Decor Maine

ISSUE NO. 1

LIVING BEAUTIFULLY IN MAINE

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PULP FRICTION

AT THE UNIVERSITY OF MAINE IN ORONO, THE WORLD'S FIRST FULLY **BIO-BASED 3D PRINTED** HOME PUTS MAINE ON THE MAP

BY **ALLISON PAIGE**

Mesmerizing patterns on the bedroom walls of the prototype home resemble bespoke wood-work. *below:* Governor Janet Mills and Senator Susan Collins help celebrate the launch of BioHome3D.

PHOTOGRAPHS **COURTESY OF UNIVERSITY OF MAINE | ADVANCED STRUCTURES & COMPOSITES CENTER**

'*Waste not, want not.* That wise, old adage is more prescient than ever in these notoriously disposable times. It is a tenant the team at the University of Maine at Orono's Advanced Structures and Composites Center (ASCC)—a multidisciplinary center devoted to the research, education, and engineering of advanced structures—aims to follow to the letter. In November 2022, the center unveiled the first ever entirely bio-based 3D-printed home. Dubbed "BioHome3D," the structure is 100-percent comprised of wood fibers and bio-based resins, produced with very little waste.

The catalyst for the project is the high cost of living and the need for low-income housing in Maine and across the country, explains ASCC Executive Director and Professor of Structural Engineering, Dr. Habib Dagher, who spearheaded the project. "Over 20 years of research in bio-based materials at our lab, along with our research in large scale additive manufacturing, gave us the tools to create a solution. Essentially, the idea is to print with abundant wood residuals that exist in our region."

The 600-square-foot one-bedroom, one-bath structure was printed with the world's largest polymer 3D printer, a warehouse-sized machine. Pellets were poured in, heated, and extruded into four house modules that were assembled on-site at ASCC's Orono campus. The home's economic shape and curved lines give it a low-slung, midcentury vibe of which Frank Lloyd Wright would surely approve. Remarkably, due to the properties of the printed materials, the home could eventually be dismantled, reprocessed, and reprinted to demonstrate, quite literally, how a home can be recycled numerous times without losing its structural integrity.

"This is a thermoplastic material," explains chief operations engineer, Evan Gilman. "So, a hundred years from now,

left: **The prototype home showcases the sustainability of its design, as well as options for customization.** *above:* **BioHome3D's inviting exterior demonstrates how 3D design can be both affordably and rapidly produced without sacrificing style.**

if people don't like that home anymore, it could be ground up and printed into a different home."

Some surfaces were left natural to highlight the mesmerizing patterns of the 3D printing, which angle and swirl, neatly mimicking the look of bespoke millwork. Others were finished with sheetrock, to demonstrate the look of a traditional domestic interior and customization opportunities. Wood cellulose insulation is blown in post-printing and can be adapted for most every climate. "The idea was to try to highlight a unique design that showcases what the 3D printer can do," Evan continues. The home is not only environmentally friendly and rapidly produced, it was also designed with accessibility in mind, meeting affordable housing standards put forth by the Maine State Housing Authority.

"We had certain parameters specific to the square footage and the space," says administrative coordinator Celena Powell, who notes that her favorite aspects of the project are "its tidy carbon footprint and the aesthetics of the printed materials."

BioHome3D was made possible with funding from the U.S. Department of Energy's Hub and Spoke program, as well as partnerships with MaineHousing and the Maine Technology Institute. ASCC has also teamed with the Penquis Community Action Agency in Dover-Foxcroft to promote future sustainable, affordable housing projects in the state.

The project has garnered interest from all over the state, the nation, and the world as an elegant solution to a daunting problem. But the ASCC team is not ready to rest on its laurels. The prototype is just the tip of the iceberg—or the 3D printer, if you will. "We have plans to use the facility to develop printed neighborhoods for low-income and homeless populations," Dr. Dagher notes. "We're designing a facility to scale up the BioHome3D production technology, so that we can print one of these homes every 48 hours."

Creating dwellings that are environmentally sensitive, fiscally feasible, and assembled in a manner of days may seem like Jetson-era sci-fi, but as the ASCC team has demonstrated, not only is it possible, it is also the future. ■