



# Perfect PPE Prototypes

Startup Launches  
Ergonomic  
Face Mask with  
PolyJet 3D Printing



“

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Matt Havekost

**Vice President of Additive Manufacturing  
Sales at AdvancedTek**

# Perfect PPE Prototypes

When Max Bock-Aronson was living in Singapore, he noticed problems with the air quality that made outdoor activities difficult and even painful. However, there weren't any face masks on the market that offered the protection, comfort, and design he was looking for. So he decided to build one himself.

This was the starting point for Breathe99, founded in 2018 by Bock-Aronson and his friends Coleman Rollins and Joél Valdez Jr. The concept was simple: a reusable, industrial-grade respirator, comfortable enough for an active lifestyle. The three co-founders ran a Kickstarter campaign in August 2019. Though they did not meet the funding goal of their initial campaign, they came away with valuable insights about how to further improve the design for daily use.

That's when the COVID-19 pandemic pushed personal protective equipment into the spotlight.

"We were taking feedback and iterating on the design, but it wasn't until COVID-19 came to American shores that demand for face masks spiked in the US," explained Bock-Aronson.

Suddenly, the company's mission to produce high-quality public health equipment was universally relevant.

The original respirator design – the B1 – was a good starting point, but needed several improvements to make it suitable for mitigating the spread of infectious disease. The new design incorporates elements of industrial respirators, such as two filtering elements and an ergonomic seal to ensure the only air flowing in and out goes through the filters. However, the B2 mask uses unique flat filters that help keep the design lightweight and wearable. The filters are also the only part of the mask that need to be replaced, which helps reduce ongoing costs and waste compared to alternative PPE options.



Breathe99 B2 respirator with replaceable filters.



Multimaterial B2 respirator prototype 3D printed with Agilus30.

## Perfect PPE Prototypes

As Breathe99 began contacting investors in early 2020, the team knew they needed better, more accurate prototypes to help communicate their design goals. Because the B2 mask requires a flexible seal around the face, creating a functional multimaterial prototype was difficult.

Initially, they tried casting in silicone, but adjusting the process to achieve a truly high-quality prototype would have taken too much time.

“Because the casting process is different from the eventual molding process, that work would not have furthered production itself,” Bock-Aronson explained. “I had tried a number of different materials and technologies, and nothing was really working,” he said. “It’s a fairly hard thing to prototype.”

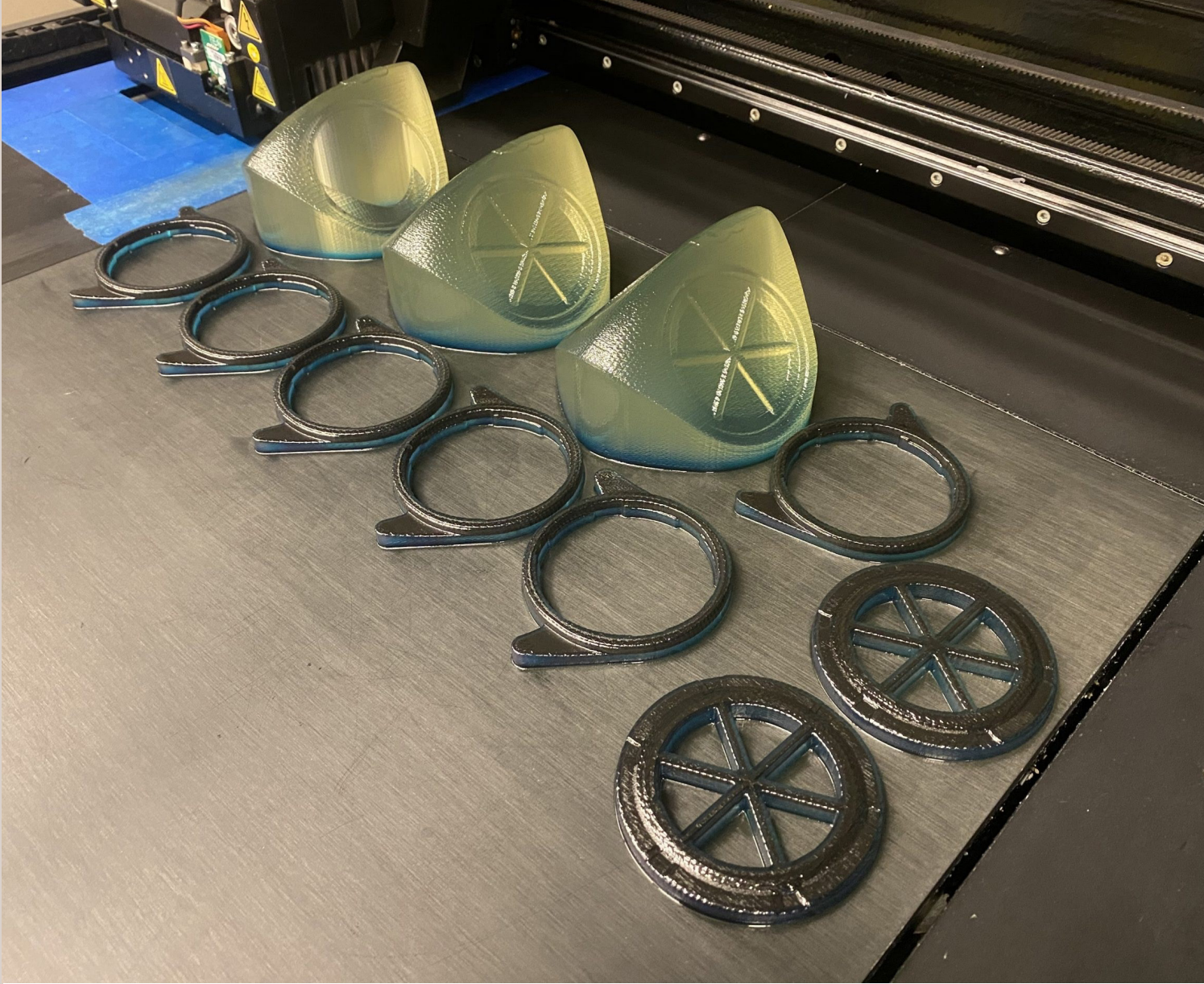
The team also experimented with several 3D printing technologies, including SLA and CLIP (Continuous Liquid Interface Production). None of them offered both the right material properties and the ability to create cavities and complex geometries. Moreover, the models often weren’t

durable enough for user testing, an important step for ergonomic products.

That’s when Bock-Aronson reached out to AdvancedTek, a reseller for Stratasys 3D printers based in Minnesota. He had a previous working relationship with the company, but he was also interested in their ability to 3D print Agilus30™ PolyJet material, a flexible photopolymer. This, combined with multimaterial printing on the J Series, would allow for realistic, fast prototypes.

“I had difficulty finding a 3D printing technology that created more robust, more durable prototypes, and that’s what drove me to AdvancedTek and using the Agilus material,” Bock-Aronson explained.

“Initially, I think it wasn’t about mechanical properties, but marketing the concept to investors,” said David Kadlec, an application engineer at AdvancedTek. With PolyJet 3D printing, the team was able to produce a flexible respirator prototype in just a day.



It took only one prototype iteration from the J Series printer for Bock-Aronson to understand how useful Agilus30 could be, partially because it allows for a range of shore values.

“It was way too soft the first iteration, melting like a Dali clock,” he explained. “But I saw that there was potential in it, and in the ability to adjust durometer. The next batch was much better.”

“Designing and testing a sealable mask that fits everyone’s face is extremely challenging, and the hardware components made it even more complicated.” said Matt Havekost, vice president of additive manufacturing sales at AdvancedTek. “PolyJet was the obvious solution to meet these challenges for Breathe99.”

Bock-Aronson was happy with the Stratasys models for marketing purposes, but also realized they could help further develop and perfect the design. He was familiar with PolyJet Technology™, but had never seen the Agilus30

flexible material in action. “I think it was eye-opening for him that you could change the durometer on the fly,” Kadlec said. In just a few days, AdvancedTek created several different iterations of the respirator, with varying durometers, sizes, and assembly options. It was exactly what Breathe99 needed.

“It was awesome,” Bock-Aronson said. The prototypes were durable enough to be handled and disassembled, making them ideal for stakeholder reviews.

For AdvancedTek, projects like these are valuable because they provide clear examples of the value of multimaterial 3D printing for product design.

“People don’t always understand how they’ll use multimaterial 3D printing,” Kadlec explained. “Any chance that we have of helping people understand the power behind fast problem-solving using material combinations is really important.”



Now that face masks and respirators are ubiquitous in daily life, Breathe99 wants to help the public understand how important they are – even without a pandemic.

“Aside from COVID-19, the wildfires in California are a great example of why having good protection is really important,” said Bock-Aronson. “I think what’s happening is really shifting our relationship to this type of product – it’s a really important public health tool in the 21st century.”

Bock-Aronson wanted to make those public health tools both wearable and functional. And now that the B2 Mask is officially on the market, more consumers can take advantage of well-designed, comfortable face mask.

“Obviously, the ultimate goal is to address climate change, to reduce pollution in our urban environments – but in the next thirty years, while we’re doing that work, we’re going to need protective equipment that keeps us safe.”

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