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Drone Body CASE-STUDY

- 21 unique, ready-to-print designs
- Generated in 3 minutes
- 73% mass reduction
- Passes 250 lbf compression test

Introduction

With increasing demands for longer flight times and greater payload efficiency, optimizing drone structures is becoming more crucial for aerospace and defense industries. Lightweight frames that maintain structural integrity can significantly improve flight performance and energy efficiency.

This case study explores how Vixiv AI helped to rapidly design and optimize a 3D-printed drone body, achieving significant mass reduction while maintaining strength and stiffness in minutes.

Industry Standard Parameters

Component: Drone Body
Original Material: Carbon Fiber Reinforced Polymer (CFRP), Aluminum Alloys
Manufacturing method: Composite Layup, 3d printing
Original design features: Drone body that balances weight, payload, and range

Design Challenges

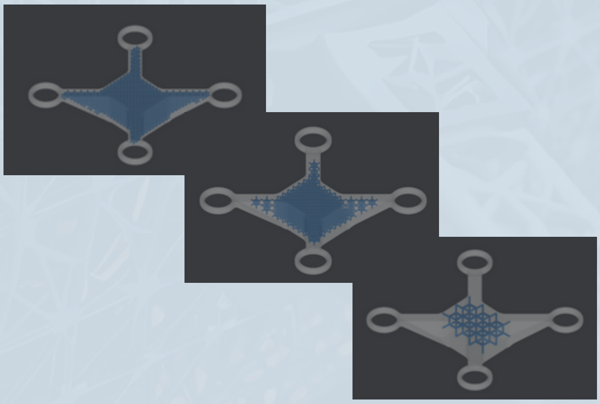
- Designs may prioritize lightweight construction for endurance and agility, or emphasize heavy payload capacity that demands high structural strength.
- Heavy frames lead to high energy consumption
- Inefficient material distributions lead to overbuilt, underperforming structures.
- Using solid infill in structures increases material usage and print time, resulting in extended development cycles.

Input parameters into Vixiv AI

- Domain: Static
- Load: 250 lbf (1112.06 N)
- Shell thickness: 0.036in (1mm)
- Printer: HP MJF 5200
- Material: HP HR PA12
- Zero thickness direction: None

Outputs

Designs Generated: **21**
Time to Generate: **3 minutes**
Mass Reduction Range: **13.21 - 73.43%**
Stiffness Range: **1,068,966 - 1,690,898 lbf/in**
Lattice types: FCC, BCC, and Fluorite



Test Results:

Original drone body
- Weight: 172.718 g
- Passed 250lbf compression test

Vixiv AI optimized latticed drone body
- Weight: 45.882 g
- Passed 250lbf compression test
- **73.43% mass reduction**

Conclusion

Vixiv AI enabled a drastic reduction in design time, producing 21 unique geometry configurations in 3 minutes. The Fluorite lattice achieved the highest stiffness and mass savings, making it ideal for high-payload drone variants.

The results show that AI-optimized lattice structures can outperform traditional solid parts while reducing material usage and production cost. Additionally, designs are immediately ready for 3D printing with no additional support or tooling required.

Vixiv AI helps users with minimal 3D printing experience create optimized, additive-ready designs that print faster and cost less while maintaining performance. By integrating Vixiv AI into the drone development workflow, design teams can respond faster to changing requirements, create better-performing drones, and reduce both time-to-market and material costs, all without compromising structural performance.

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Angle Bracket CASE-STUDY

- 6 unique, ready-to-print designs
- Generated in 99 seconds
- 77% mass reduction
- Passes 200lbf compression test

Introduction

Triangle (angle) brackets are used to join, support, or reinforce two perpendicular surfaces, making them useful in a wide range of industries, including automotive, construction, industrial equipment, and medical devices.

This case study explores how Vixiv AI was used to optimize an angle bracket for additive manufacturing, achieving significant weight reduction, stiffness improvement, and cost-efficiency without compromising structural integrity.

Industry Standard Parameters

Component: Triangle bracket
Original Material: Polymer ABS
Manufacturing method: Injection molding
Original design features:

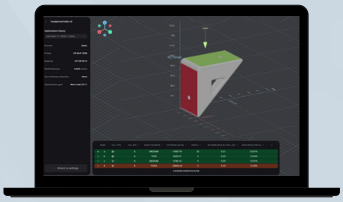
- Two mounting holes on each leg for connections
- 90-degree geometry
- Designed for load-bearing support, connecting two surfaces

Design Challenges

Although angle brackets are mechanically simple, they often face static and dynamic loads, requiring durability and rigidity. However, traditional manufacturing methods (like injection molding or forming) often lead to greatly overbuilt parts, resulting in excess material use and weight. The goal was to reduce mass while maintaining mechanical stiffness.

Input parameters into Vixiv AI

- Domain: Static
- Load: 200 lbf (889.64 N)
- Shell thickness: 0.036in (1mm)
- Printer: HP MJF 5200
- Material: HP HR PA12
- Zero thickness direction: None



Outputs

Designs Generated: **6**
Time to Generate: **99 seconds**
Mass Reduction Range: **15.26 - 77.24%**
Stiffness Range: **151,579 - 162,012 lbf/in**
Lattice types: FCC, BCC, and Fluorite

Test Results:

<u>Original angle bracket</u>

- Weight: 244.875 g
- Passed 200lbf compression test

<u>Vixiv AI optimized latticed angle bracket</u>

- Weight: 55.725 g
- Passed 200lbf compression test
- **77.24% mass reduction**

Conclusion

Vixiv AI optimized a standard angle bracket in under a minute, resulting in:

- Up to 77.24% weight reduction
- Designs ready for 3D printing with no additional machining
- Flexibility to rapidly adjust geometry for different load cases or applications
- Maintaining mechanical stiffness to hold the desired load
- Both brackets were able to withstand the desired load of 200 lbf without issue

With Vixiv AI, an angle bracket was optimized in under two minutes, cutting weight by up to 77% while maintaining stiffness and load capacity. The results prove that everyday parts are often overbuilt with traditional methods, and can be made lighter, stronger, and ready for additive manufacturing.

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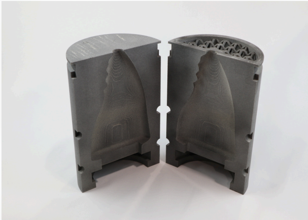
Blow Mold CASE-STUDY



- 18 unique, ready-to-print designs
- Generated in 122 seconds
- 52% mass reduction
- Passes 4000lbf compression test

Introduction

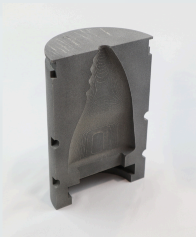
Blow molding is a widely used manufacturing process for creating hollow plastic parts, particularly in automotive, consumer goods, and industrial applications. However, typical metal blow molds with solid infills are slow to manufacture and expensive to change, resulting in tools that are overbuilt relative to their functional requirements and very inefficient to manufacture.

This case study explores how Vixiv AI can optimize the design of blow molds to significantly reduce weight while maintaining structural performance, highlighting both mechanical and potential thermal benefits. This allows for rapid creation of polymer blow mold prototypes with small design changes, allowing teams to refine designs before committing to full-scale metal production.

Industry Standard Parameters

Component: Triangle bracket
Original Material: 7050 Aluminum Alloy
Manufacturing method: Casting & CNC
Original design features:

- Central component shape machined into the mold cavity
- Mass is retained in the part as it is expensive and difficult to remove



Design Challenges

Traditional blow mold production is slow, with design changes to metal molds often taking months and multiple iterations extending development to several years. In contrast, additive manufacturing enables molds to be built in days, allowing many design variants to be tested before final machining and providing temporary supply while permanent molds are in production.

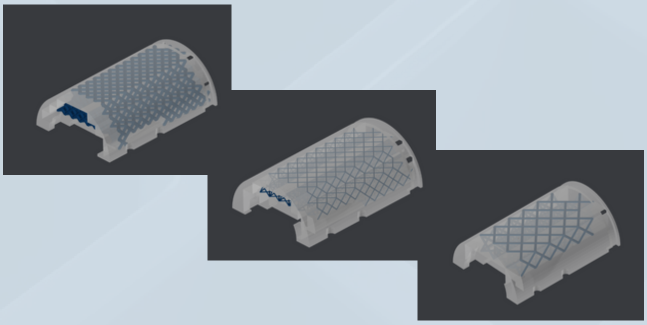
Most blow molds are also heavy and overbuilt, since they must withstand clamping forces and repeated heating and cooling, yet much of their material does not contribute to performance. By reducing weight without sacrificing strength, molds can be made more efficient to produce and easier to handle.

Input parameters into Vixiv AI

- Domain: Static
- Load: 4000 lbf (22,241.10 N)
- Shell thickness: 0.036in (1mm)
- Printer: HP Multi Jet Fusion 5200
- Material: HP HR PA12
- Zero thickness direction: X Axis

Outputs

Designs Generated: **18**
Time to Generate: **122 seconds**
Mass Reduction Range: **14.05 - 51.85%**
Stiffness Range: **706,667 - 1,742,146 lbf/in**
Lattice types: FCC, BCC, and Fluorite



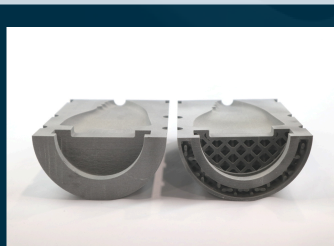
Test Results:

Original blow mold

- Weight: 846 g
- Passed 4000lbf compression test

Vixiv AI optimized latticed blow mold

- Weight: 407.4 g
- Passed 4000lbf compression test
- **51.85% mass reduction**



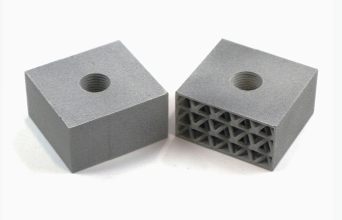
Conclusion

Latticed infills in blow molds have shown great potential to distribute temperature better than standard solid infills using metal additive manufacturing.

The Vixiv AI optimized latticed blow mold held the desired load of 5000 lbf. This shows that blow molds with solid infills are overbuilt. We can reduce the weight of a blow mold by over 50% while still maintaining the desired mechanical stiffness.

Vixiv AI cut the weight of a blow mold by over 50% while still meeting load requirements, proving that traditional molds and prototype molds are often overbuilt. Latticed designs reduce handling and production costs while also show potential for future thermal performance gains. With Vixiv AI, manufacturers can achieve lighter, stronger, and more efficient tooling in minutes instead of months.

Floor Plinth CASE-STUDY



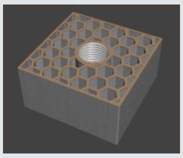
- 5 unique, ready-to-print designs
- Generated in 147 seconds
- 35% mass reduction
- Passes 1600 lbf compression test

Introduction

This case study explores the use of Vixiv AI to optimize a 3D-printed aerospace floor plinth, a load-bearing structural component typically used for mounting within aerospace assemblies. The goal was to reduce mass, improve stiffness, and give solid attachment points for other equipment.

Industry Standard Parameters

Component: Aerospace floor plinth
Original Material: Aluminum Honeycomb
Original design features:



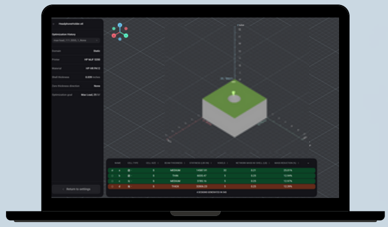
- Typically constructed using epoxy-fiberglass or carbon fiber face sheets encasing an aluminum honeycomb infill to maximize the stiffness-to-weight ratio

Design Challenges

- Mechanical properties of these traditional panels are difficult to verify.
- Physical impact testing is still required for certification because the internal structure cannot be fully modeled or verified through simulation.
- When attachment points (such as tie-downs or brackets) are required, holes must be punched or drilled through the honeycomb, compromising structural integrity and stability.
- There is a need for material efficiency and elimination of secondary processing while maintaining high stiffness under dynamic and static loads.

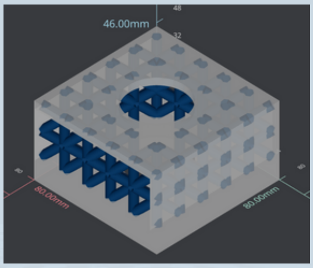
Input parameters into Vixiv AI

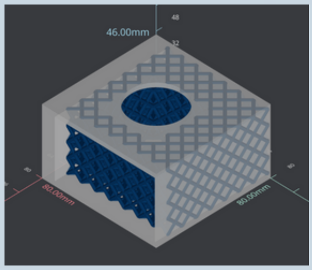
- Domain: Static
- Load: 1600 lbf (7117.15 N)
- Shell thickness: 0.046 in (1.18 mm)
- Printer: HP MJF 5200
- Material: HP HR PA12
- Zero thickness direction: None



Outputs

Designs Generated: **5**
Time to Generate: **147 seconds**
Mass Reduction Range: **0 - 35.05%**
Stiffness Range: **554,695 - 664,725 lbf/in**
Lattice types: FCC, BCC, and Fluorite

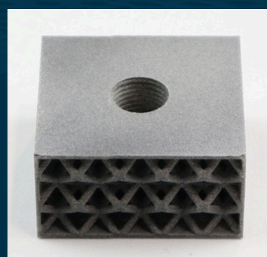




Test Results:

Original floor plinth
- Weight: 25.72 g
- Passed 1600lbf compression test

Vixiv AI optimized latticed floor plinth
- Weight: 16.705 g
- Passed 1600lbf compression test
- **35.05% mass reduction**



Conclusion

In our demonstration, we designed a mechanically verifiable lattice structure that achieves comparable or superior weight reduction and stiffness characteristics. Because the lattice is additively manufactured, tie-downs and interface features can be built directly into the structure, rather than punching through it. Our approach ensures mechanical stability while reducing reliance on trial-and-error testing for static and dynamic loads.

Vixiv AI optimized the floor plinth by cutting weight by over 35% while maintaining stiffness and strength. Unlike traditional honeycomb panels, the latticed design integrates attachment points directly into the part, eliminating secondary processing and increasing structural instability.