

Development of BAAM System Spurs Birth of an Industry

Oak Ridge National Laboratory in partnership with Cincinnati Incorporated and Strangresse

Large-format 3D printer developed, licensed, and commercialized as industry adopts new additive manufacturing technology.

Innovation

Additive manufacturing (AM) processes had been widely limited by slow printing rates, a narrow range of source materials (e.g., extruded plastic), and small-volume product output capabilities. In 2014, Oak Ridge National Laboratory (ORNL) and Cincinnati Incorporated (CI) helped transcend these limits by developing the Big-Area Additive Manufacturing (BAAM) technology. Using new materials (carbon fiber-reinforced polymers), new processes (extruders) and controls, the team enabled an “out-of-oven” additive process that eliminated size constraints, enabled processing rates 500 times faster and build volumes 100 times larger than those of state-of-the-art commercial printing systems—with less material and energy waste.^{1,2}

Outcomes

Technology Advancement

ORNL has used its large-area printers to demonstrate a variety of AM innovations ranging from full-scale prototype systems (cars, boats, submarines) to rapid low-cost tooling for the automotive, marine, aerospace, and construction industries. The system is the first to utilize plastic pellet feedstock reinforced with 20% carbon fiber, enabling production of stronger and stiffer parts. It has an 8-foot by 20-foot build area and can print structures up to 6 feet tall.^{1,3}

Impact

ORNL licensed the BAAM technology and CI sold the first BAAM beta system in September of 2014. As of November 2017, CI has sold 14 BAAM systems to industries including aerospace, automotive, material providers, and tooling, among others. Since rolling out the BAAM, ORNL helped Cosine Additive with a medium-scale system, Strangresse developed a line of BAAM extruders, Thermwood commercialized a large-scale additive manufacturing (LSAM) system, and ORNL partnered with Ingersoll to develop wide and high additive manufacturing (WHAM) machines.⁴



Using carbon fiber-enhanced polymers, the BAAM printer produced the frame and body of a full-scale Shelby Cobra in 2014; body panels feature a surface variation of 0.020 inches.

Photo: ORNL

“The auto industry could save energy and time with this type of additive manufacturing.”⁵

Rick Perry,
U.S. Secretary of Energy

Timeline

February 2014: CI signs a partnership agreement with ORNL to develop new, large-scale AM system¹

September 2014: Strati car printed live at the International Manufacturing Technology Show with the BAAM⁴

January 2015: ORNL presents 3D-printed Shelby Cobra at Detroit Auto Show³

September 2016: Ingersoll and ORNL partner to develop WHAM

October 2017: Strangresse commercializes ORNL extruder technology

November 2017: CI has sold 14 BAAM systems⁴

¹ Press Release. www.assets.e-ci.com/PDF/Press-Releases/CI-and-ORNL-Advancing-Large-Part-Additive-Manufacturing_Mar-2014.pdf

² EESD Review. ornl.gov/blog/eesd-review/mdf-new-large-area-multi-material-printer-advance-research

³ ORNL Press Release. ornl.gov/sci/manufacturing/media/news/detroit-show/

⁴ ORNL. energy.gov/eere/amo/downloads/amo-peer-review-july-17-19-2018

⁵ Instagram. [instagram.com/p/BXYgMtwgTPi/](https://www.instagram.com/p/BXYgMtwgTPi/)