Desktop Metal

CASE STUDY

Metal Binder Jetting at an R1 University

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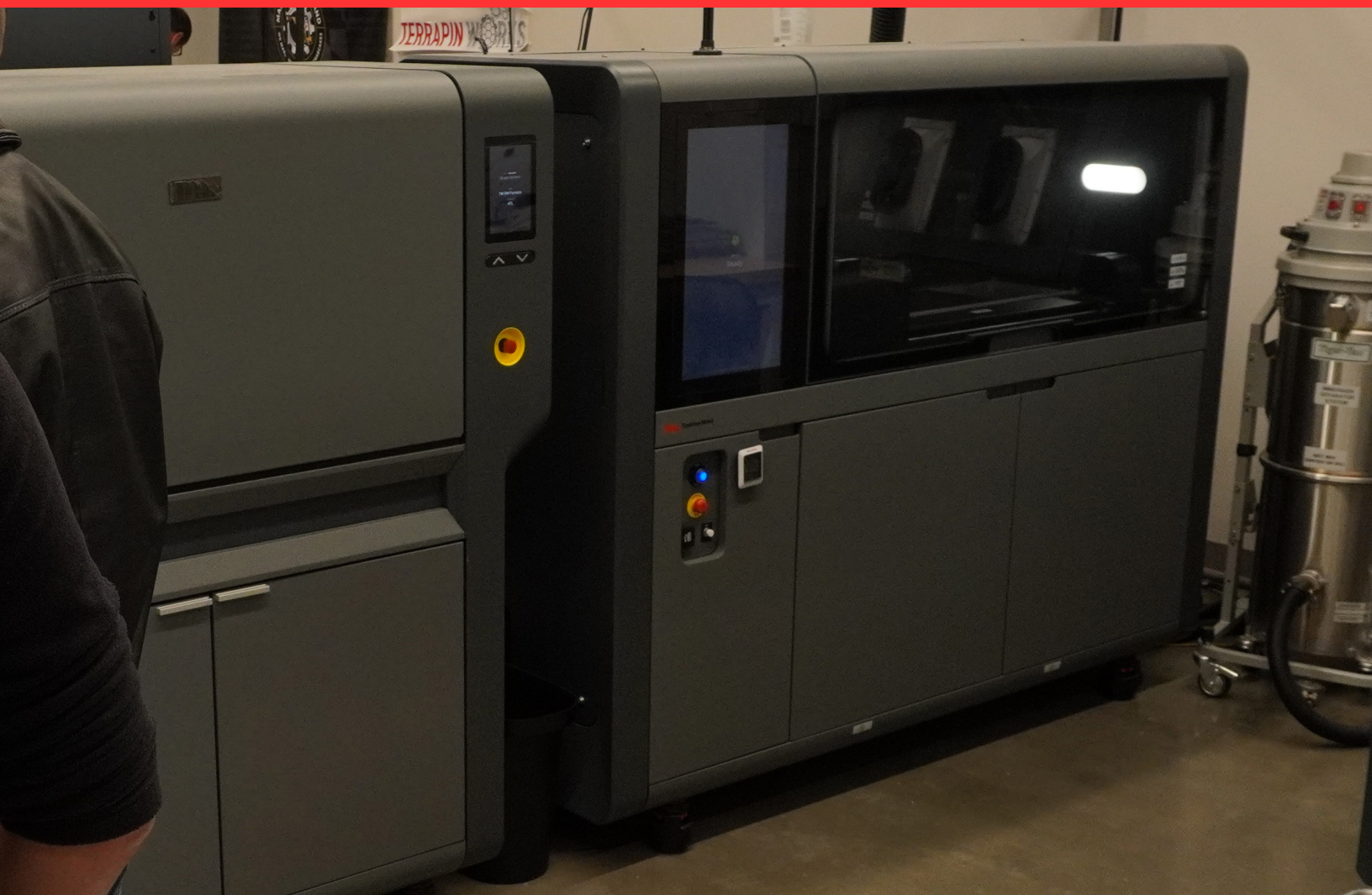
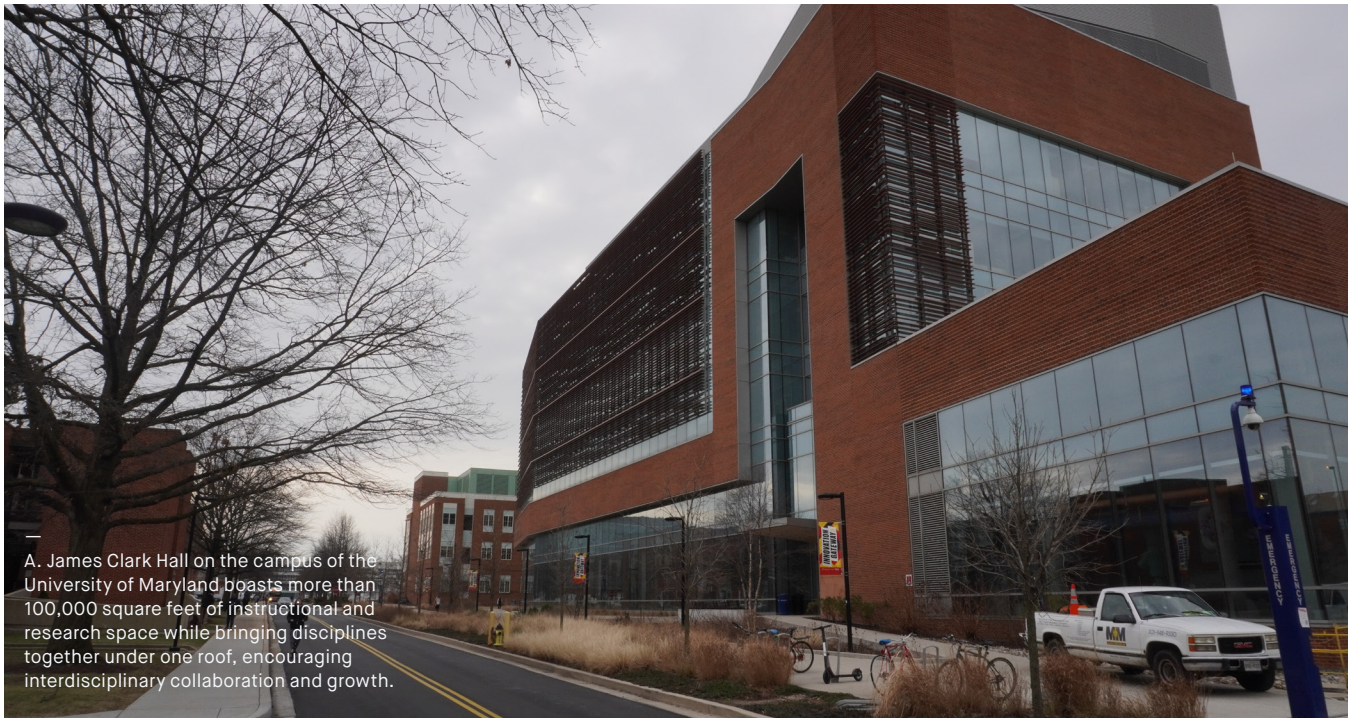
Terrapin Works at the University of Maryland serves students, researchers, and businesses with the Shop System





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A. James Clark Hall on the campus of the University of Maryland boasts more than 100,000 square feet of instructional and research space while bringing disciplines together under one roof, encouraging interdisciplinary collaboration and growth.

Customer
University of Maryland
A. James Clark School of Engineering
Terrapin Works Advanced Fabrication Lab

Location
College Park, Maryland

Industry
Education

Machine
Desktop Metal Shop System™

Material
17-4 PH Stainless Steel

Website
terrapinworks.umd.edu

Democratizing the trends of research and industry

Founded in 1856, the University of Maryland is a public land-grant research university in College Park, Maryland. Part of the A. James Clark School of Engineering, Terrapin Works was founded in 2014 to provide rapid prototyping, advanced manufacturing, and digital design resources as a service to the campus and surrounding community. Today, Terrapin Works offers an ecosystem representative of nearly every major technology or manufacturing process. including consumer, research, and industrial grade 3D printers in 17 labs with 30,000 square feet of fabrication space.

The Advanced Fabrication Lab at Terrapin Works is unique on campus because it is the only space where a raw ideation can be followed through all the way to a fully functioning electromechanical product within a single space. Binder jet 3D printing of metal powders on the Desktop Metal Shop System joined other technologies like multi jet fusion of nylon powders, polyjetting photopolymers, and laser cutting in the advanced lab. Other lab spaces include direct metal laser sinter technology and even two Desktop Health BioPlotter™ 3D printers in the Tissue Engineering & Biomaterials Laboratory for creating matrices of cell structures and scaffolding.

“Ultimately our goal is to, to democratize these technologies as much as possible,” explained Rick Blanton, Director of Technical Operations at the A. James Clark School of Engineering. “We feel that the more people who have access to this and understand that it’s not some dark magic that they’ll be able to see the utility of it and able to, to leverage going forward.”

"We can see where the trends of research and industry are headed and we have three primary focuses for where we generate impact," said Blanton. "First, is obviously student support for projects or the individual student experiential learning opportunities. We also support student competition teams. Secondly, we also support academics, integration into curriculum, and finally, we provide support to research groups around campus."

Binder jetting for research and development flexibility

With just under $10 million of capital equipment under its management, the Terrapin Works team aims to aggregate demand to identify what solutions on the market satisfy that need to make a purchase. Blanton explained, "We maintain the staff for continuous operations and continuity of knowledge that allows the researchers to use their funds on research and treat us as a fee- for- service job shop or service bureau instead of spending the bulk of their grant money on capital acquisitions."

To take a leading role in metal additive manufacturing, Terrapin Works was looking to expand its ecosystem of metal offerings. After conducting a full market discovery of available solutions, the Desktop Metal Studio System's extrusion-based Bound Metal Deposition technology was a frontrunner.

After reaching out to current Desktop Metal customers, the Terrapin Works team was connected with a facility that operated both a Studio System and Shop System in-house. The teams discussed the pros and cons of different aspects of each technology, but the part resolution was what sealed the deal in favor of binder jetting. With Bound Metal Deposition technology, the extruded layer lines are more visible on a final part whereas, the same parts printed with the Shop System were "flawless," according to Blanton as he recalled seeing a side-by-side comparison on parts off the two metal 3D printing systems.

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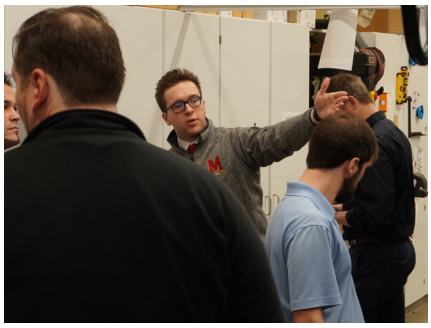
Rick Blanton, Director of Technical Operations at the A. James Clark School of Engineering, provides a tour of Terrapin Works to the local business community

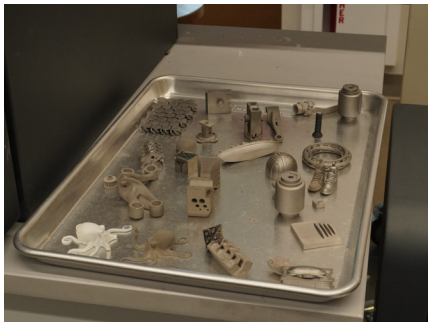
While some academic institutions may lean toward an extrusion-based approach for the powderless operation that lowers barriers to entry, a powder-based binder jetting process had inherent benefits important to the University of Maryland's mission. "As an R1 University it is critical that we have enough expected utilization of capital equipment in the long-term to justify the expense," Blanton explained. Using a sinter-based process similar to already-established green/brown part sinter methods, especially combined with the prospects of the AI driven Live Sinter software workflow, provided the team with a long-term vision for viability in more complex geometries with binder jetting.

Furthermore, the open parameters were key to the university team. "You have to be able to play with the

different parameters to see how it all shakes out," Blanton said. "At the end of the day, our job in technical operations and Terrapin Works is to identify platforms for research groups to be able to leverage the next generation of research and discovery," he emphasized. "The Shop System hit a sweet spot that offered the right combination of build volume and acceptable operating costs for us. We're still in spool-up, but as this comes online, we'll be able to start advertising it to the research groups on campus and we expect to see significant uptick in utilization."

First-hand student experience for future success





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Aerospace engineering student and Terrapin Works Technical Coordinator John Wulff provides a tour of the Shop System (above), displaying some early student prints off the binder jetting machine (below).

With most curriculum today set up around theoretical teachings, Blanton sees the opportunity to introduce practical project work with additive manufacturing. Mechanical engineering courses, for example, could easily undertake a real FEA analysis by printing models for destructive testing to verify theoretical analyses.

A staff of around one hundred students at any given time work within the lab system, with most machines being operated by student technical coordinators who turnover often due to co-ops, internships, and graduation. Blanton states the general rule of thumb is that freshly graduated engineering students take between six to 18 months from being hired to being productive and profitable for any company that hires them. "So, one of the primary goals that we have for Terrapin Works is to shorten that runway," he emphasized.

John Wulff, an aerospace engineering student who works as the technical coordinator of the Desktop Metal Shop System at Terrapin Works. He serves as the first point of contact for customers looking to use metal binder jetting and trains new operators on the system.

Wulff sees additive manufacturing, with metal in particular, popping up in many applications and, especially in the aerospace sector, wouldn't be surprised if he's around 3D printing in his future career. Gaining firsthand experience now is helping him hone his skills and understand the limits of the technology. "I've participated in floor runs and I printed really stupid parts, things that I knew weren't going to work because I wanted to see how they would fail and sort of how far I could push things," he said. He emphasized how this learning helps him better advise students and other customers on their own projects.

And this junction of student experience and research innovation is helping the University of Maryland accelerate advanced manufacturing technologies and develop future leaders in the field.

"Practical experience is really valuable," Blanton concluded. "It's one thing to know how to do something in CAD and have infinite precision. It's another thing when you try to do that and you run it on a machine and you learn what small thing actually makes a difference. All of our students have at least that basic understanding of the limitations of the equipment so they automatically are going to be better designers with that foundational knowledge."

TERRAPIN WORKS

About University of Maryland Terrapin Works

Terrapin Works is home to an expansive collection of additive and subtractive manufacturing resources that enable rapid prototyping in the A. James Clark School of Engineering, University of Maryland campus, and surrounding community. These resources range from 200+ consumer, research, and industrial grade 3D printers, to a complete ecosystem of subtractive manufacturing equipment capable of creating complex parts in a variety of materials, to electronics testing and PCB manufacturing equipment and more. We offer rapid prototyping and design services as well as access to equipment in our many locations and our vision is to accelerate the adoption of advanced manufacturing methods, engineering design processes, and experiential learning by the campus community.

Desktop Metal

About Desktop Metal Inc.

Desktop Metal (NYSE:DM) is driving Additive Manufacturing 2.0, a new era of on-demand, digital mass production of industrial, medical, and consumer products. Our innovative 3D printers, materials, and software deliver the speed, cost, and part quality required for this transformation. We're the original inventors and world leaders of the 3D printing methods we believe will empower this shift, binder jetting and digital light processing. Today, our systems print metal, polymer, sand and other ceramics, as well as foam and recycled wood. Manufacturers use our technology worldwide to save time and money, reduce waste, increase flexibility, and produce designs that solve the world's toughest problems and enable once-impossible innovations. Learn more about Desktop Metal and our #TeamDM brands at www.desktopmetal.com