



CARACOL

At the Forefront of Additive Manufacturing,
Enabling Your Next Move

DOMMINO Webinar

November 2021

Caracol Offers

**EXTREME ADDITIVE MANUFACTURING
SOLUTIONS, WITH NO SCALE LIMITS,
FOR ADVANCED INDUSTRIAL APPLICATIONS.**

Our Value Proposition

TECHNOLOGY

Working with a wide range of advanced tech solutions: from state-of-the-art industrial printers to our robotic AM system, to manufacture parts with no limits in size.

ENGINEERING

We use the most advanced design for additive manufacturing techniques – working with generative and parametric design, and topological optimization of parts to improve geometries.

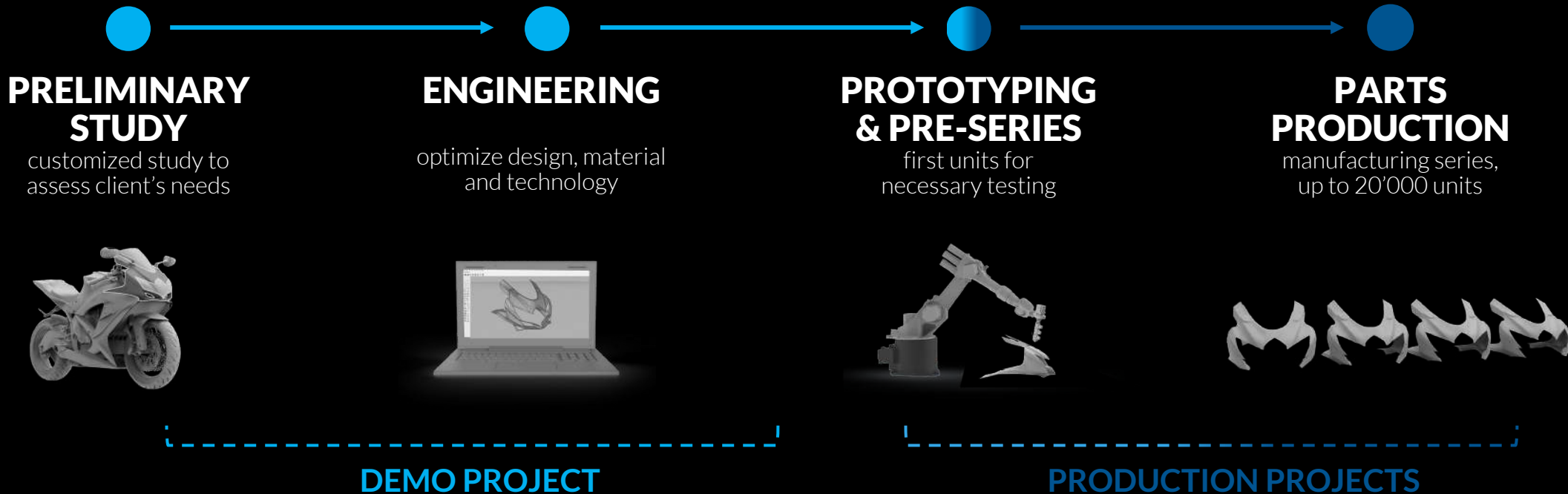
INTEGRATED PROCESS

Integrating all core competences across the value chain, starting from know-how on materials and a network of partnerships with suppliers, as well as on hardware, software and on our client's industries.

SOLUTION-ORIENTED

We accompany clients starting with identifying their needs and opportunities, and we customize our solutions to provide the most out of their adoption of additive manufacturing, addressing the most demanding requirement of the most advanced industries.

We accompany clients throughout the production process



An integrated process Engineering parts for AM from Design to Production

DESIGN TOOLS

From **parametric design tools** of parts to iteratively find the ideal solution based on performance and geometric requirements, to **computational design** inputting variables to define and manipulate complex geometries.

ANALYSIS TOOLS

We also perform **topological optimization** and **FEM analysis** while designing and optimizing parts, for example to anticipate part's mechanical or thermal behavior and more.

F AUTODESK®
FUSION 360

DS SOLIDWORKS

nTopology



DS
CATIA

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We work with a variety of Technological solutions

PRINTERS

We work with a variety of state-of-the-art industrial 3D printers.

30 + printers (FDM & SLA)

Up to **70x100 cm**

3D Filaments or Resins



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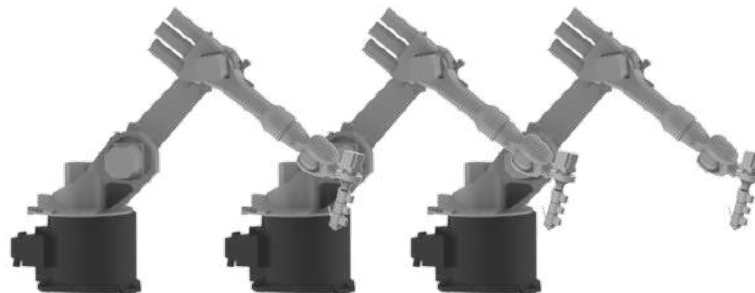
ROBOTIC AM

We developed an AM robotic system to manufacture large-scale, advanced parts, with a wide range of composite materials.

4 operating robots

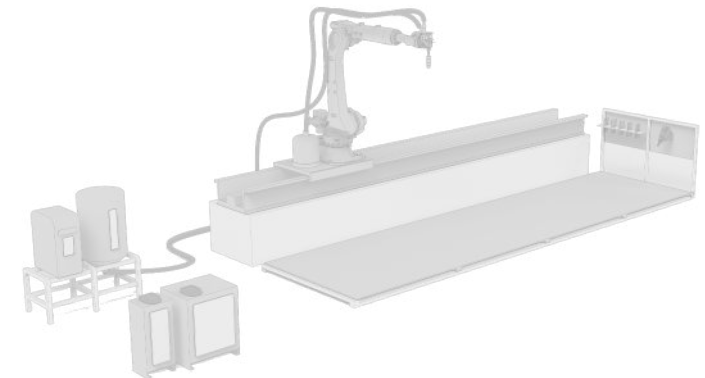
Up to **360 cm**

Raw material Pellets / Shreds + Fibers



SOON

Fully automated customizable robotic cluster to manufacture large scale, extremely accurate, performing, ready-to-use parts.





Our Additive Manufacturing Robotic System

- **BETTER MECHANICAL RESISTANCE & PERFORMANCE**

Caracol's robotic system prints very large parts with better material adherence, precision, compactness and resistance.

- **COMPLEX PARTS**

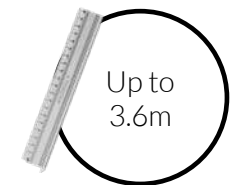
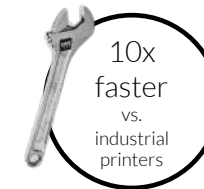
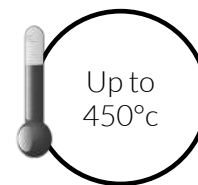
Caracol's software algorithms and use of a 6-axis robotic arm allow to manufacture a higher number of applications and more complex geometries.

- **LOWER OPERATING COSTS & FLEXIBILITY**

A highly flexible that adapts to productive needs, it works efficiently with low operating costs without compromising on quality and performance.

- **LOWER RAW MATERIAL COSTS**

Works with a wide range of composites: from advanced techno polymers blended with fibers (e.g., carbon, glass) to recycled material shreds.



We process a wide variety of polymeric materials

FILAMENTS & RESINS

We work with best-in-class 3d filament and resin providers who manufacture advanced and high-quality techno polymers, often also reinforced with fibers.

We also work with biodegradable and recycled filaments.

PELLETS & SHREDS

Our robotic system works with raw material in the form of pellets or shreds.

This allows us to work with a much broader variety of materials compared to the ones available traditionally in 3d printing and for much lower costs.

Polymers are blended with carbon, glass, and natural fibers, up to 40%.

RECYCLED MATERIALS

Collecting production waste from clients we can process the material, transforming into a reusable blend that we can work with on our robotic systems to manufacture new projects that enable companies to achieve circular economy.

The main Industries we serve

**AUTOMOTIVE
& MOTORSPORT**



**AEROSPACE
& DEFENSE**



ENERGY



**MEDICAL
DEVICES**



MARINE



**INDUSTRIAL
MACHINERY**



**DESIGN
& ART**

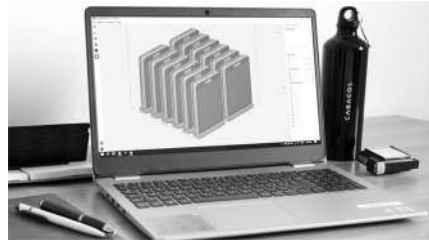


What We Offer



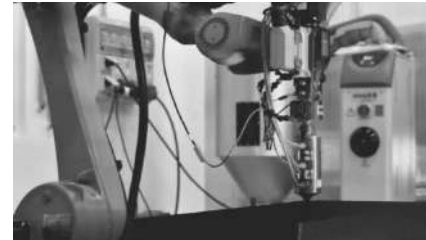
Design & Concept Development

Using the most advanced AM software and design techniques we can bring to life products and components



Engineering

We optimize design for production in AM and we can test components' mechanical and thermal performance



Prototypes & Pre-Series with no size limit

Using both a variety of industrial 3D printers and an advanced robotic system for meter large prints



Line Production of Finished Parts

Our flexible manufacturing set up can be organized to print multiple series of pieces



Materials characterization and waste recycling

We develop 3D printing materials in filament or pellet form, starting from production waste materials or according to specific needs



Support Internalizing Additive Manufacturing solutions

We assist in understanding needs, identifying and providing the best tech, we install it and provide after service assistance



Additive Manufacturing Training and Workshops

We train company employees on 3D printing tech: project planning, tech use, identifying and knowing materials

LARGE SCALE AEROSPACE TOOLING

Traditional Aerospace Tooling Manufacturing

Traditionally produced in several parts milled from solid metal, then assembled into one.

Issues:

- Numerous parts requiring manual work for assembly of final tool
- Long lead times 2-4 months for one tool
- Heavy weight of part impacts ability to move tool around causing logistics difficulty
- Significant material waste
- Significant costs



Our Solution

- Part: Large scale jig for suction and positioning of aircraft belly fairing panels
- Composite Material: Techno polymer (e.g., PA, PP, PPS) reinforced with fiber (e.g., carbon, glass)
- Process: Robotic Additive Manufacturing of part in one piece and CNC post-production of tool-face
- Size: 84,8 cm (w) x 125 cm (l) x 32,7 cm (h)

Combining Processes for Sustainable Manufacturing

- Digitalized workflow combining Additively Manufactured part with CNC milling for surface finishing.
- Achieved Requirements:
 - Dimensional Tolerances: 0.1mm
 - Surface Roughness: 1.6 μm
- With direct printing of composite material in pellets we use only the needed material, milling of tool face layer generates limited waste which can be reused in future productions

Key Results

Parts Integration

From 30 + parts to 1 single piece

Design to Production Lead Time

From 2 months to 2 weeks

Weight Reduction

600%

Part Production Cost Savings

30-50%

Other Indirect Costs

Drastic reduction of material used; logistics & storage costs reduction due to decreased weight

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