JABIL | MADE **POSSIBLE.** MADE **BETTER.**

KAV
MADE FOR YOU

COMPANY

KAV

INDUSTRY

Sports and Recreation

COUNTRY

USA

EMPLOYEES

25

WEBSITE

kavsports.com

CHALLENGES

- **Meeting Requirements:** Off-the-shelf 3D printing materials did not meet KAV's requirements for printing a customized bike helmet. They needed a material that could withstand extreme environmental conditions and high velocity impacts.
- **Materials Expertise:** KAV needed to find a partner with extensive materials science knowledge that could also provide testing and scaling support.
- **Appealing Aesthetics:** KAV needed to create a helmet that was not only protective but also looked good. They wanted an additive material that, when printed, did not show visible layering on the final product.

SOLUTIONS

- **Custom Material Development:** KAV entrusted Jabil's expertise to create a custom material that was stiff and strong but also had superior resistance to high temperatures, low temperatures and impacts.
- **Focus on Quality:** Jabil developed a repeatable, measurable manufacturing process that provided KAV with a consistent and reliable solution to product challenges.
- **Production Speed:** Jabil's ability to develop materials, conduct system integrations, and qualify and test products under one roof made it the perfect partner for KAV. Through this partnership, Jabil created a completely new and customized material that met KAV's requirements in just nine months, with the delivery of an ISO 9001 certification in an additional six months.

BENEFITS

- **Mass Customization at Scale:** Jabil provided KAV with access to a material that met their requirements and is qualified for KAV's intended use. No matter a customer's head shape, they will have a comfortable, fashionable and protective helmet.
- **Material Iteration:** Access to Jabil's team of material scientists and material development technology has helped KAV create the next generation of additive materials.
- **Business Expansion:** Jabil's extensive global capacity and efficient supply chain capability will help KAV expand its business and continue making a positive impact.

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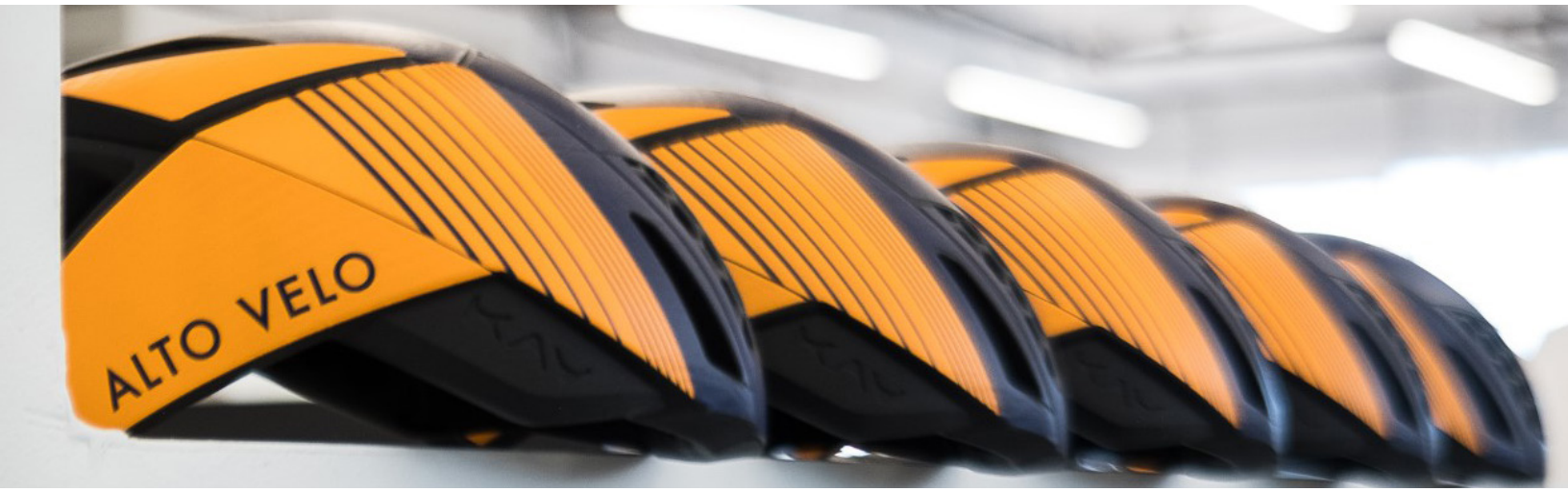


> **We partnered with Jabil because, frankly, no one else could do it. We had evaluated many other vendors and it's Jabil's combination of technical skill sets and willingness and ability to innovate that won us over.**

WHITMAN KWOK
CEO & Founder, KAV

Custom Engineered Materials Enable Mass Customization

Developing an additive manufacturing material with the mission to save lives

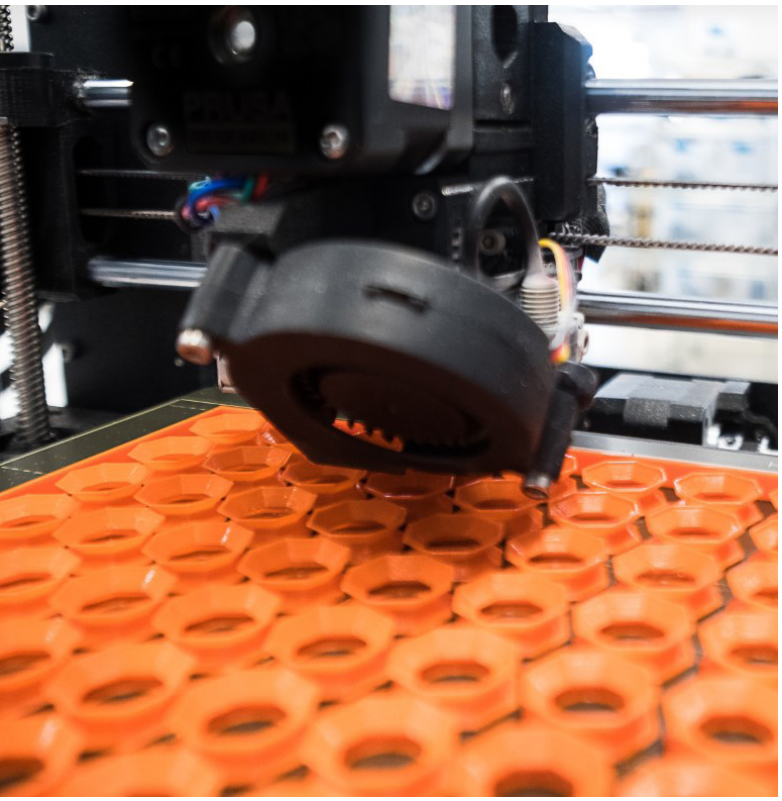
Consumer needs have shifted over the years. The demand for greater control over product design and features has increased competition and put pressure on original equipment manufacturers (OEM) to deliver mass customization. Mass customization allows for the creation of one-of-a-kind products without the need for expensive tooling or molds. In the case of helmets, it makes a better performing product: more protective, more comfortable and a slim aerodynamic profile as a byproduct of the perfect fit.

KAV, a custom helmet company, has developed an innovative way to address the demand for customization at scale. Utilizing additive manufacturing to create custom bike helmets makes KAV's production process more efficient, reducing costs and time to market. Additive manufacturing also allows for greater freedom in design, enabling engineers and designers to explore new forms, shapes and functionalities that were not previously available.

KAV's use of additive manufacturing to create helmets tailored to exact head measurements was a game-changer. However, the team faced challenges in finding an off-the-shelf additive material that met the exacting standards of durability and aesthetics.

The Perfect Fit Requires the Perfect Material

Every bike helmet on the market is made from injection-molded expanded polystyrene (EPS) foam, which has serious limitations. Bike helmets created with EPS foam are manufactured in one to three sizes limiting the fit of the helmet. To address this they add retention devices that add complexity, weight and a potential failure point. EPS foam is a great insulator, but in the context of cycling, that means it traps heat, increasing perspiration and reducing comfort.



KAV's cutting-edge software enables mass customization. Their technology begins by analyzing specific anatomical points on the head and then creating a precise 3D model of each individual's head. This data is then seamlessly converted into a set of manufacturing instructions for their 3D printers, enabling KAV to create truly customized helmets tailored to any head type in just a matter of hours. The software platform is beaming with potential for other customization application as well.

Prior to working with Jabil, KAV evaluated more than 20 materials, which were all compromised in energy attenuation — the ability to absorb impacts — or lacked stability across environmental conditions.

KAV had several specifications for their custom material. First, it had to be at least as light as EPS and maintain stability in temperatures ranging from -15 degrees Celsius to over 60 degrees Celsius. Additionally, the new material had to demonstrate high impact and energy absorption across a matrix of impact tests spanning the spectrum of environmental conditions, impact speeds, impact locations and impacting objects. Layer adhesion, a characteristic missing from materials currently on the market, was also an extremely important factor to providing consistent performance regardless of the impacting vectors.

Finally, exceptional surface finish was paramount. In order to achieve their mission of safety, KAV helmets not only had to improve protection but look like a premium product. Consumers have expectations with regard to fit and finish and the material had to have a comparable finish with the best helmets on the market.

Not only is Jabil a great cultural fit for KAV because they understood KAV's mission and the consumers' need for a more protective helmet. Jabil provided multiple solutions in different form factors like powders, filaments and pellets, which made their innovative approach to material development unlike any other manufacturing solutions provider.

> **"The most important thing is how the helmet will behave under extreme stress. So, if you go over the handlebars and hit the ground, that helmet material needs to absorb energy."**

DAVE STOUTAMIRE
Chief Technology Officer, KAV

Think Outside the Filament: Designing the Unicorn of Additive Materials

Executed under one roof, Jabil's polymer science approach coupled with its material development process — which includes three crucial steps: formulation, compounding and system integration — combined to create the best material that fit KAV's requirements.

- Formulation is the process of creating a specific material composition, whether that's polymers, pigments or fillers. This process results in a material's strength, flexibility and color. A proper formulation ensures that the additive material will have the necessary properties to perform well in the intended application.
- Compounding is the mixing and blending of the formulated materials to create one complete mixture. This step is critical for achieving consistent and uniform properties throughout the additive material.
- System integration incorporates the formulated and compounded materials into the additive manufacturing process. It's at this stage that we see how well a material performs.

By creating a custom material, KAV eliminated the need for expensive and time-consuming modifications to off-the-shelf materials. Instead, they got a material they trust and that works for their intended use.

With Jabil's help, KAV is the only custom helmet business that not only meets but exceeds the rigorous safety standards set by the U.S. Consumer Product Safety Commission. Their exclusive custom material sets them apart and gives them an unrivaled competitive edge.

> **"Many people in additive manufacturing don't take our approach. They tend to take materials, throw them at the wall and see what sticks. And that's not a scientific or an engineered solution to customer problems."**

MATT TOROSIAN
Director of Product Management, Jabil

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Speedy Production: Getting KAV Helmets to Customers Faster

Existing suppliers in the marketplace could not operate at the pace KAV needed to penetrate the market. KAV is accustomed to feedback one day and fabricating a new helmet the next for testing and wanted a partner who enabled rather than constrained their iterative engineering process. Jabil's Quality Management System (QMS) is the backbone of our success and the success of our customers. A QMS guaranteed a consistent and high-quality final material iteration for KAV, with minimal defects and variations. It also ensures compliance with industry standards and regulatory requirements, giving them peace of mind that their product is ready to go to market.

KAV's top priorities were to create an additive material that could protect bikers' heads, print according to the customer's head measurements and look amazing. By building to production rather than building to inventory, Jabil was able to help KAV respond to the customization needs of its consumers.

"Our customers were mind blown that they could have something made for them at approximately the same price as other high-end helmets. They absolutely love it. They're blown away by the comfort," said Kwok.

KAV offers custom-made helmets in three different colors: grey, black, and white, giving customers flexible choices. The helmets are made-to-order through a simple custom-fitting process, using 3D printing technology, and are delivered within two-to-three weeks.

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Swift production through additive manufacturing not only expedites the delivery of goods to consumers but also boasts a host of additional advantages. Faster production can help reduce the amount of waste sent to landfills — a goal Jabil and KAV both seek to obtain — by producing goods that are more durable and have a longer lifespan, which means they will need to be replaced less often. KAV's five-year warranty reflects the confidence in the fundamental durability of the new material and manufacturing process.

Having a manufacturing partner that aligns with KAV's mission and has robust manufacturing processes can help to increase profitability to support future R&D, maintain a strong reputation and attract consumers who want something quantitively better, all of which are vital for long-term success.

"Jabil's material science expertise and innovation and their desire to push the boundaries of what's possible, in our case, to fulfill our mission of saving lives and reducing brain injuries, is vitally important to us when maintaining a strong partnership," Kwok said.

Having immediate access to each other has allowed for KAV and Jabil to be more innovative and collaborative. As a result of their partnership, Jabil produced a high-quality material that will aid in KAV's efforts to increase bike safety.

> **"It probably took us about nine months to develop the material for KAV, which I feel is pretty astounding considering how much innovation we needed to do and the fact that there was no other material on the market even remotely close to the performance that that we ended up developing."**

LEVI LOESCH
Process Engineer, Jabil

About Jabil

Jabil (NYSE: JBL) is a manufacturing solutions provider with over 250,000 employees across 100 locations in 30 countries. The world's leading brands rely on Jabil's unmatched breadth and depth of end-market experience, technical and design capabilities, manufacturing know-how, supply chain insights and global product management expertise. Driven by a common purpose, Jabil and its people are committed to making a positive impact on their local community and the environment. Visit www.jabil.com to learn more.

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