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Rendering of a 3D printed wind blade mold segment that will be produced as part of the ASCC's research effort to accelerate wind blade development through additive manufacturing. Researchers will use the world's largest polymer 3D printer to develop recyclable wind blade molds that reduce lead times and costs.

UMaine awarded $2.8 million to accelerate wind blade development through additive manufacturing

January 28, 2021

The University of Maine Advanced Structures and Composites Center has been awarded $2.8 million from the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy to develop a rapid, low-cost additive manufacturing — 3D printing — solution for fabricating large, segmented wind blade molds.

In addition, the UMaine Composites Center will collaborate on a $4 million award to Oak Ridge National Laboratory (ORNL) to apply robotic deposition of continuous reinforcing fibers in wind blades.

Currently, innovation in large wind blade technology is a costly and time-intensive process. Molds and tooling for large blades can cost upward of $10 million. The time to market of 16–20 months stifles innovation in this growing market.

"The University of Maine remains a leader in additive manufacturing and wind energy technology, and this funding will harness researchers' expertise in both areas," said Sens. Susan Collins and Angus King in a Jan. 28 announcement of the award. "We are thrilled that the Department of Energy continues to invest in UMaine's cutting-edge research and prioritizes the advancement of our state's clean energy economy and the creation of good-paying jobs."

"Building on a decade plus of research excellence in nanocellulose, composites and wind blade testing, University of Maine researchers and students will apply this knowledge to additive manufacturing, transforming large wind blade development and accelerating innovation in this growing market," said University of Maine President Joan Ferrini-Mundy. "I congratulate all of the UMaine researchers and students for continuing to advance transformational research to help

grow Maine's clean energy economy. We thank the Department of Energy for its partnership and our Congressional delegation for their continued interest and incredible support for this world-class research and development underway right here in Maine at our university."

"Very large wind blade molds will be printed on the world's largest polymer 3D printer located at the UMaine Composites Center using recyclable bio-based materials reinforced with wood," said Habib Dagher, executive director of the Advanced Structures and Composites Center. "By combining cutting-edge 3D printing manufacturing with bio-based feedstocks, our team estimates that new blade development costs can be reduced by 25% to 50% and accelerated by at least 6 months. Molds produced using these materials can be ground up and reused in other molds, making them a more sustainable solution."

UMaine is a world leader in cellulose nanofiber (CNF) technology, including development of nano- and micro-cellulose reinforced thermoplastic composites. These new bio-based materials promise mechanical properties similar to aluminum at lower fabricated costs.

Carbon fiber reinforced ABS thermoplastic feedstocks, which are widely used in large scale 3D printing, cost more than $5 per pound. By incorporating bio-based materials derived from wood, the cost of the feedstock can be reduced to less than $2 per pound.

The molds will incorporate 3D printed heating elements using a new technology developed at ORNL. Control of mold surface temperatures is a critical mold manufacturing requirement, and the new ORNL technology enables robotic deposition of heating elements, reducing mold fabrication time and cost.

"Oak Ridge National Laboratory will apply expertise in additive manufacturing, carbon fiber technology and materials science to advance the use of 3D printing in wind energy applications," said ORNL's Xin Sun, interim associate laboratory director for energy science and technology. "We look forward to collaborating with UMaine to optimize these clean energy technologies to benefit the environment and boost the economy."

The outcome of the proposed research is to transform mold production as a key enabler for more rapid and more cost-effective large wind turbine blade development. TPI Composites and Siemens Gamesa (SGRE) are partnering with the UMaine Composites Center on the project. A successful demonstration will put both SGRE and TPI in a position to transition the additive manufacturing solution into practice.

SGRE is the world's leading supplier of offshore wind turbines and TPI produces approximately 18% of the world's wind blades. Ingersoll Machine Tools, the 3D printer manufacturer, and Techmer PM, the cellulosic-thermoplastic feedstock compounder, also are on the team, providing the ability to scale-up both equipment and feedstock production.

Researchers at the UMaine Composites Center on the project include Dagher, James Anderson, John Arimond and Doug Gardner.

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