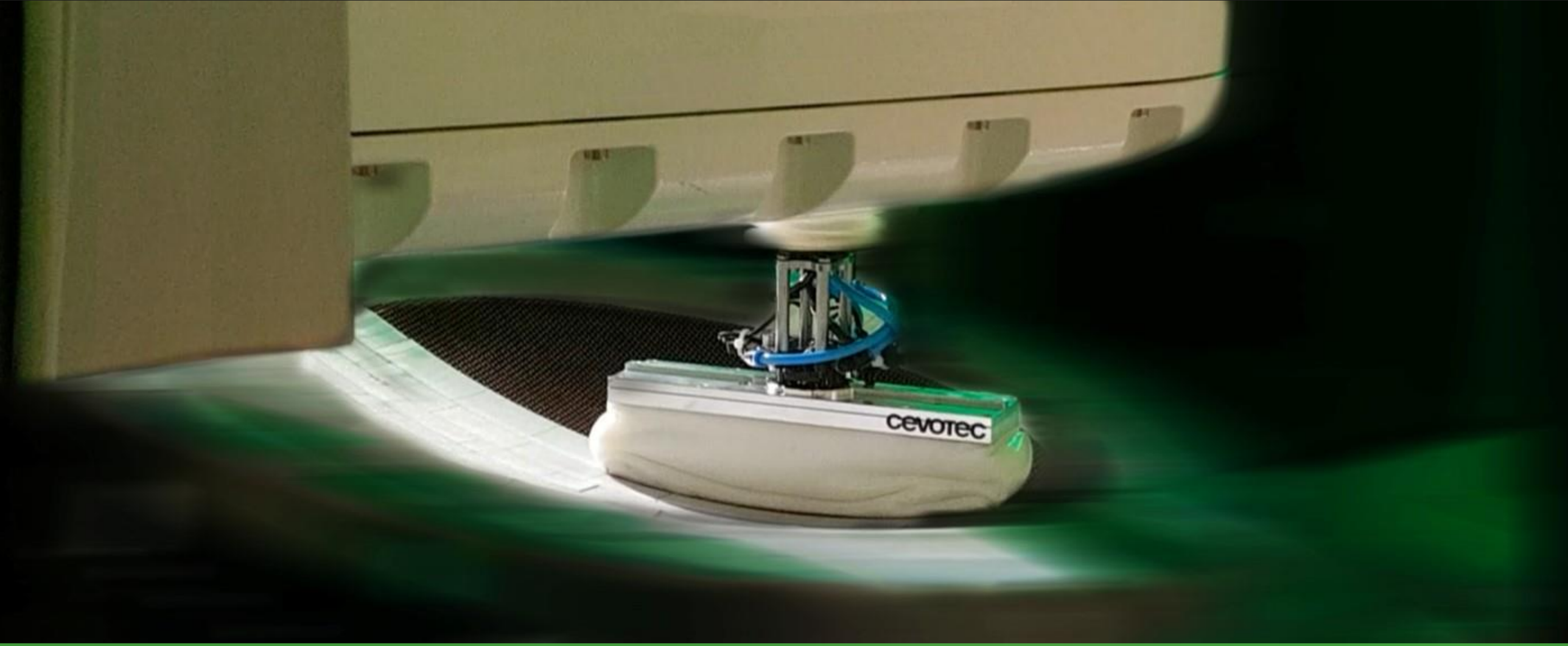


Lay-up automation for complex composites

SAMBA & ARTIST STUDIO | Fiber Patch Placement by Cevotec

March 2024

cevotec
milestones in composites

Cevotec – Fiber Patch Placement equipment & software

Founded in 2015, Cevotec has become the globally leading technology partner for automated lay-up processes based on Fiber Patch Placement (FPP) technology.

- Located in Unterhaching near Munich, Germany
- High-tech development lab & facilities
- Founded 2015 by current CEO Thorsten Groene together with composite experts Felix Michl, Dr. Neven Majic and Prof. Klaus Drechsler
- Since 2021, partnered with customized machine builder GFM (Austria)
- As of 2023, 25 employees & growing
- Local sales partners in France, North America, Japan, China
- Key products: SAMBA Series production systems
  Artist Studio CAD-CAM software
  Application development and additional services

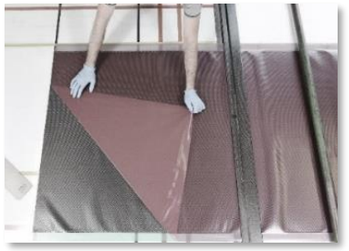
Our mission:

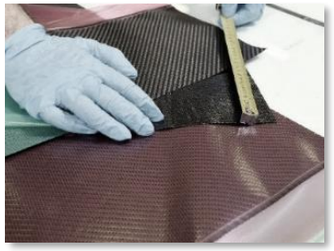
Enabling manufacturers to produce complex composites in high volume and superior quality!

The challenge: Complex composites still greatly manufactured by hand

Need for automation solutions to meet future production demand.

- Long production cycles
- No effective quality control
- High scrap rates (>30%)
- High cost



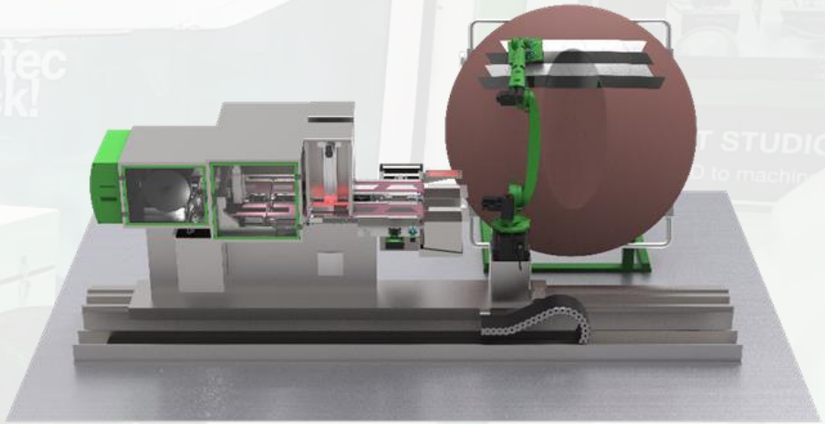


Fiber Patch Placement

Additive 3D fiber lay-up technology for complex composites.

SAMBA *Series*

3D fiber lay-up automation platform

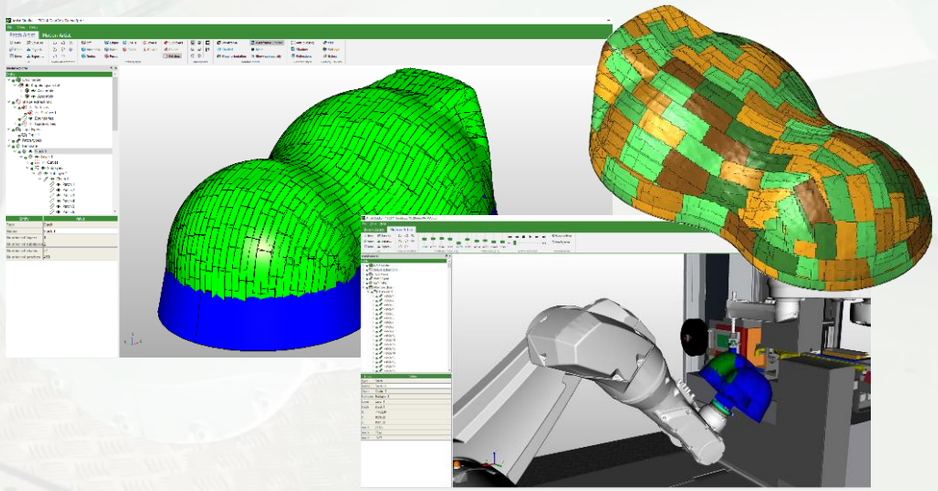


Benefits

- Digitized, automated process chain
- 100% in-process raw material control
- Multi-material lay-up capability
- 20% - 60% cost & time savings

ARTIST STUDIO

CAE software for design & production



Watch on YouTube how FPP works!

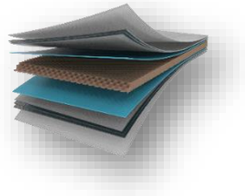
Focus industries

Automated lay-up for complex composites with Fiber Patch Placement.

Aerospace

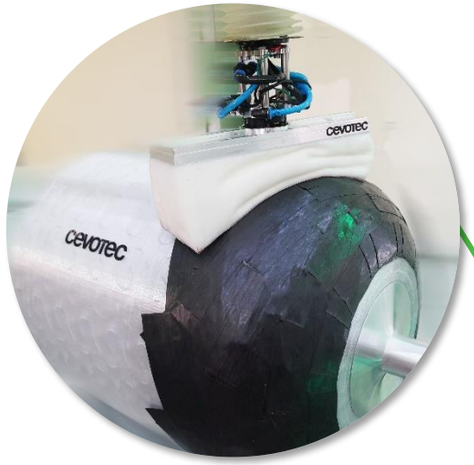
Lay-up automation for complex, multi-material composites

Multi-material composites



Complex geometries

Tailored reinforcements



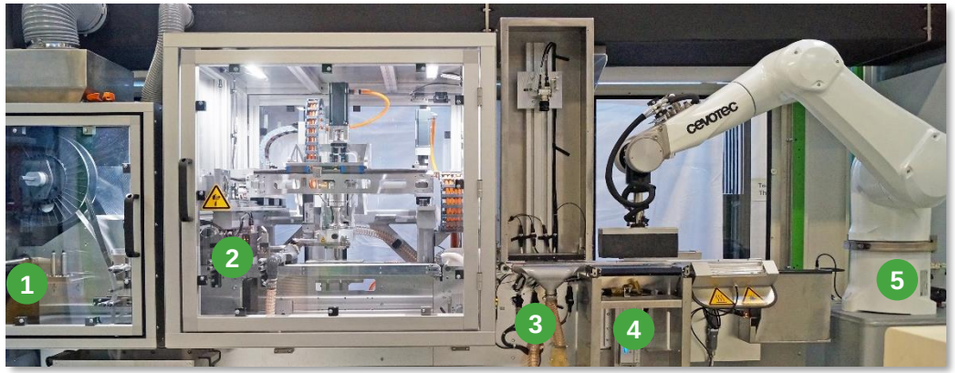
Composite tanks

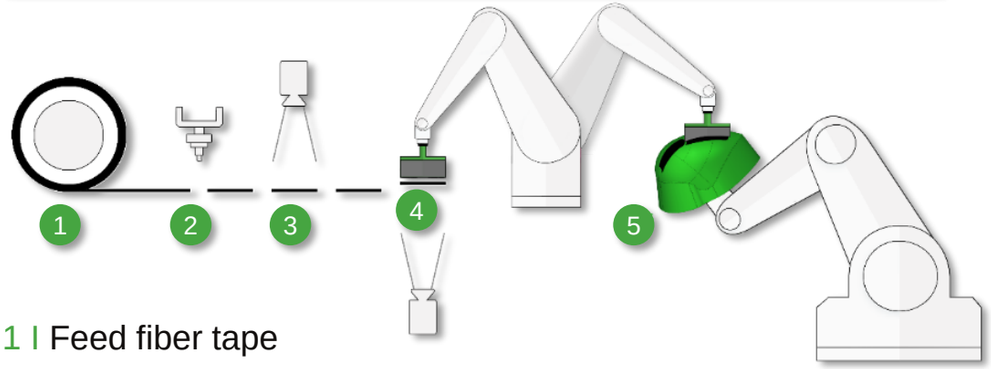
15% lighter composite tanks through FPP dome reinforcements

Fiber Patch Placement technology

The flexible lay-up technology for complex high-performance composites enables a fully automated, quality-controlled, direct 3D lay-up.

Process overview





1 I Feed fiber tape

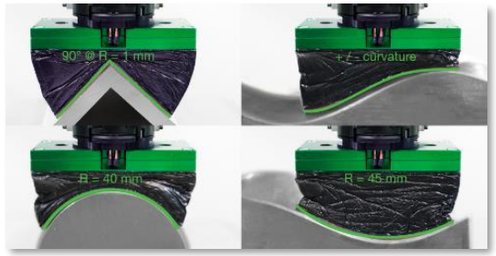
2 I Cut tape into patches

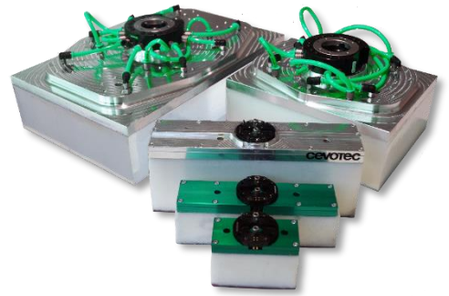
3 I Inspect quality

4 I Pick-up, check position

5 I Place fiber patch

Gripper technology for lay-up on complex shapes

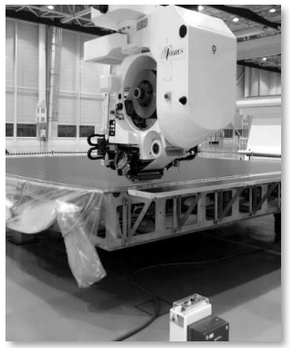




- Controlled fiber deposition on concave & convex surfaces
- Placement directly onto honeycomb cores
- Equipped with compaction-force sensor
- Multiple sizes up to 300 mm x 200 mm
- Suitable for **multi-material placement**: carbon fibers, glass fibers, adhesive films, other technical fibers

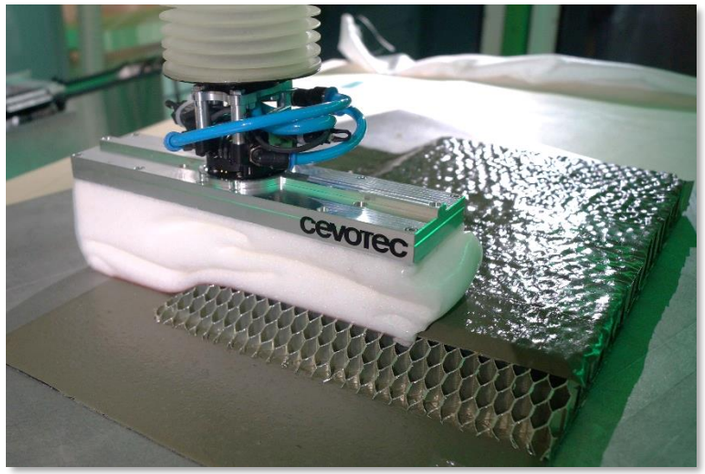
Technology uniquely positioned to extend composites' automation envelope

Fiber Patch Placement technology enables the automated lay-up of complex-shaped parts and is compatible with a broad variety of materials.



Automated
Tape Laying

Automated
Fiber Placement



Cevotec's
Automated Fiber Patch Placement

Hand layup and other
unoptimized processes

extending capabilities as technology develops

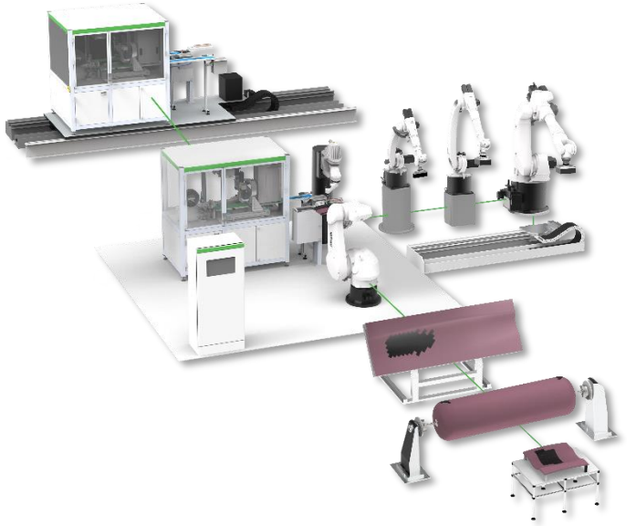
flat / simple-curved parts — *complex to very complex parts* — *highest-complexity parts*

The Cevotec portfolio

Specialized automation equipment, software and services based on Fiber Patch Placement.
We support from initial concept to series production and beyond.

SAMBA Series

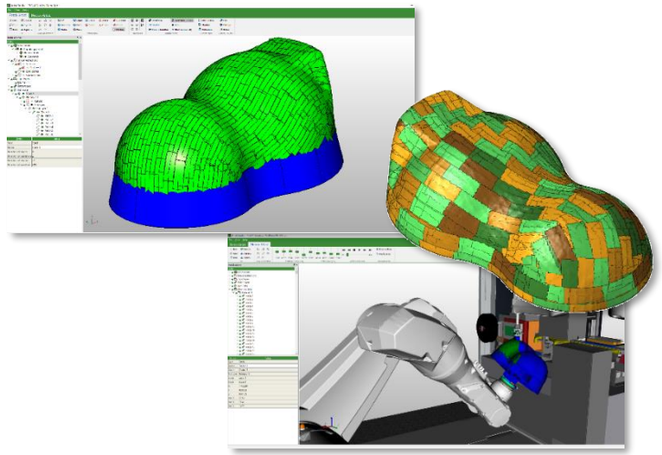
Automated lay-up systems



- Flexible 3D fiber lay-up platforms
- Configurations tailored to applications
- 20% - 60% cost & time reduction
- Maintenance & engineering services

ARTIST STUDIO

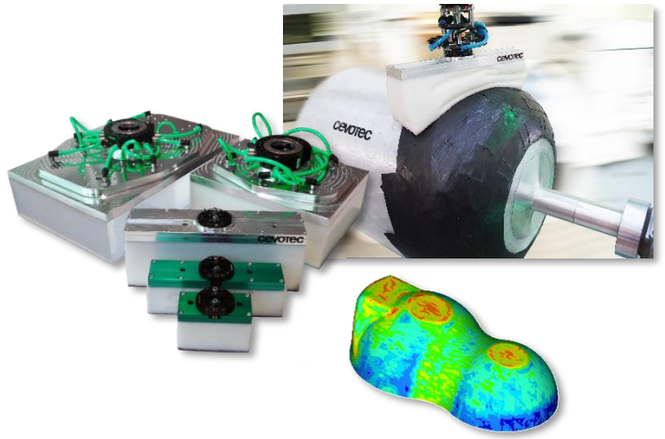
CAE software platform



- CAD-CAM for patch technology
- Automated programming of SAMBA systems
- Interface module for FE software
- Training and consulting for engineering teams

cevo**Lab**

FPP Competence Center



- Application & process development
- Customization of equipment
- Prototyping & low-volume production service
- CAE analysis & FEM-based optimization

SAMBA Series**: Lay-up automation systems based on Fiber Patch Placement**

Scalable and flexible technology for a variety of applications.

SAMBA Pro

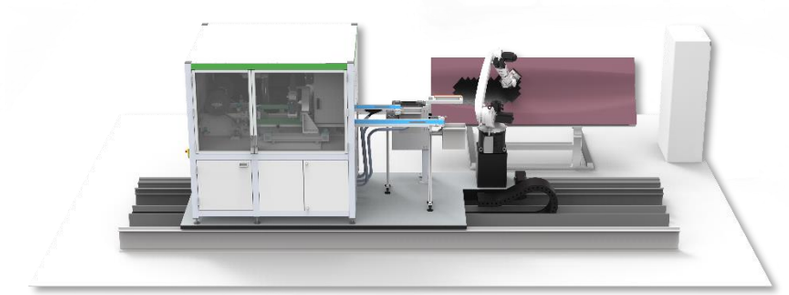
3 modules:

1. Automated material feeding & cutting
2. Placement units
3. Tool holders and manipulators

Watch our video about SAMBA!

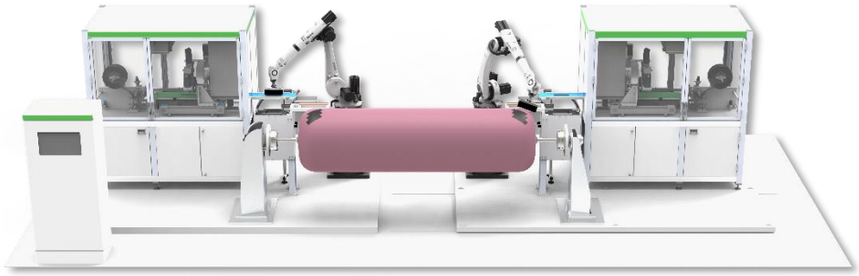
SAMBA Pro Multi

Sample configuration for
aerospace



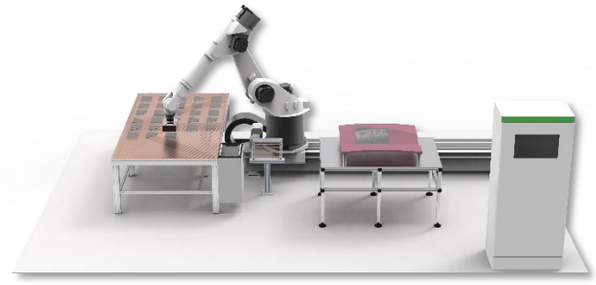
SAMBA Pro PV-1

Sample configuration for
composite tanks



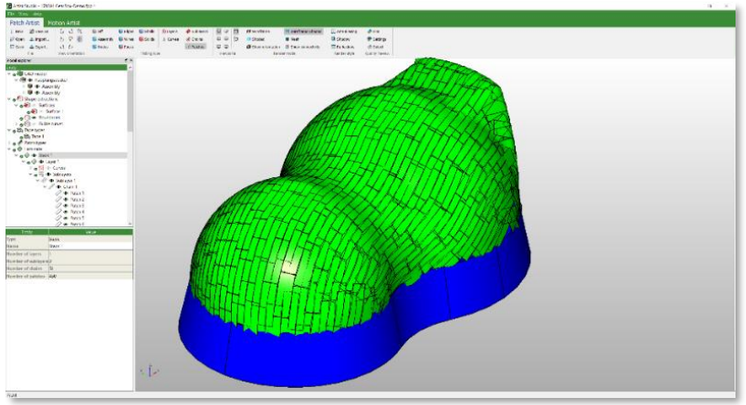
SAMBA Step L

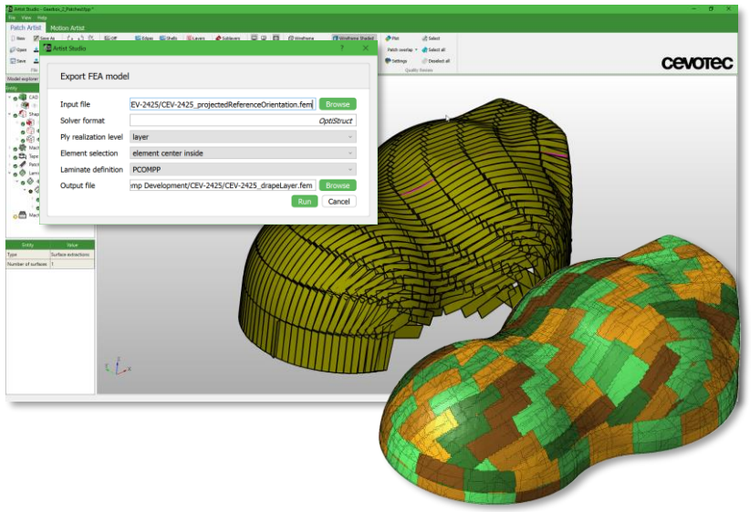
Sample configuration for
research & development

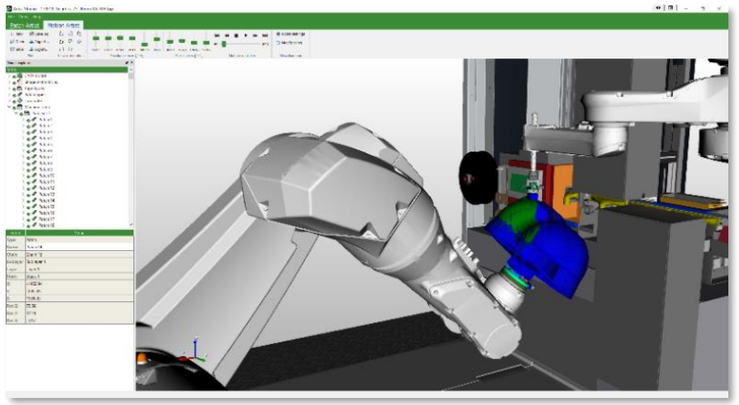


ARTIST STUDIO: CAE software platform

Advanced CAD-CAM software with interface module for FEA software to enable comprehensive digital product and process development.







CAD – Patch Artist

- Generating optimized patch laminates
- Automated patch creation on guide curves
- Unique & efficient FPP-specific design features

FE-Module

- Connecting FPP laminates with FE meshes for structural analysis
- Automated modeling of patches, fiber orientation, thickness, patch overlaps

CAM – Motion Artist

- Generating SAMBA machine data through fully automated offline robot programming
- Robot movements with consideration of axis limits, robot range, singularities, collision detection

Watch our video about ARTIST STUDO!

cevo**Lab: The Fiber Patch Placement Competence Center**

Cevotec's high-tech lab optimally supports application and process developments, prototyping and small series production.

Range of services

· Virtual design and studies, e.g. FPP laminate design, FE-based simulation, unit cost analysis

· Prototyping with FPP: material testing, proof of concept, full-scale demonstrators, etc.

· FPP-as-a-service: production of small batches of series products

· Process development and customization of equipment

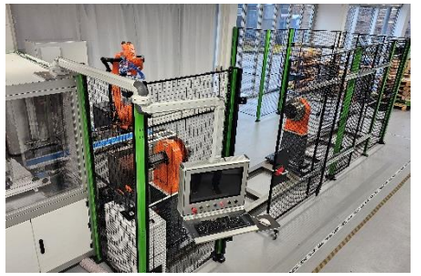
Available equipment

· **SAMBA Pro PV** lab system
  · Kuka KR 22 placement; Kuka KP1-HCS500 rotary tool manipulator
  · Ultrasonic cutting; tape width 20–75 mm; axisymmetric parts, length: <= 350 cm, diameter: <= 100 cm

· **SAMBA Pro** system (Gen 1)
  · Stäubli TP80 scara placement robot and TX 200 6-axis tool manipulator
  · Laser cutting; tape width 12.5 – 50 mm; part size envelope: ~ 1m³, max. tool weight: ~ 100 kg

· **SAMBA Step L** system
  · Large Kuka KR 60-3 placement robot mounted on KUKA linear rail; flexible space for customer tool
  · Material feeding table for patches up to ~200 x 300 m²; part size envelope (LxWxH): ~ 2 x 3 x 2 m³

· **Software** stack:
  · CAD: Autodesk Inventor, ARTIST STUDIO | FEM: Altair Hyperworks | CAM: ARTIST STUDIO



Samba Pro
PV lab

Samba Pro
lab (Gen 1)

Samba
Step L

Watch SAMBA in Rolling Motion!

Partners & references

Premier OEM, manufacturers and institutes worldwide develop innovative automation solutions with us.

Partners & references (selection)

GFM · AIRBUS · LEONARDO

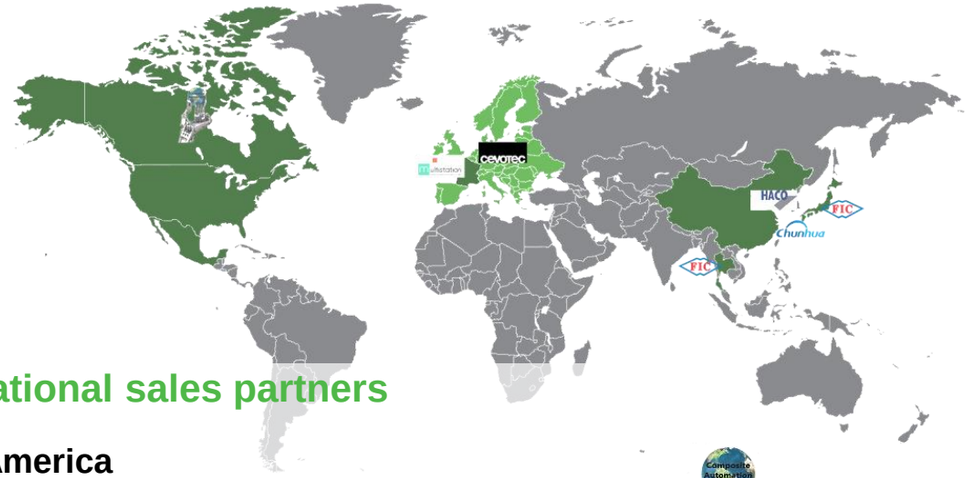
NIAR Wichita State University – National Institute for Aviation Research · Fraunhofer IGCV · THA Technische Hochschule Augsburg

Premium AEROTEC · The Boeing Company · Mercedes Benz AG · TUM · LCC Lehrstuhl für Carbon Composites

manroland web production · CIKONI composites innovation · baumann AUTOMATION

bavAIRia Europe's heart of aerospace and navigation · FPC FIBER PLACEMENT CENTER · HYDROGEN ALLIANCE BAVARIA

COMPOSITES UNITED · M·A·I CARBON · AZL AACHEN EXCELLENCE IN LIGHTWEIGHT PRODUCTION PARTNERSHIP



International sales partners

North America
Composite Automation LLC
http://www.compositeautomation.com
john@compositeautomation.com

Japan & Thailand
Fuji Industries Co. Ltd.
http://www.ficjp.com/en/
n.ueno@ficjpn.co.jp

China
Hesse, André & Co. GmbH & Co. KG
info@hesse-andre.com
ChunHua Automotive Technology Co., Ltd.
DavidLi@chunhuarp.com

France, Tunisia, Algeria, Morocco
Multistation SAS
multistation@multistation.com

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How to get started with Fiber Patch Placement?

Step 1: ROI & suitability assessment

Includes manufacturability assessment, unit cost & time analysis, benefits & ROI estimation. This service is free of charge.

→ **How much does your application benefit from FPP?**

Step 2: Joint application development

Includes virtual studies, application and demonstrator development, equipment customization, and more.

→ **How do you best develop & test your FPP application?**

Step 3: Customized lay-up equipment

Includes SAMBA lay-up systems, ARTIST STUDIO software, customized patch grippers, quality control systems, and more.

→ **Which system configuration is best for your application?**

Get started with

Fiber Patch Placement

☎ **+49 89 2314 1650** ✉ **advantages@cevotec.com** **www.cevotec.com**

We enable manufacturers to produce complex composites in high volume and superior quality.

For a lighter, more sustainable future.