination of established methods with Additive Functionalisation.”

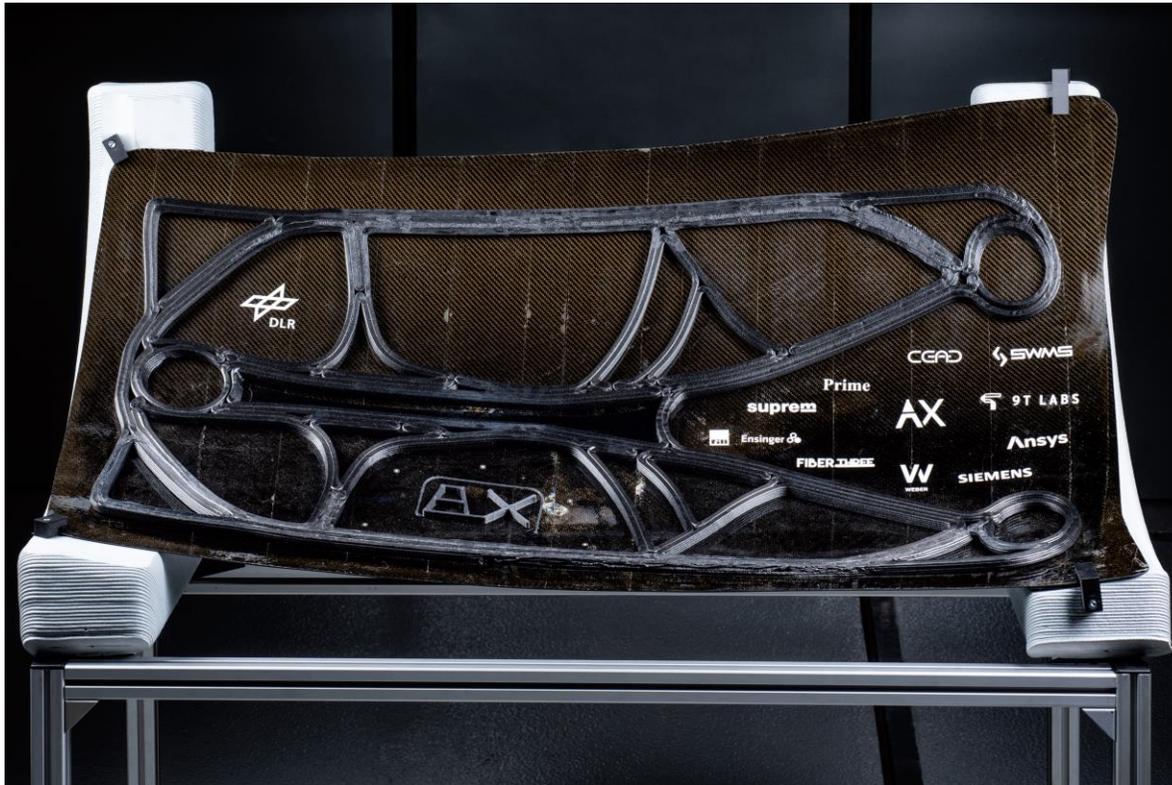




ADDITIVE FUNCTIONALISATION COMBINATION INSTEAD OF SUBSTITUTION

The concept of Additive Functionalisation

Combination instead of substitution



- Combination of conventional & additive manufacturing processes
- Combination of different materials
 - Thermoset + thermoplast
 - Short and continuous fibre-reinforced material (SFRP + CFRP)
- Overprinting of a multi-curved Shell

EmpowerAX Demo Part
„Additive Functionalisation of a multi-curved shell“

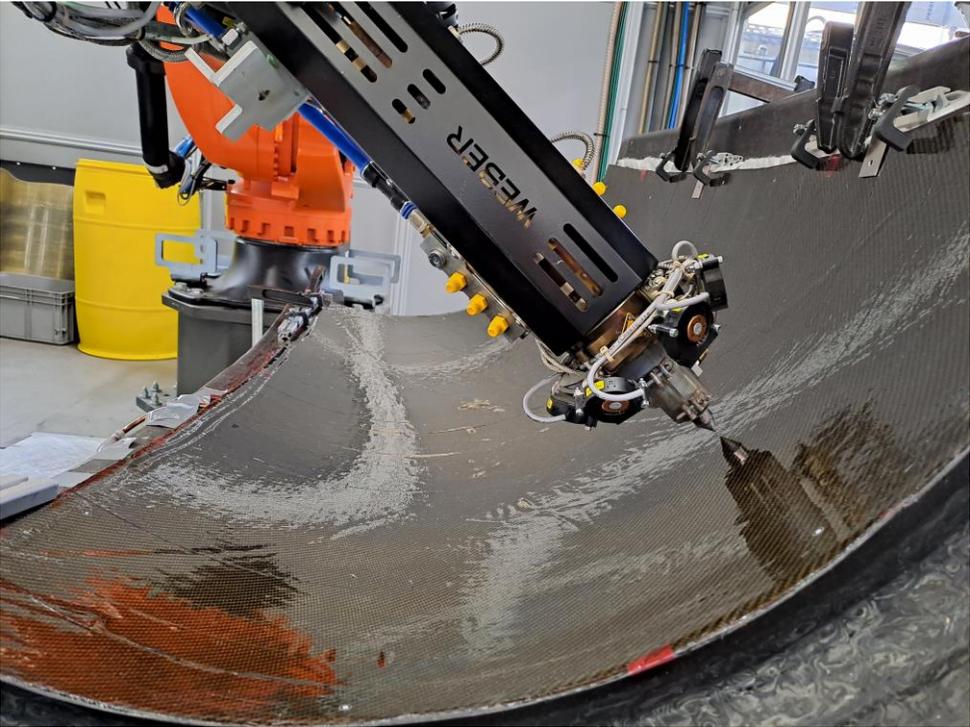
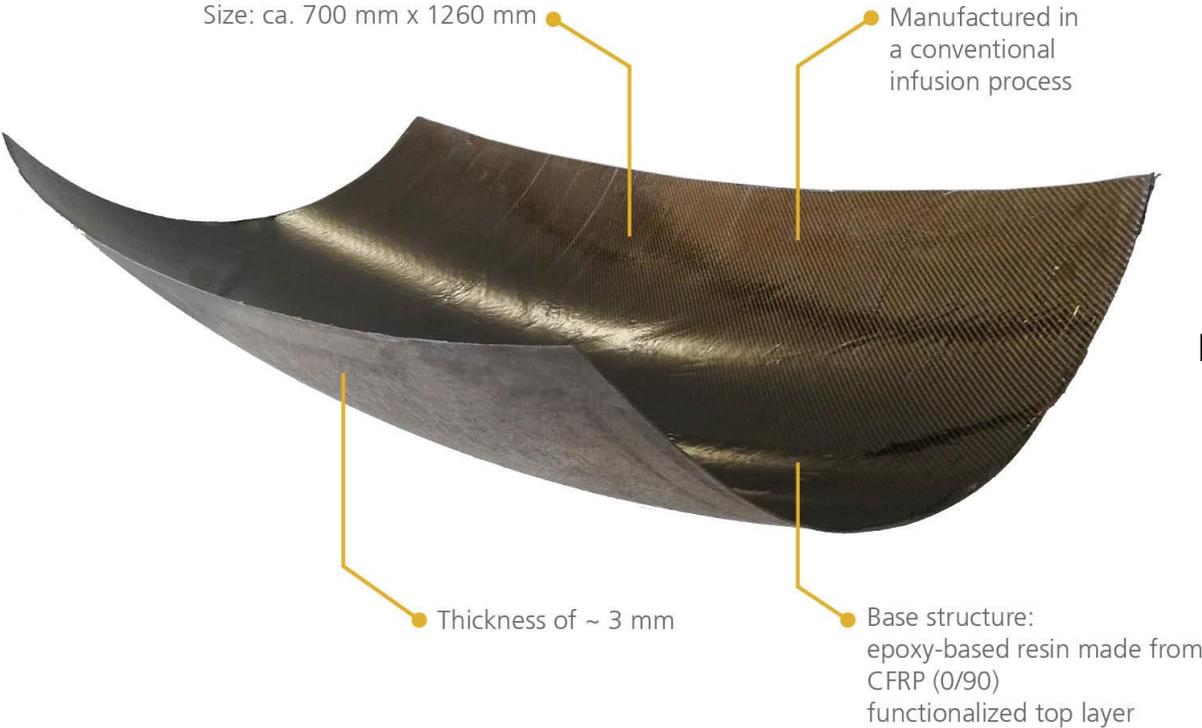
EmpowerAX Demo Part

The Basic Idea



EmpowerAX Demo Part

The Basic Idea



Printing of the tooling by
CCAD
Composite Additive Manufacturing

Manufacturing of the basic shell structure by
DLR

Path planning by
SWMS
DIGITAL INNOVATIONS

Transfer of fibre planning by
9T LABS

High performance thermoplastic short FRP & continuous FRP by
Ensinger suprem

AM process simulation by
Ansys

Additive Functionalisation of a multi-curved shell

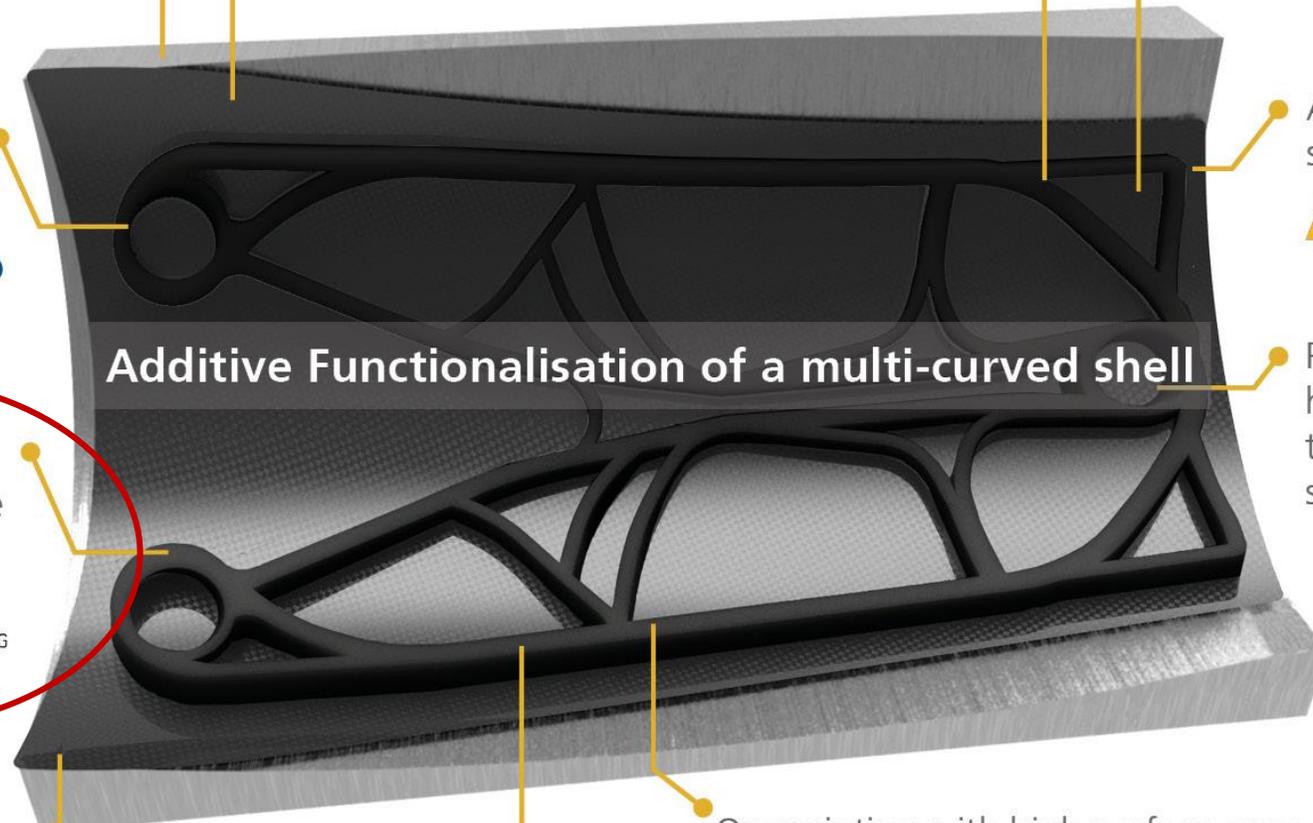
Printing with high performance thermoplastic short FRP by
WEBER additive

Design & topology optimisation of the ribs by
PRIME ENGINEERING IDEAS

Printing of supports and fixtures by
FIBER THREE MATERIAL

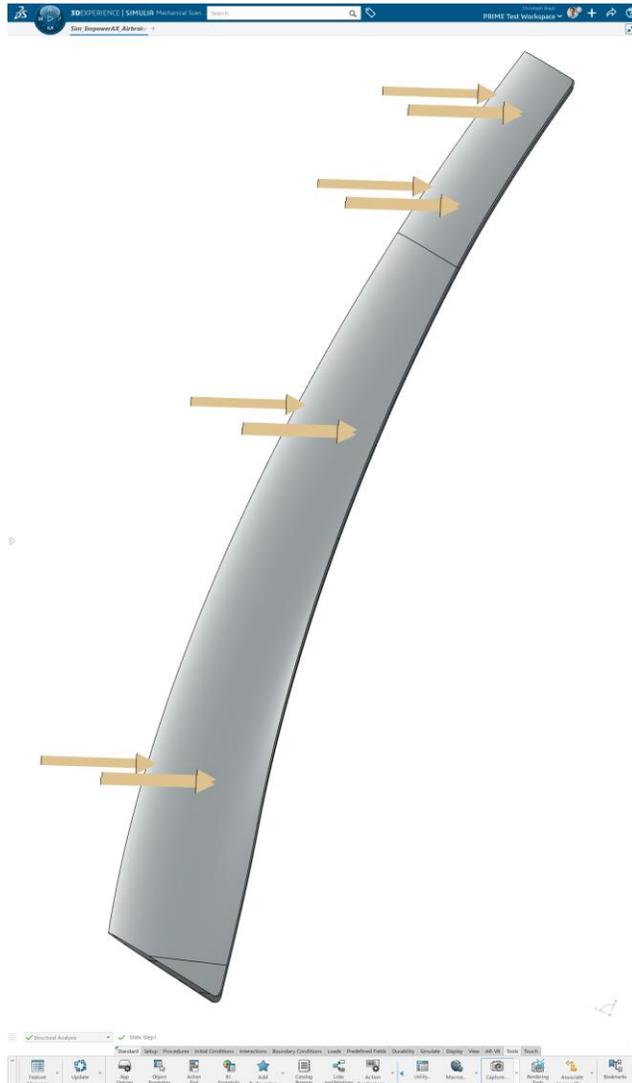
Metrology and NDT by
fill

Overprinting with high performance thermoplastic short FRP + continuous FRP using CNC robotics by
DLR AX SIEMENS



EmpowerAX Demo Part

Starting point: Topology-optimised Design by PRIME

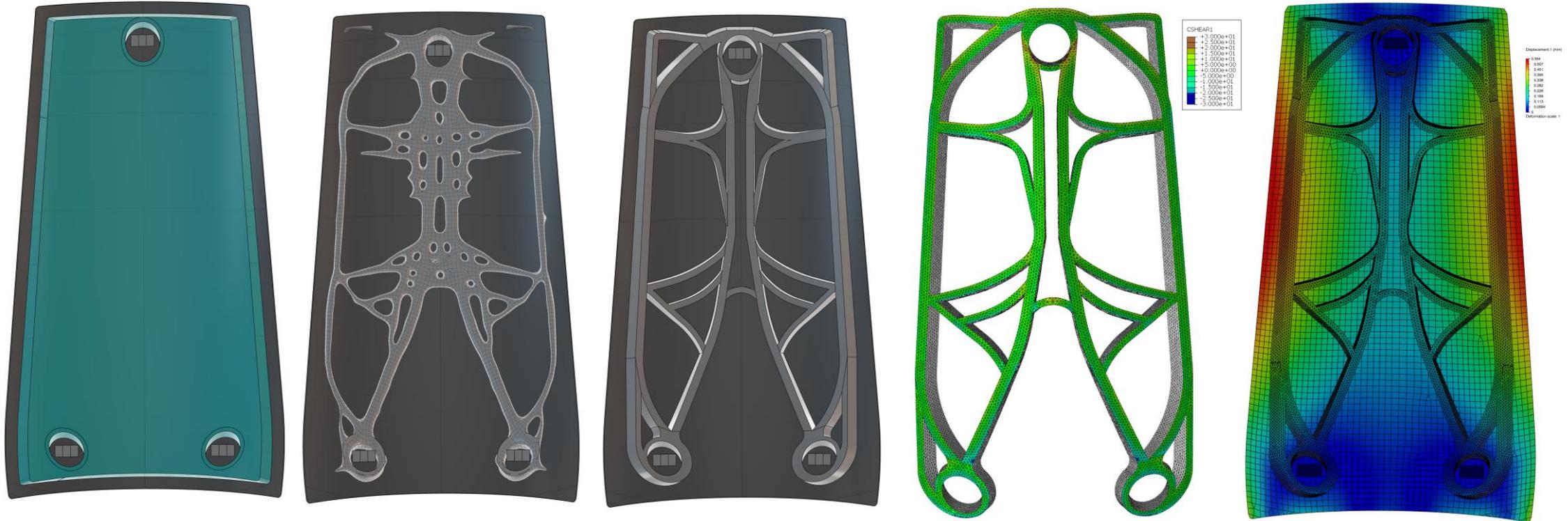


Basic assumptions for loadcase as design requirements:

- Aeronautical application
- During a landing of 360 km/h
- Aerodynamic drag force combined with simultaneous front and side winds

EmpowerAX Demo Part

Starting point: Topology-optimised Design by PRIME



Topology-optimised design to use material only where it is really needed

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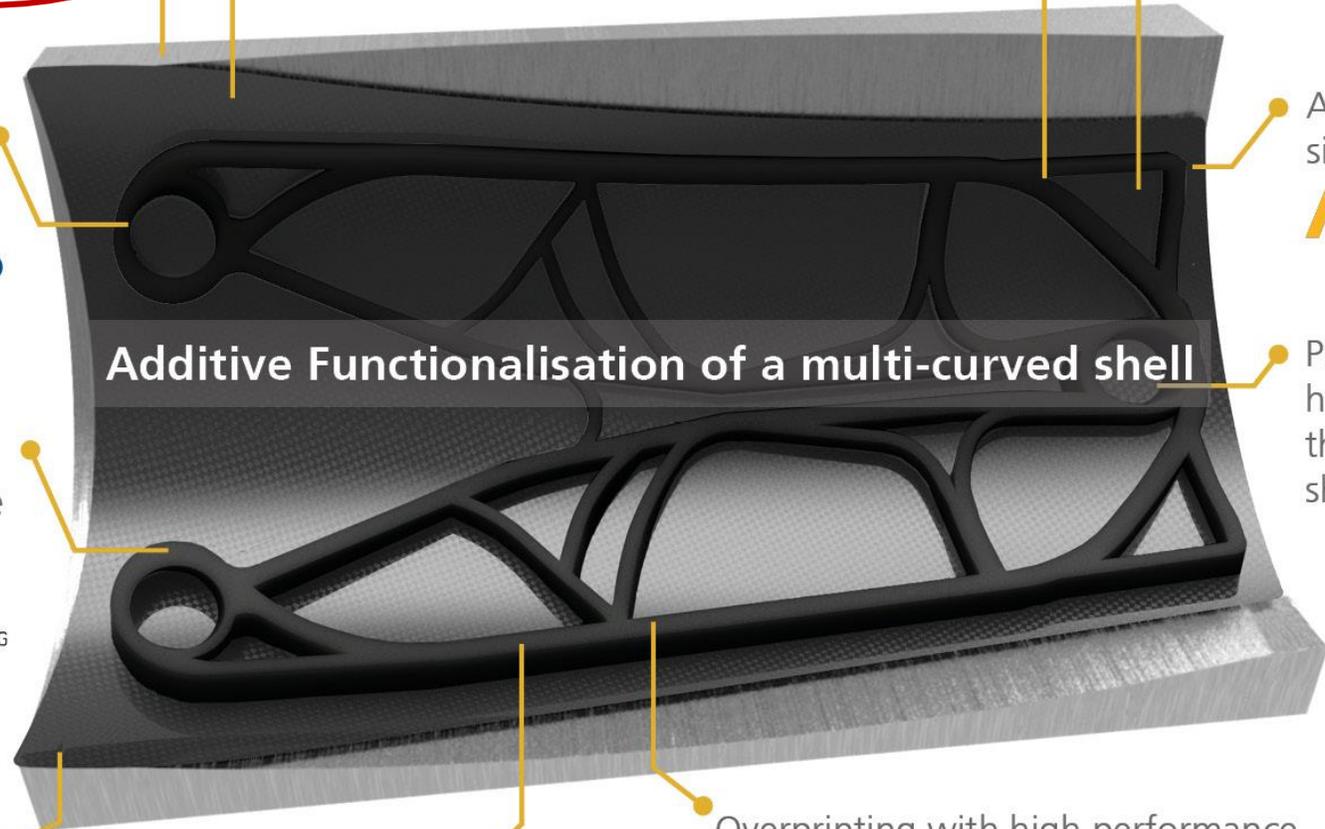
Additive Functionalisation of a multi-curved shell

Printing with high performance thermoplastic short FRP by
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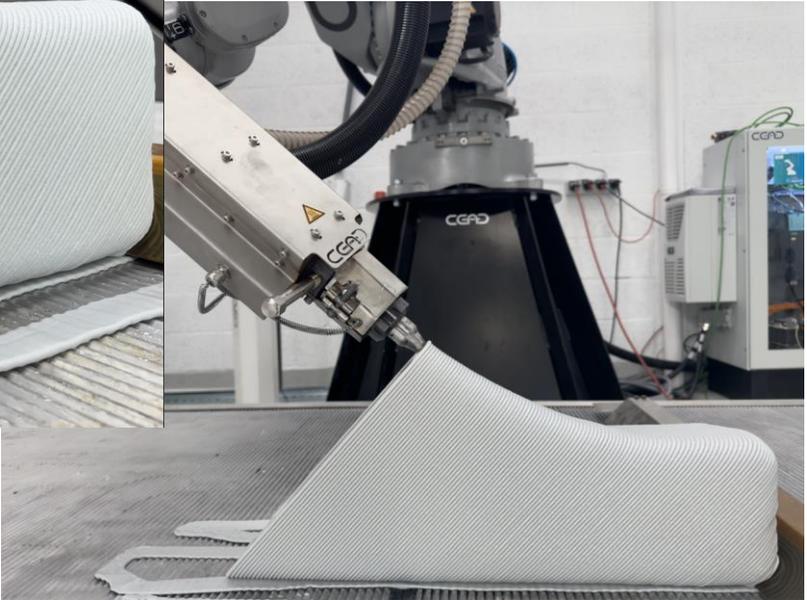
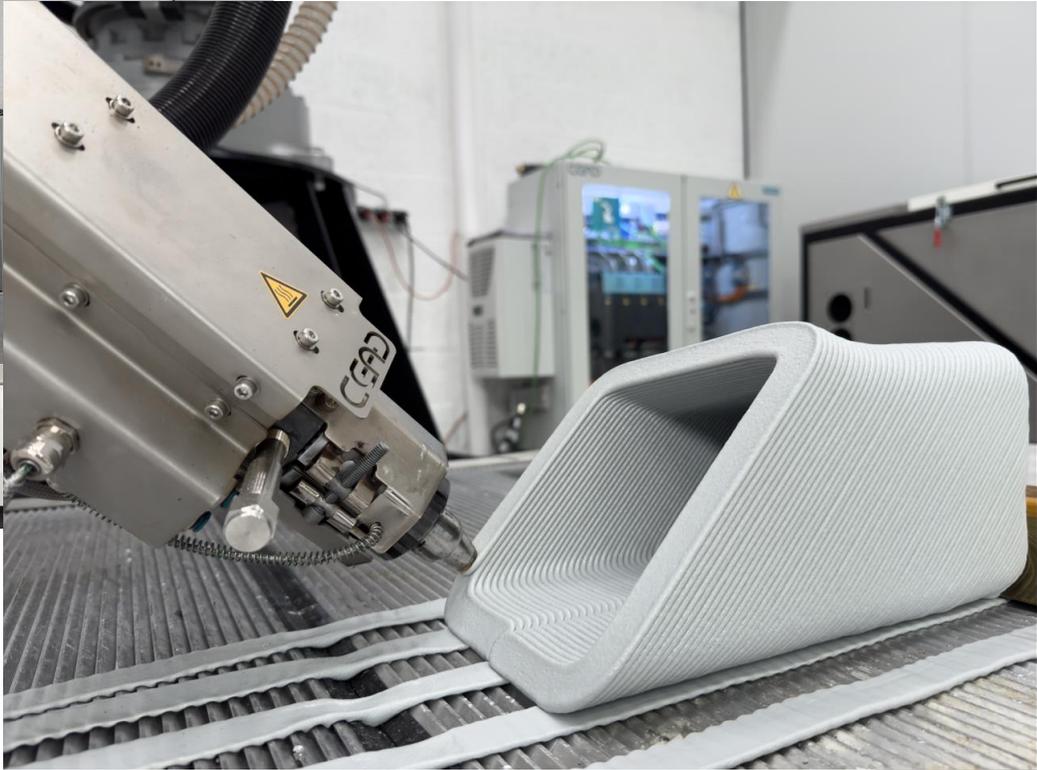
Printing of supports and fixtures by
FIBER THREE MATERIAL

Metrology and NDT by
fill

Overprinting with high performance thermoplastic short FRP + continuous FRP using CNC robotics by
DLR AX SIEMENS



EmpowerAX Demo Part Printing of the tooling by CEAD



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Composite Additive Manufacturing

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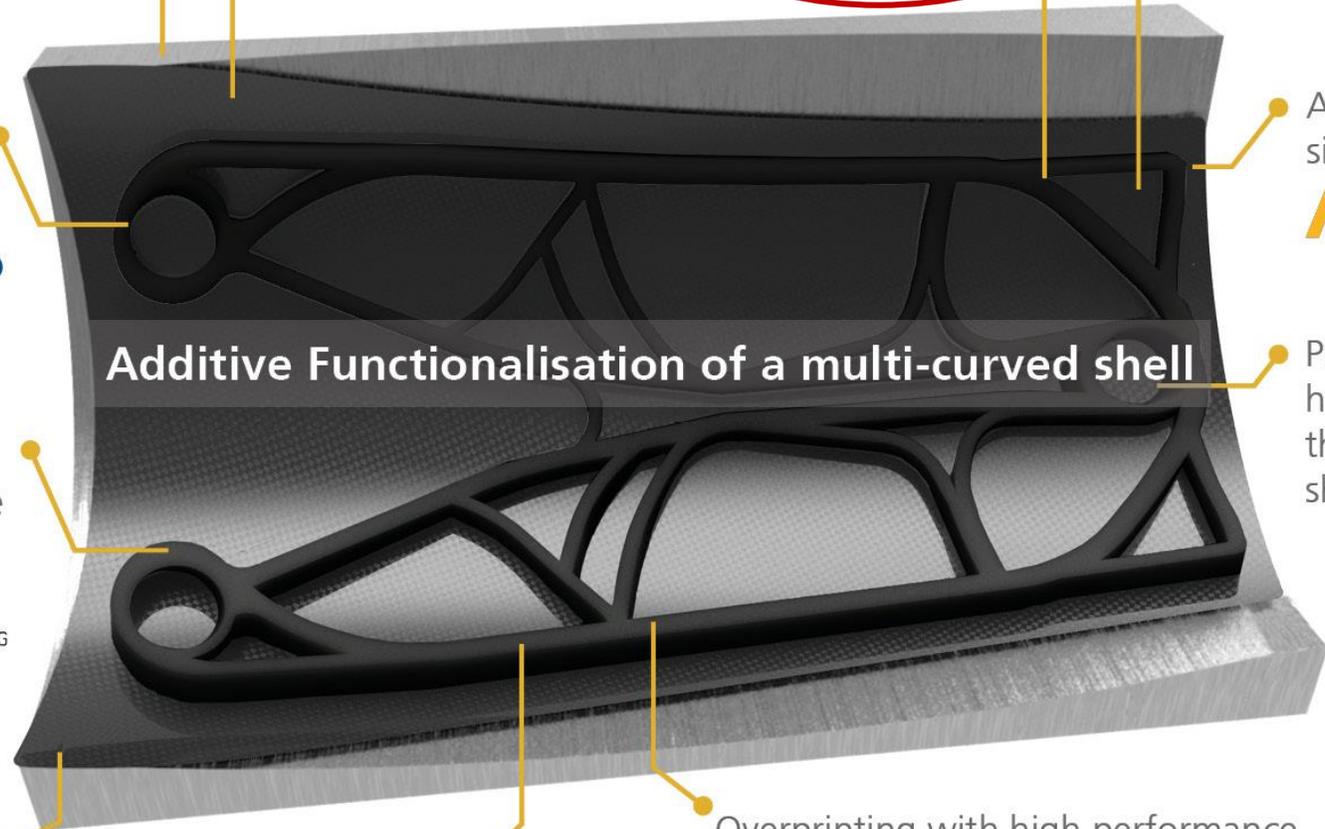
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ADDITIVE EXTRUSION



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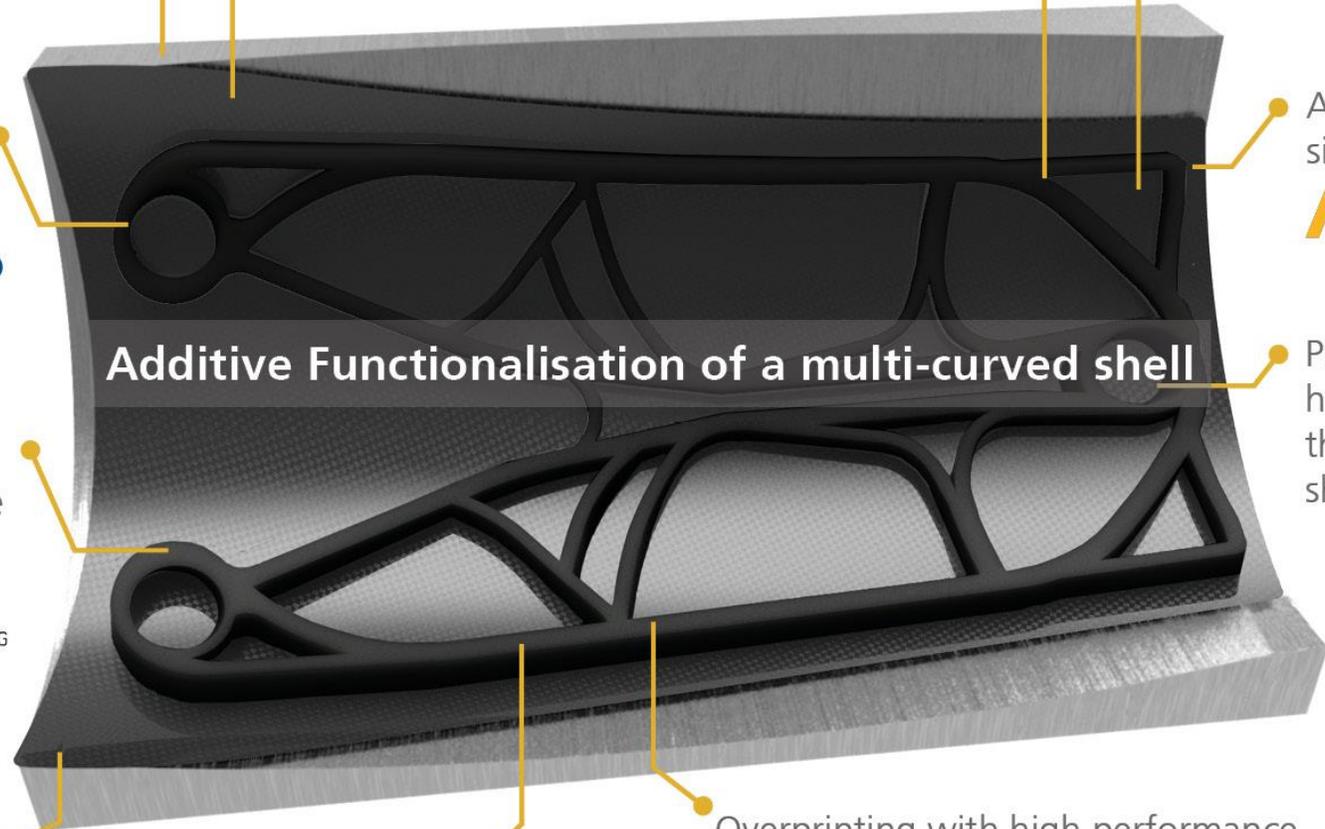
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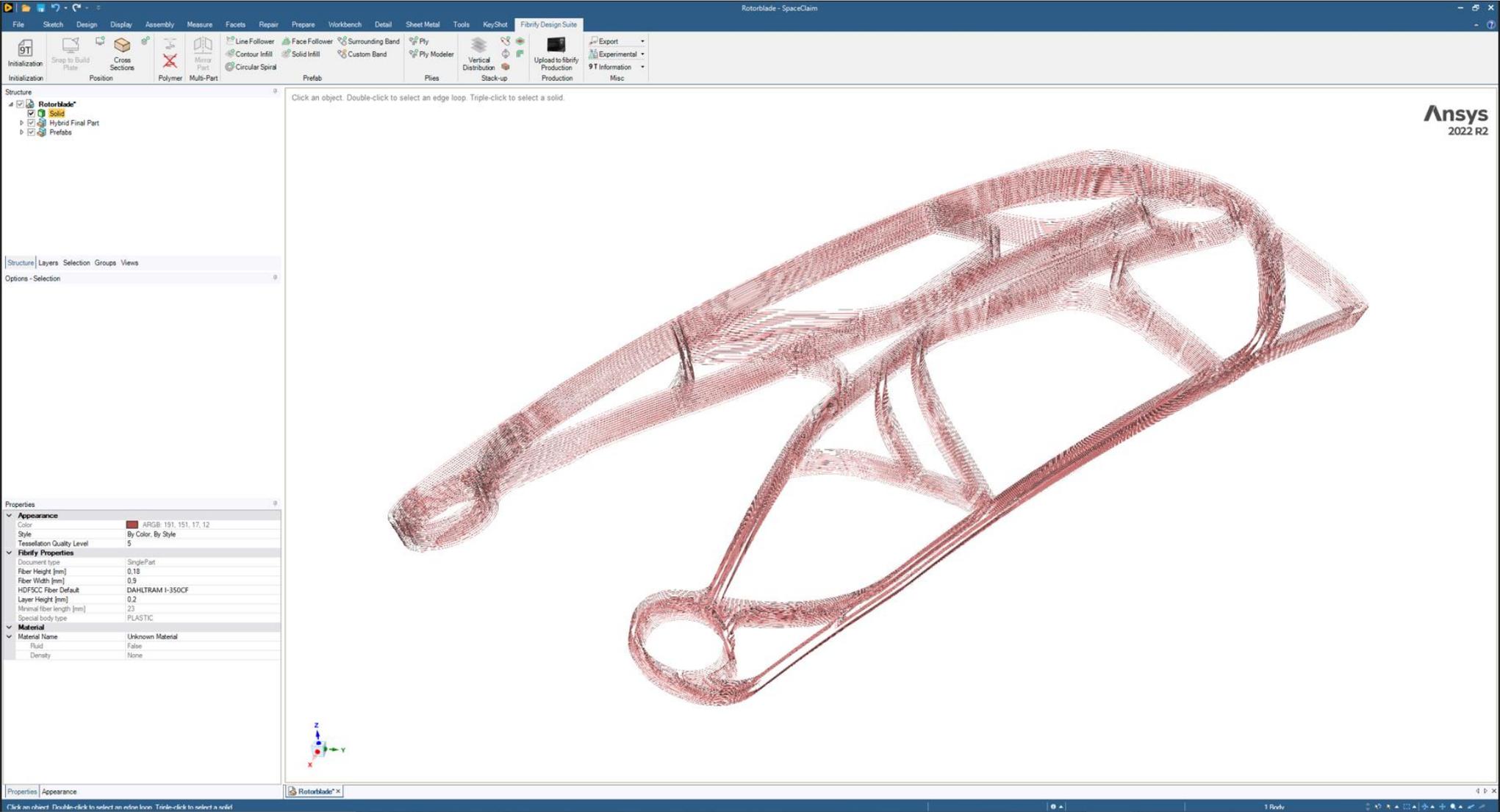
Metrology and NDT by
fill

Overprinting with high performance thermoplastic short FRP + continuous FRP using CNC robotics by
DLR AX SIEMENS



EmpowerAX Demo Part

Transfer of fibre planning by 9T Labs



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Composite Additive Manufacturing

Manufacturing of the basic shell structure by
DLR

Path planning by
SWMS
DIGITAL INNOVATIONS

Transfer of fibre planning by
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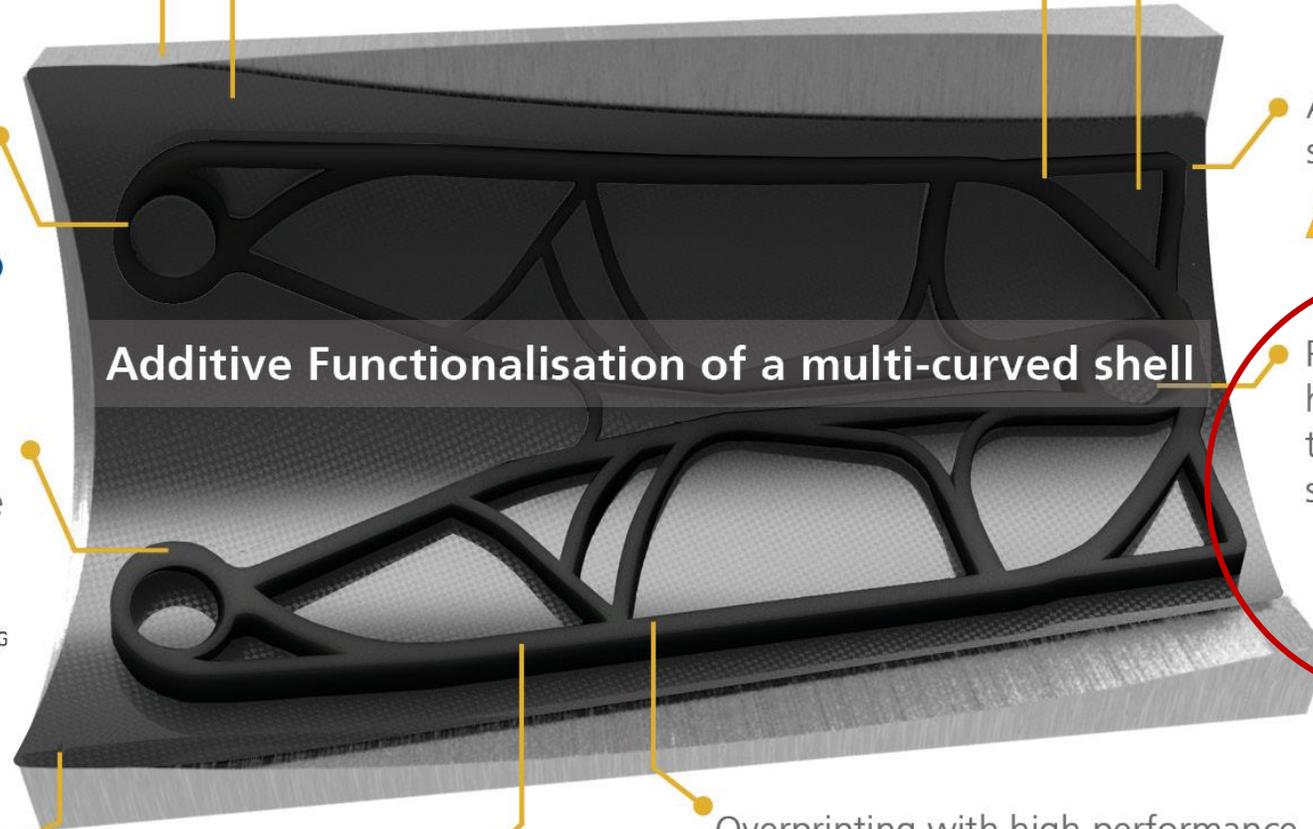
Additive Functionalisation of a multi-curved shell

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WEBER additive

Printing of supports and fixtures by
FIBER THREE MATERIAL

Metrology and NDT by
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Overprinting with high performance thermoplastic short FRP + continuous FRP using CNC robotics by
DLR AX SIEMENS



EmpowerAX Demo Part Printing of the stiffening ribs by WEBER



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Composite Additive Manufacturing

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SWMS
DIGITAL INNOVATIONS

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Additive Functionalisation of a multi-curved shell

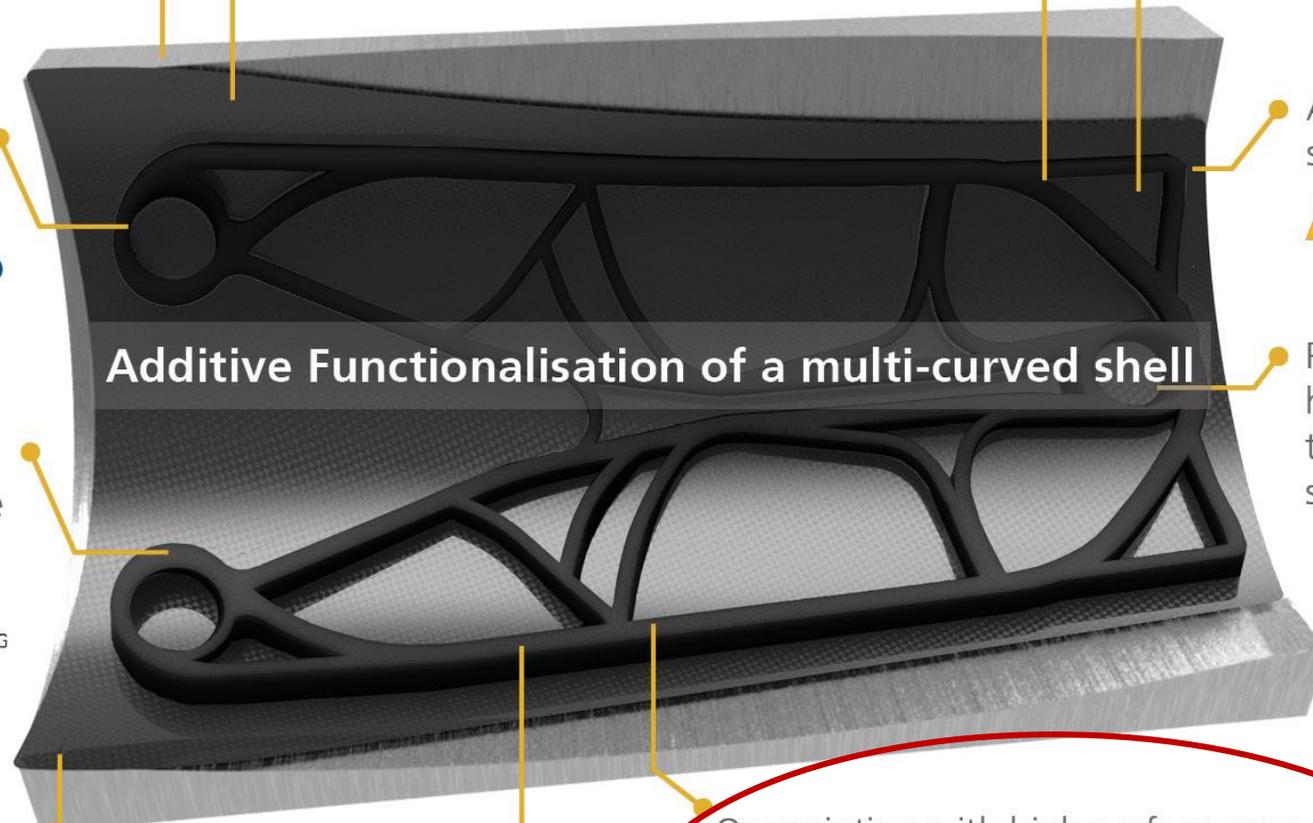
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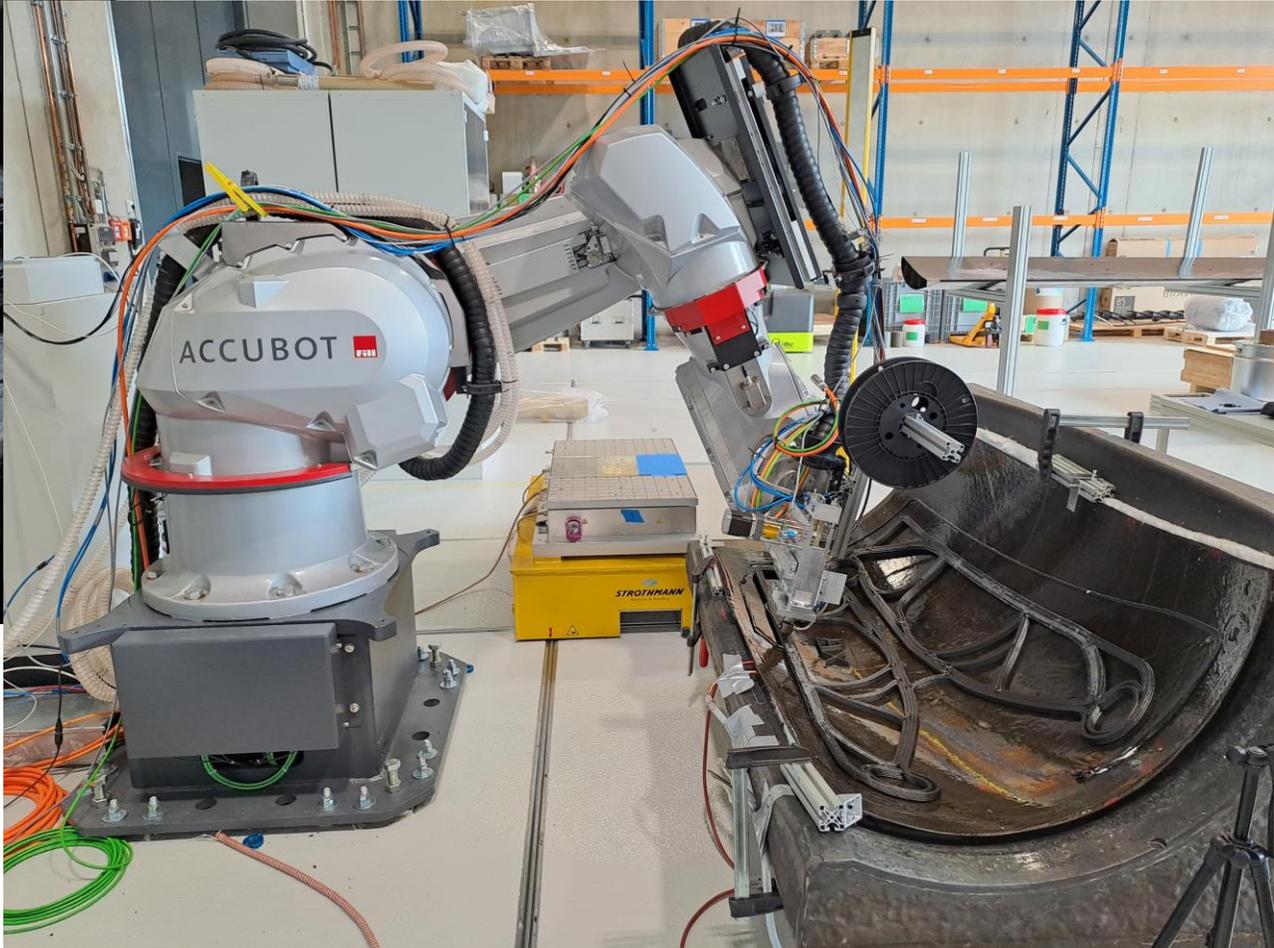
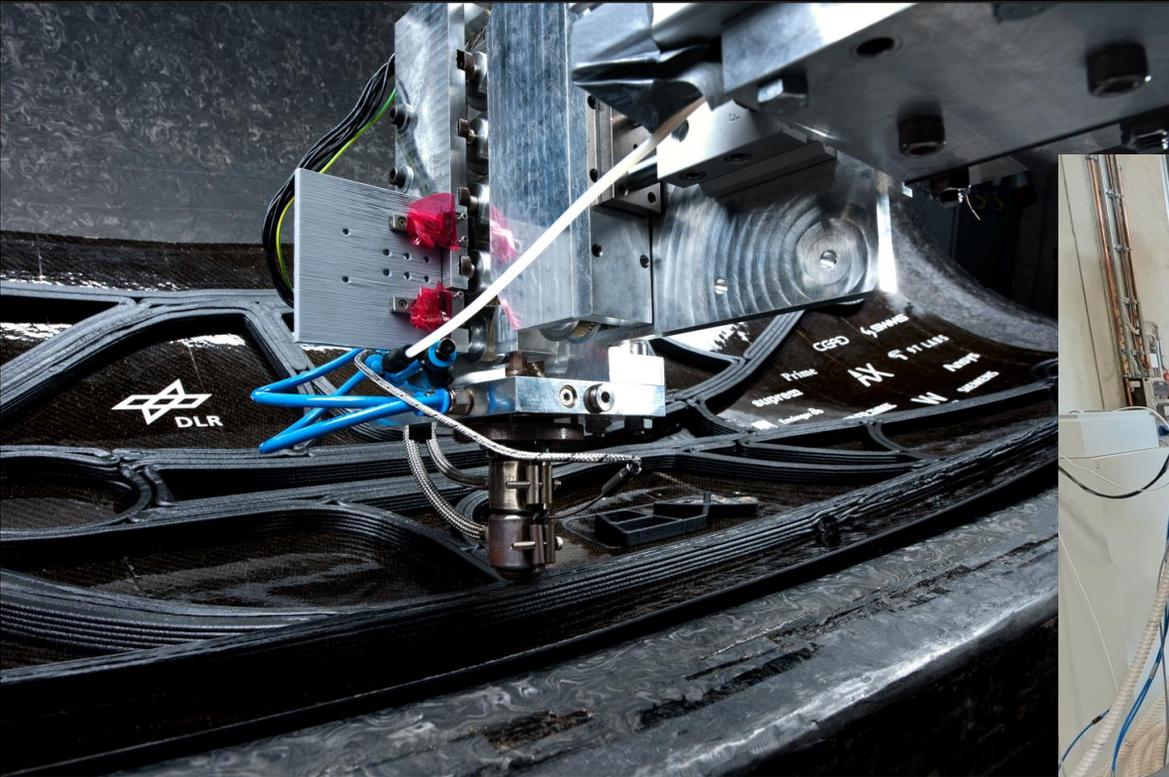
Metrology and NDT by
fill

Overprinting with high performance thermoplastic short FRP + continuous FRP using CNC robotics by

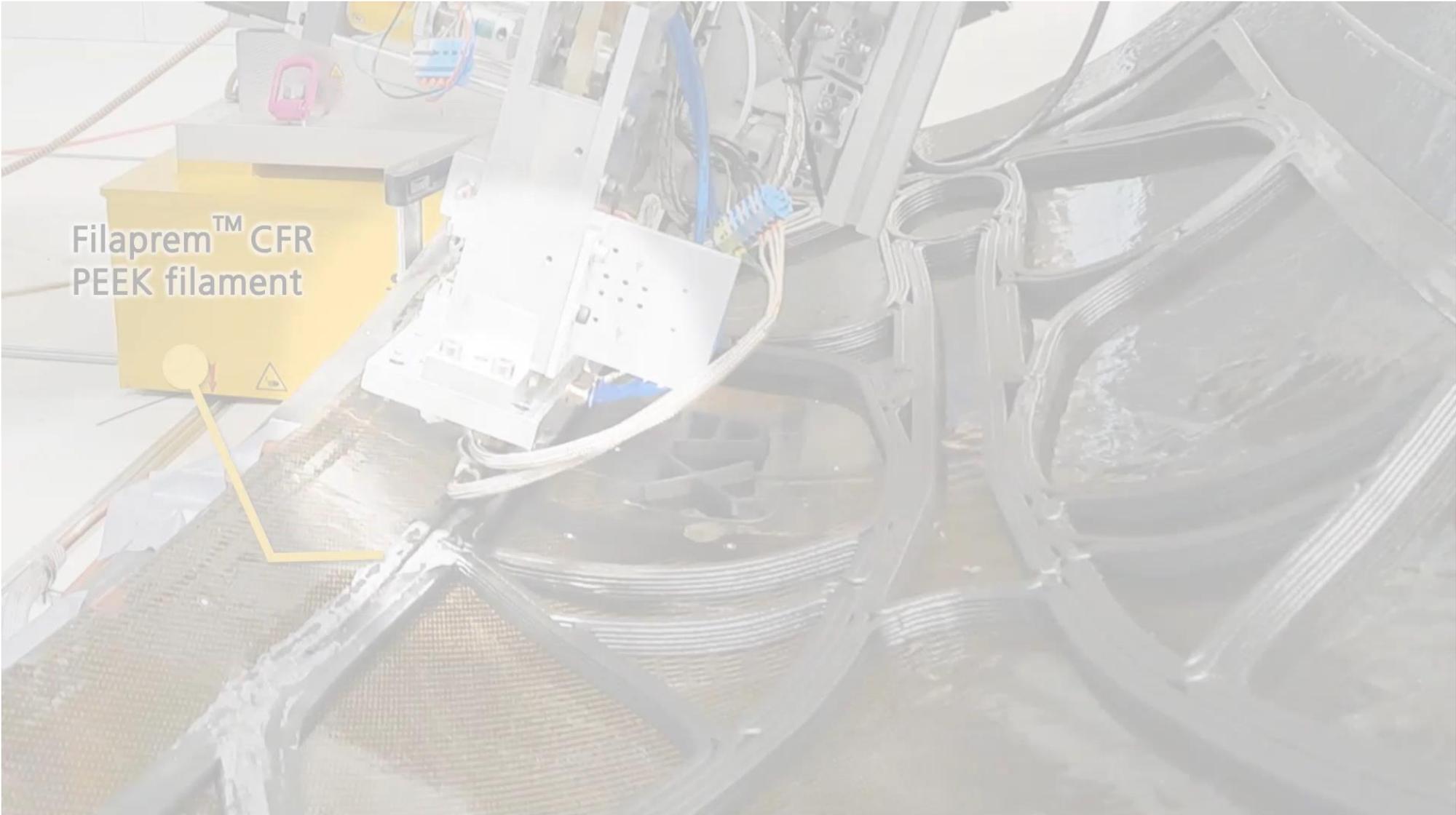
DLR AX SIEMENS
ADDITIVE EXTRUSION



EmpowerAX Demo Part Overprinting by DLR / EmpowerAX



EmpowerAX Demo Part Overprinting by DLR / EmpowerAX



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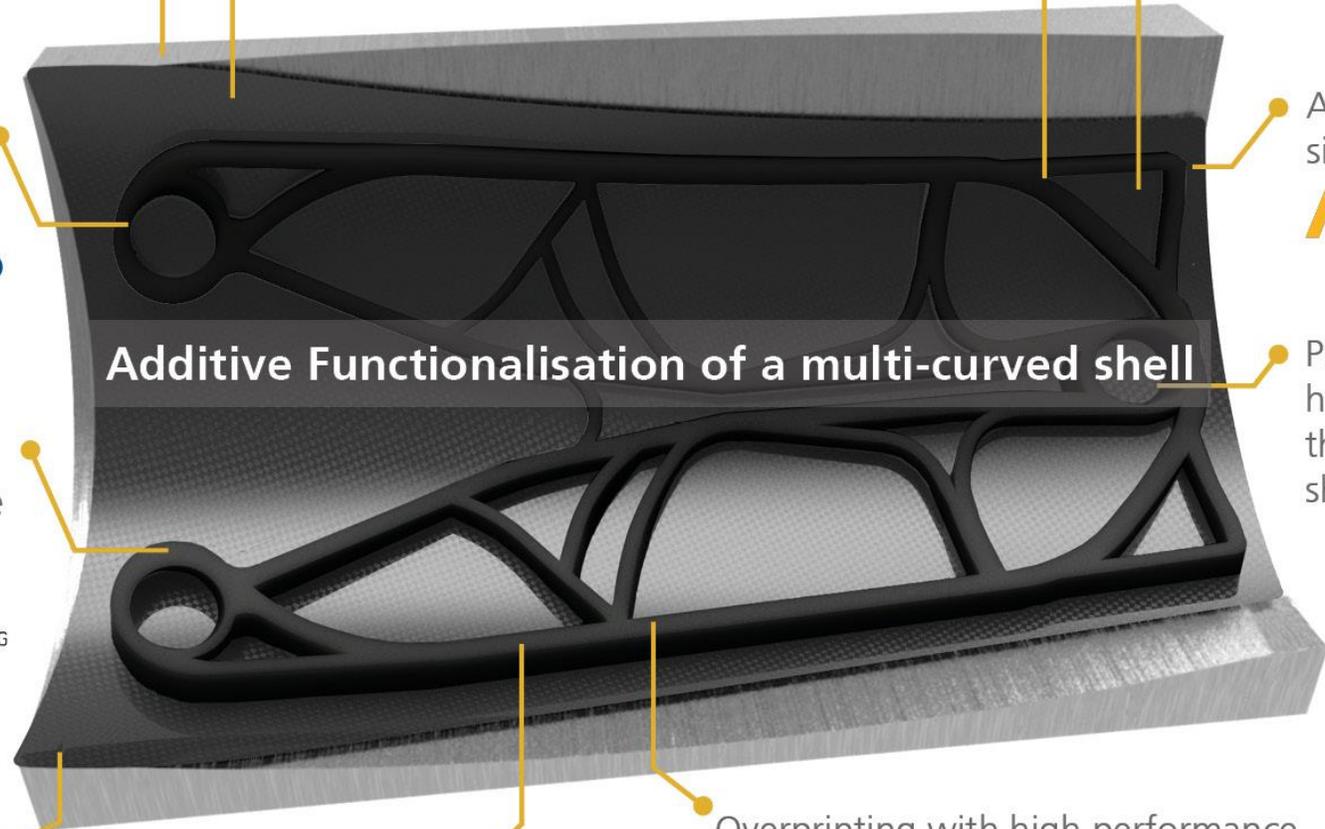
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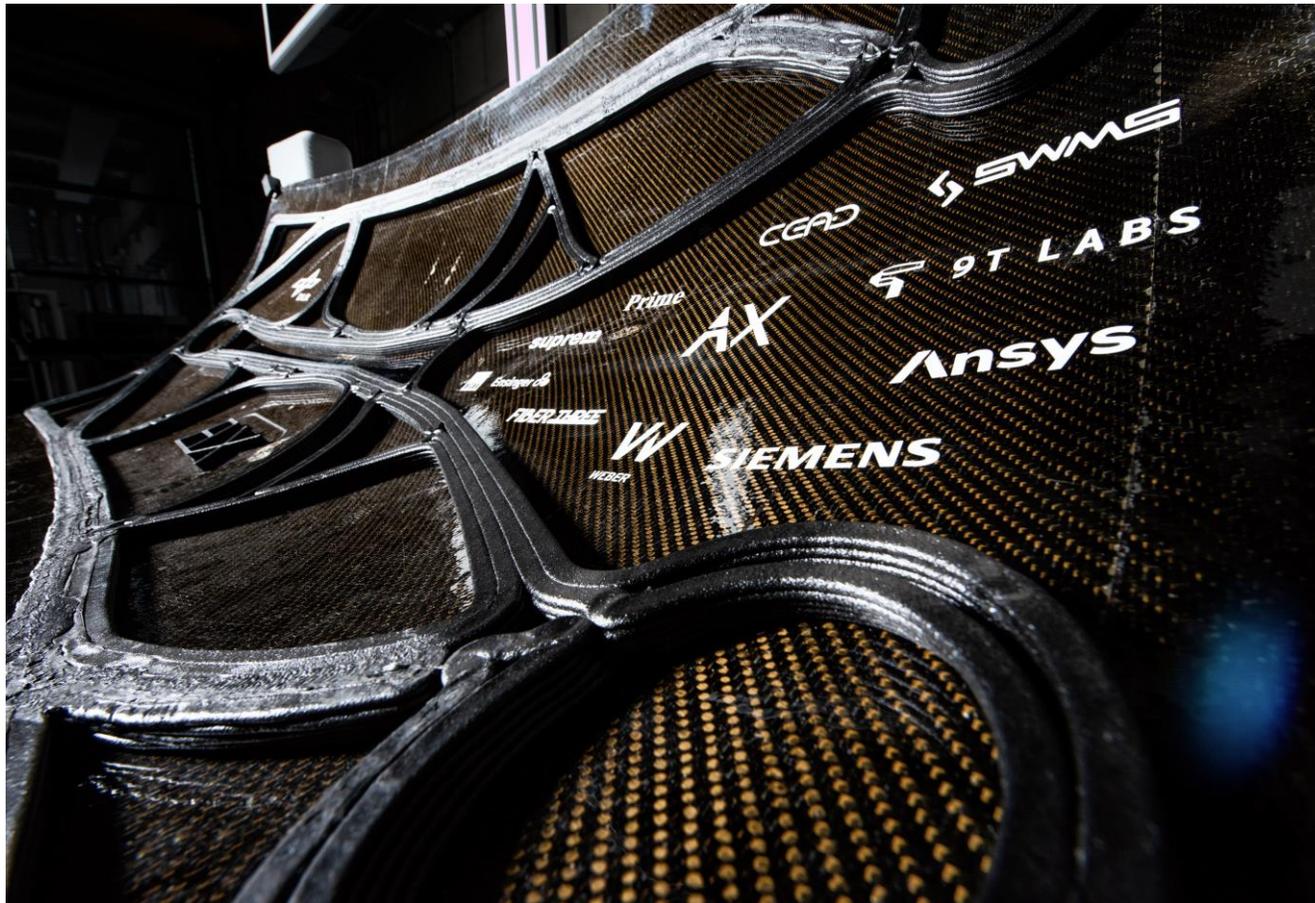
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Overprinting with high performance thermoplastic short FRP + continuous FRP using CNC robotics by
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EmpowerAX Demo Part Additive Functionalisation – Summary



- Additive Functionalisation for cost-efficient manufacturing of composites parts
- Overprinting of a multi-curved shell with short and endless fibre-reinforced materials
- Combination of thermoset and high performance thermoplastic
- Demonstration of an industrially available process chain

INNOVATIONSPREIS
NIEDERSACHSEN
2023

Sieger!
in der Kategorie „Kooperation“



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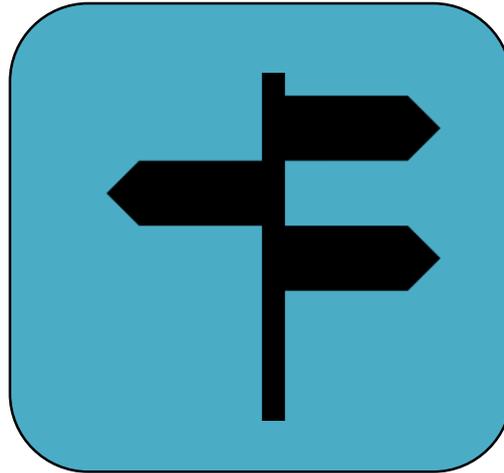
MANAGEMENT OF A COLLABORATIVE ENVIRONMENT

Management of a collaborative environment

The working level



Visibility &
regular exchanges



Agility in strategy



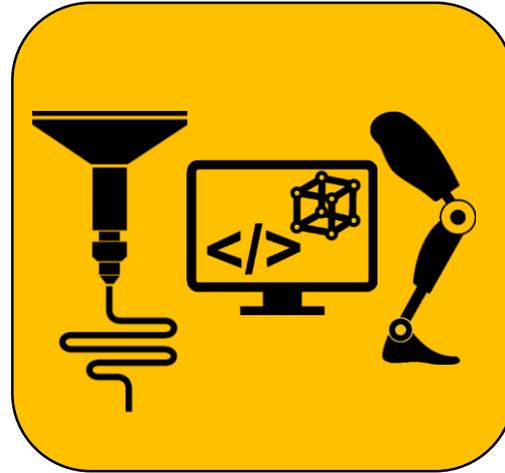
Legal framework

Management of a collaborative environment

The technology level



Interesting Topic &
Technology



Heterogeneous
Partner Structure



Space for
Experimentation

but the most important part of a collaborative environment are...

The most important part of a collaborative environment



People with Passion



EmpowerAX Science Day on the topic „fibre-reinforced 3D-printing in application“

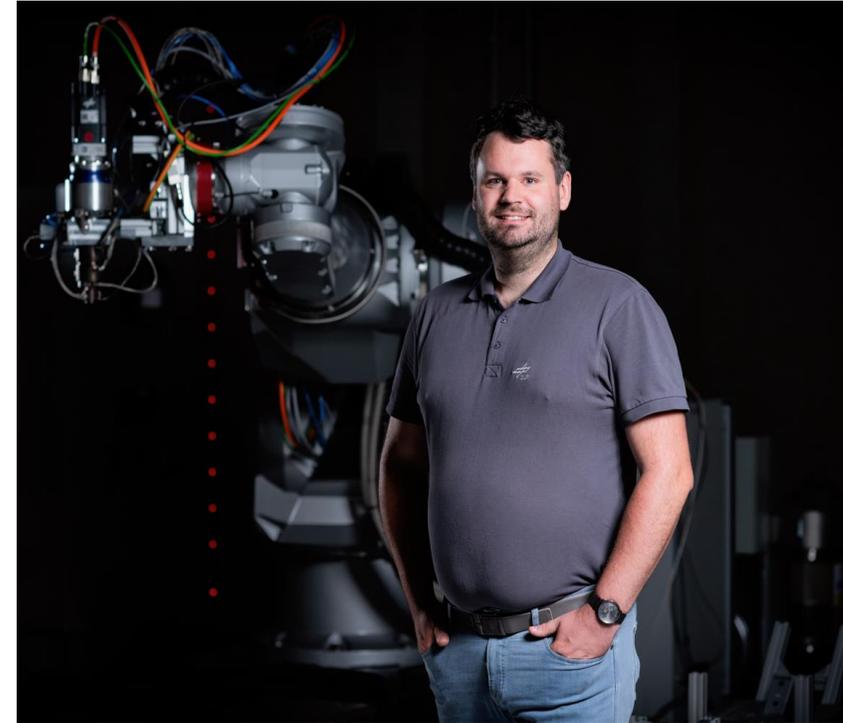


The EmpowerAX team on site



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