

HP 3D printing helps startup cost-effectively design and produce groundbreaking new medical device



With support from Athena 3D Manufacturing, Optima Recovery overcomes the limits of traditional production methods by leveraging HP's Multi Jet Fusion technology to accelerate innovation, increase flexibility, and reduce the cost of product development.

Optima Recovery is a startup focused on disrupting the way physical therapists manage heating, cooling, and compression treatments. Recently they collaborated with Athena 3D Manufacturing to develop a new version of their device. Leveraging the capabilities of HP's Multi Jet Fusion (MJF) 3D printing technology, they were able to re-engineer 60% of the parts, improve the new machine's performance and reduce its weight, while also eliminating much of the upfront cost typically associated with injection molding and other manufacturing technologies.

Introduction

"Our mission is to provide optimal relief, optimal recovery, and optimal living for our patients," says Optima Recovery CEO, Luke Olsen. "We believe there is significant opportunity in the physical therapy market and our solution for heating, cooling, and compression is unmatched."

Optima Recovery, a startup located in Logan, Utah, is working to release its first product, a combination thermotherapy and cryotherapy device. Their unique invention meets a common need for physical therapists, athletic trainers, and medical professionals who regularly use heat, cold, and compression to promote healing and recovery. Among other benefits, their solution consolidates these therapies into a single device, which eliminates excessive equipment and maintenance.

The founders at Optima Recovery have participated in several startup competitions, including the University of Utah Center for Medical Innovation's Bench to Bedside program, where they won the \$25,000 grand prize. They have allocated much of their earnings towards improving their device and preparing it for launch. Recently they collaborated with Athena 3D Manufacturing to iterate and develop the latest version of their product.

Founded in 2019, Athena 3D Manufacturing is a 3D printing service bureau located in Phoenix, AZ. The company seeks to challenge the traditional methods and processes used to design, fabricate, and introduce hardware products. Athena leverages HP's Multi Jet Fusion 3D printing technology to create low cost, higher volume, production quality parts.

Problem

"Most of our competitor's devices have glaring limitations," says Mr. Olsen. "Typically, they have to be filled with ice or water, and they have to be cleaned frequently. Many don't offer heat, so the therapist still has to juggle between different hot and cold solutions. In most cases, that's a manual, labor-intensive effort. We completely automate the treatment regimen."

Physical therapy treatments often include cooling, heating, and compression of the afflicted body parts. Some injuries even require multiple rotations of heating and cooling cycles. Traditionally a therapist or trainer would alternate between using ice packs and a heating pad. Lately, though, more are using machines to regulate the temperature and timing of each session. While the available devices do help simplify the process, many of the current offerings don't offer heat, and most require users to add ice or water, which necessitates regular care and cleaning.

Optima Recovery had a functional, working prototype but wanted to enhance it in several ways. Instead of using a sheet metal box, they wanted a more professional and lighter weight plastic shell. They also wanted to improve their distinctive reservoir system. It encapsulates and disperses the liquid used in Optima Recovery's machines. Unlike those that rely on water, it doesn't need to be refilled or replaced.

In the development of their new prototype, Optima Recovery considered technologies like injection molding and machining. But as a startup with limited resources, the upfront cost of tooling was prohibitive. Further, their sales projections are very conservative, with the team estimating they'd need only 58 units in the first year. Traditional manufacturing methods typically require significantly higher volume to achieve an affordable cost-per-part.

Solution

Move beyond the design constraints of old production technology

"With HP's Multi Jet Fusion 3D printing technology, startups like Optima Recovery don't need to worry about the age-old challenge of minimum order quantities," says Athena 3D Manufacturing CTO Dean Pierce. "Instead, they can order what they need, when they need it."

When they were introduced, Optima Recovery's founders shared their wish list of upgrades. The engineers at Athena 3D Manufacturing went to work, with the goals of completely improving the product, while also keeping it affordable.

Quickly develop robust, lighter weight, consolidated parts

They began by working on the machine's reservoir. Using Design for Additive Manufacturing (DfAM) design principles, they were able to consolidate five different components down to one. Next, they designed a new bezel and bracket assembly for the machine's controller and other electronics. In addition they designed a new front and back external shell, handle, vent screen and several other components.

"HP's PA-12 makes a great structural material," says Mr. Pierce. "We've designed several new brackets and load bearing structures within the Optima Recovery machine and we're confident they will perform well over time, enduring the use and abuse that's typical in a clinical setting."

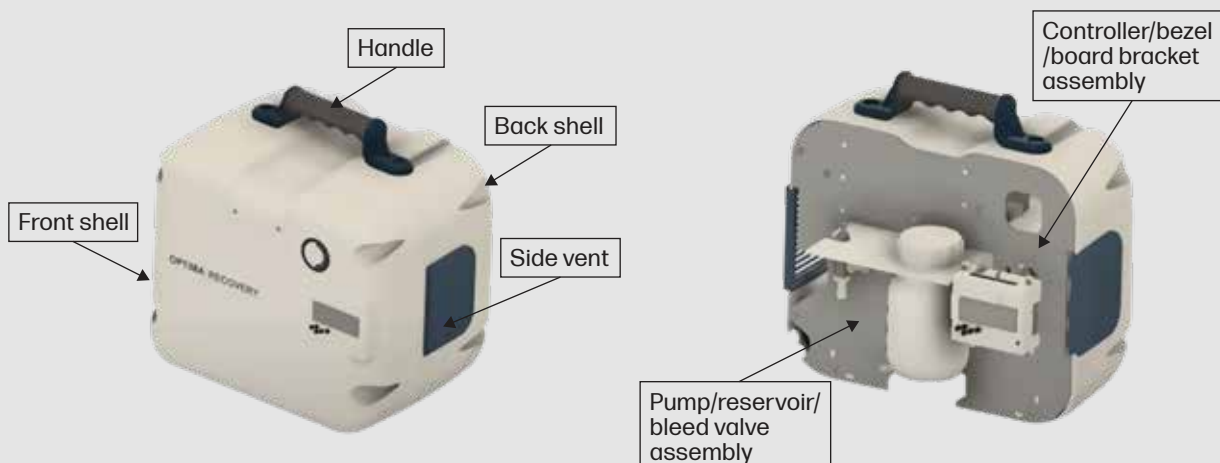
All of the reengineered parts were designed to be manufactured on Athena's HP Jet Fusion 5210 and 4210 3D printers. The parts were produced using HP's PA-12 glass bead material, which provides superior dimensional stability and high repeatability, making it ideal for parts like the enclosures and housings needed for Optima Recovery's machine.

Move from prototyping to production with one seamless solution

After completing their review, the staff at Athena 3D Manufacturing determined they would be able to 3D print roughly 60% of the new machine's parts. The remainder included the bulkhead and frame which were made from sheet metal, and commercial parts such as the electronics and hoses.

Improve and differentiate with multiple materials and finishing options

In addition to their functional characteristics, some of the parts, such as the outer shell, are visible to the end user. To facilitate decoration and branding, while also improving durability, Athena 3D Manufacturing plans to finish them using a thin, protective ceramic coat called Cerakote. It is recommended for use with HP's 3D printable materials and enhances a number of performance properties such as abrasion and wear resistance, corrosion resistance, chemical resistance, impact strength and hardness.



Benefit

“With HP’s MJF 3D printing technology, all the digitally manufactured parts for each device can be produced in one and a half print builds,” says Athena 3D Manufacturing’s Head of Applications Engineering, Steven Szymeczek. “This allows us to deliver parts far more quickly than we could with injection molding and other technologies, which of course creates a speed-to-market advantage for our client.”

3D printing enables design features that aren’t possible with traditional manufacturing technologies. By leveraging DfAM, the engineers at Athena 3D Manufacturing were able to create parts that not only offered better performance, they were also consolidated, which in some cases reduced assembly time by 75 to 85%.

While the combination of DfAM and 3D printing certainly enables a quick and efficient innovation process, it also provides other benefits. Machined metal parts are heavy and Optima Recovery’s machine is designed to be portable. HP’s PA-12 material allows them to lighten the weight of the machine considerably, without sacrificing strength or durability. Also, since they can design without the limitations of older manufacturing technologies, Optima Recovery can create clean sheet designs that further solidify their intellectual property advantage.

The large build area and productivity of HP’s MJF 3D printing solution allows Athena 3D Manufacturing to print all the corresponding parts for one Optima Recovery machine in approximately 12 hours. Given the company’s forecast of 58 total machines, Athena 3D Manufacturing has the capacity to produce an entire year’s supply in just a few weeks. With injection molding, the lead time was several months.

“It can be difficult and expensive to scale a hardware startup,” says Mr. Olsen. “HP’s 3D printing solution removes many of the roadblocks and greatly reduces our exposure with regards to product development. As we grow our collaboration with Athena 3D manufacturing, it’s also reassuring to know we’ve built a resilient, readily available supply chain.”

For a startup like Optima Recovery, an all-digital workflow reduces several risks. First, it eliminates the upfront cost of tooling, which can cost \$30,000 or more for a single part. Also, because they don’t have high fixed costs to absorb, they can produce in low quantities, eliminating inventory cost. Further, as the team continues to iterate their design and receives ongoing feedback from the field, they can continuously improve their product, without having to scrap stockpiles of obsolete components.

To learn more about HP’s Multi Jet Fusion 3D printing technology, and how 3D printing in healthcare is transforming the way we help people: <https://www.hp.com/us-en/printers/3d-printers/industries/healthcare.html>

