APRIOS®
CUSTOM MFG

OPTIMIZING DESIGNS WITH DESIGN FOR ADDITIVE MANUFACTURING (DFAM)

Design for Additive Manufacturing (DFAM) is a transformative approach that optimizes product design specifically for additive manufacturing processes. By leveraging the unique capabilities of 3D printing, DfAM allows for more complex geometries, reduced material waste, and shorter production timelines. This approach not only enhances the design flexibility but also drives cost efficiency and improves overall product performance. In this guide, we explore the key principles of DFAM, its benefits across industries, and how adopting this mindset can streamline your product development from concept to final production. With the right strategies in place, DFAM can revolutionize your manufacturing processes and elevate the quality of your parts.

Design and Manufacture the Impossible

HAMPERED BY LIMITATIONS

Many new product designs and innovations have been restricted by the limitations of plastic injection molding and other conventional manufacturing processes. After the design is completed, the part typically requires modifications in addition to prototyping and tooling, which are costly and cause delays.

Available for decades, traditional 3D printing allows engineers to design more complex geometries.

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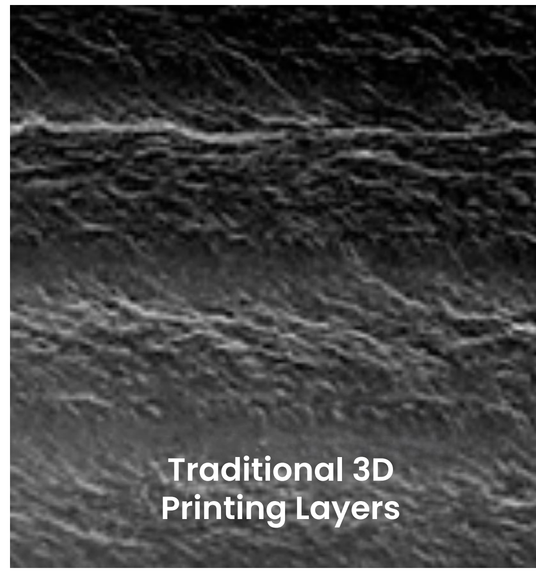
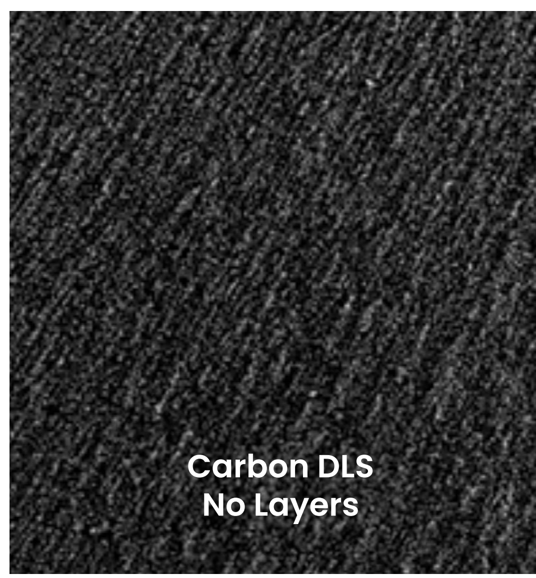
However, high-volume end-use part production has not been practical due to:

- Slow printing speeds
- Limited material selection

Additionally, most 3D-printed parts are built in layers that must adhere to one another during the printing process. Under specific thermal stress or part orientation, the layers of some geometries may separate, causing the part to fail.





MANUFACTURABLE DESIGN FREEDOM

Up to 100 times faster than traditional 3D printing, Carbon® Digital Light Synthesis™ (DLS™) additive manufacturing transforms product design and production. This technology allows manufacturers and engineers to explore what has been impossible to produce through conventional manufacturing, including:

- Articulating structures
- Complex geometries
- Part consolidation
- Variable wall thickness
- Sharp corners
- Complex lattices
- Surface textures
- And more

Unlike other traditional 3D-printing technologies, Carbon DLS is not just for prototyping. It delivers **small to large-volume production of end-use parts using a wide range of materials with diverse mechanical properties.** Thanks to the design flexibility of Carbon, engineers are also able to boost quality, strength, stiffness, heat dissipation and performance.

For faster design iterations, concurrent designs can be placed on the same build platform to test the pros and cons of each. Because Carbon DLS technology doesn't require

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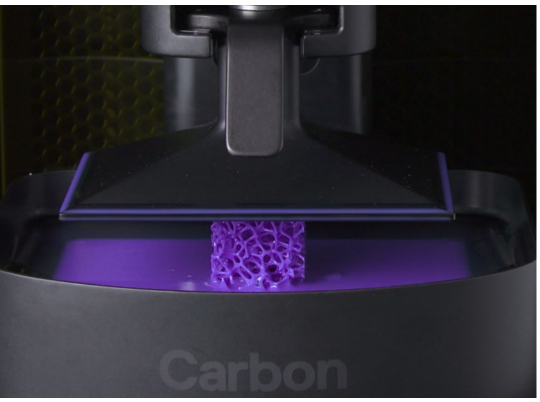
expensive tooling, engineers and manufacturers have more design freedom and production control than ever before at an economical price.



UNLEASH YOUR BRILLIANCE

Innovation may be a fresh idea or simply a better solution to meet the same requirements. Regardless of the task at hand, ingenuity is a key to success. Carbon's ability to produce previously unmakeable parts is ideally suited for **generative design and topology optimization tools.**

GENERATIVE DESIGN tools help engineers go beyond traditional design limits by:

- Inputting goals and constraints (e.g., performance, material, manufacturing characteristics)
- Automatically generating multiple optimized, CAD-ready solutions using Carbon DLS technology

TOPOLOGY OPTIMIZATION involves digital analysis to:

- Remove or optimize material usage while maintaining part functionality
- Identify the part features that support or resist a load
- Deliver CAD geometry that is typically organic but optimized for its intended purpose

LOSE WEIGHT – STAY STRONG

Growing demand for lighter products drives the need for optimized geometries, lattices, and materials to maintain strength and durability while reducing weight.

DYNAMIC LATTICE DESIGN enhances performance by:

- Reducing part weight, which cuts material costs and shortens production time.
- Achieving structural and non-structural lattice elements using Carbon DLS.

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NON-STRUCTURAL LATTICE

- Uniform design that removes unnecessary material.

STRUCTURAL LATTICE

- Non-uniform struts and varying thicknesses to reduce weight while supporting defined service loads.

Based on application requirements, lattices can be printed using Carbon DLS with multiple functional zones that have varying mechanical properties in the same part. Specialized software tools and Carbon's lattice library allows engineers to optimize the ideal lattice parameters, such as unit cell type, shape and structure.

MANY BECOME ONE

Complex parts that have many separate components can be expensive and difficult to manage. A potential failure point, each component must be designed, tested, validated, sourced, assembled and monitored. Carbon DLS technology allows multiple components to be consolidated into a single design that serves the same function, saving time and cost.

TACTILE EXPERIENCE

Scientists have shown that people can detect nano-scale wrinkles when running their fingers over a seemingly smooth surface. This emphasizes the importance of using texture on products.

When injection molding a part, incorporating texture typically requires costly and complex etching treatments to a mold cavity or post-processing. Applying texture on curved injection molding surfaces is exceptionally challenging. Carbon's texturing process:

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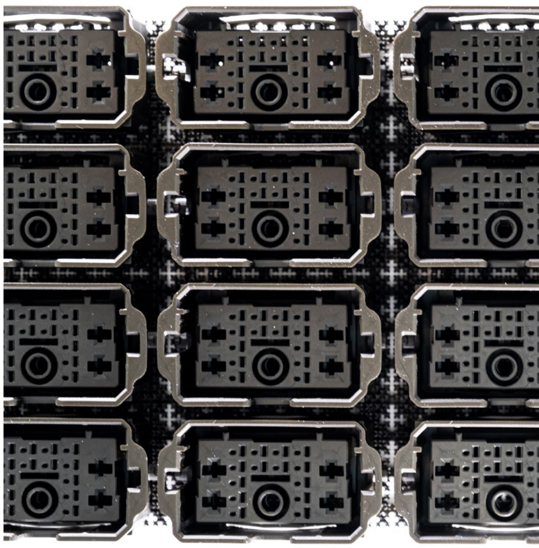
- Enables the freedom to print textures directly onto final production parts.
- Offers tunable and controllable texturing on any surface.

This reduces labor costs, post-processing and time to market while improving the aesthetics and tactile nature of a part.



HIGH CUSTOMIZATION

Carbon DLS technology does not require molds or other traditional manufacturing, which allows for the customization of each part. In addition to adding serialized numbers, each part manufactured using Carbon technology can be built to user-specific parameters.

MANUFACTURING AS A SERVICE (MaaS)

We've all heard of SaaS (software as a service). Rather than purchasing an expensive printer, Carbon's business model includes production network partners, such as Aprios Custom Manufacturing in Minnesota, to provide the Carbon Digital Manufacturing Platform as a service. Aprios' Acceleration Station® offers Carbon DLS manufacturing along with design for additive manufacturing (DFAM) assistance, validation services, cleanroom assembly and more.

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To schedule a call, please scan the QR code below.

https://www.aprios.com/meetings/nerickson1/dfm-consultation?uuid=3a754d1b-fd97-4ae7-8442-e8aef-558d8a4