

Example: Creating unique composites learning opportunities

Art to Part: Composite sleds with the University of Tennessee, Knoxville

University of Tennessee, Knoxville students at the IACMI-supported Fibers and Composites Manufacturing Facility (FCMF) designed and created composites sleds to learn more about vacuum assisted transfer molding and the material properties of a variety of fibers including carbon fiber, basalt fiber, and glass fiber with resins such as vinyl ester or epoxy – an established technology process used in the racecar industry.



Students prepare the vacuum assisted transfer mold.



Students show the finished carbon fiber composite sled.

The advantage of fiber reinforced sleds over traditional plastic sleds is the higher mechanical performance and durability, in addition to weight reduction that leads to aerodynamic performance improvement.

Creating sleds with a variety of fibers allows students to gain knowledge about the characteristics of different materials; it also allows students to learn about the molding process through hands-on experiments.

Showcasing learning outcomes for the community



The students then took the sled to the opening night of Ober Gatlinburg, a Tennessee ski and sled park in Gatlinburg, Tenn., to showcase to the community the opportunity for composites in sporting goods.

The project was covered by CompositesWorld and the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, and was noted as the #1 highlight on the U.S. Department of Energy's Advanced Manufacturing Office highlights of 2017.



IACMI – The Composites Institute®

Institute Outcomes in Tennessee

March 2019



Tennessee: Home to IACMI headquarters

Tennessee is home to IACMI's headquarters and more than 25 members have facilities throughout the state. Tennessee is the third-highest in the U.S. for employment in the advanced materials industry, and manufacturers employ more than 16,800 Tennesseans*. Tennessee is also the second largest manufacturing region in the U.S. with more than 90,000 jobs in the automotive industry*. Tennessee's strong manufacturing and advanced material ecosystem helped to lay the foundation for the creation of IACMI, and IACMI has continued to support and leverage the innovation and manufacturing heritage of the state for continued economic growth.

*Source: TN Department of Economic & Community Development

About IACMI

IACMI – The Composites Institute is a 160+ member community of industry, academia, and government agencies leading innovation and workforce development initiatives to drive the adoption of advanced composites to grow U.S. manufacturing and support national security. IACMI, a Manufacturing USA institute, is supported by the U.S. Department of Energy's Advanced Manufacturing Office, as well as key state and industry partners.

Advanced composites provide strength and stiffness while being very lightweight. These characteristics provide advantages in many transportation, energy, and infrastructure applications. Greater deployment of advanced composites can offer benefits, such as providing safer, more energy-efficient vehicles. IACMI is working to drive the large-scale adoption of advanced composites in diverse markets.



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University, State, Regional, National Laboratory, & Association Partners



The Institute for Advanced Composites Manufacturing Innovation (IACMI), managed by the Collaborative Composite Solutions Corporation (CCS). CCS is a not-for-profit organization established by the University of Tennessee Research Foundation. As a Manufacturing USA institute, IACMI is supported the U.S. Department of Energy's Advanced Manufacturing Office in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE).

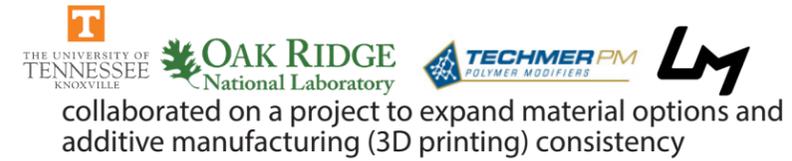
IACMI – The Composites Institute creates an **ecosystem of innovation** to drive

commercial outcomes that lead to **economic growth**.

Creating an Innovation Network

- 18** Current IACMI technical projects with innovations created in Tennessee
- 8** Tennessee members participating on current IACMI technical projects

Innovation example:



- Outcomes:
- Techmer PM expanded its catalogue of additive manufacturing products, expects to double sales in 2019, and customer demand is driving the installation of a new multi-million dollar manufacturing line.
 - Local Motors has installed the world's largest 3D printer, made by Thermwood (IN), at its Knoxville, TN microfactory and is planning to start production of its first autonomous people mover Olli 2.0 beginning in

Impacting Economic Development

In Tennessee, the IACMI partner network:

Announced **\$340M** in capital investment

- \$11.9M: Magnum Venus Products, announced 2016
- \$21.4M: HTS IC, announced 2016
- \$125M: LeMond Composites, announced 2016
- \$6.2M: Leisure Pools, announced 2016
- \$115.6M: Lifetime Products, announced 2016
- \$50M: OshKosh, announced 2018
- \$4M: Carbon Fiber Recycling, announced 2018
- \$7M: RMC Advanced Technologies, announced 2018

Created **2,391** new manufacturing jobs

- 70 jobs: Magnum Venus Products, announced 2016
- 200 jobs: HTS IC, announced 2016
- 242 jobs: LeMond Composites, announced 2016
- 1,000 jobs: Leisure Pools, announced 2016
- 500 jobs: Lifetime Products, announced 2016
- 300 jobs: OshKosh, announced 2018
- 25 jobs: Carbon Fiber Recycling, announced 2018
- 54 jobs: RMC Advanced Technologies, announced 2018

Establishing an Environment for Innovation

Tennessee is home to four facilities within the IACMI innovation environment network. These facilities offer space for R&D in carbon fiber development, modeling and simulation for risk and reliability, physical testing of materials and processes with world-renowned researchers, and locations for students to gain hands-on experience learning with IACMI industry partners while conducting research in the composites field.

Facilities within the IACMI network in Tennessee

	Laboratory for Systems Integrity and Reliability at Vanderbilt University Combines modeling and simulation tools, sensing and control techniques, and risk and reliability analytics to improve performance and dependability of manufacturing systems	
	Carbon Fiber Technology Facility at Oak Ridge National Laboratory Offers flexible, instrumented carbon fiber line for demonstrating advanced technology scalability	
	Manufacturing Demonstration Facility at Oak Ridge National Laboratory Collaborates with industry to reduce risk and accelerate development and deployment of energy-efficient manufacturing processes and materials	
	Fibers and Composites Manufacturing Facility at the University of Tennessee, Knoxville Allows students and researchers to work through complete composite manufacturing process, collaborating with industry for problem solving, testing, and product development	

Supporting regional industry networks

 IACMI, in partnership with the State of Tennessee, was a key driver in developing and launching the Composites Coalition, representing Tennessee composites materials and process manufacturing companies, which are regionally connected through this coalition. The Composites Coalition is managed by the Innovation Valley, with members including TVA; Oak Ridge National Laboratory; the University of Tennessee, Knoxville; and other businesses throughout the state.

Serving Workforce Needs

7,000+ K – 12 STEM participants in Tennessee supported by IACMI



- **475** students attended Manufacturing Day events in Knoxville
- **4,000** attendees at Vanderbilt's Mini Maker Faire
- **2,700** participants in First Robotics Smoky Mountain Regional competition

380+ Adult composites training participants



- **17** senior executives at the National Defense University toured with IACMI to learn about advanced composites
- **255** attendees at Vanderbilt Composites One hands-on events
- **115** participants in Tooling U-SME

34 Tennessee internship placements



- **100%** Interns who graduated with a job offer or acceptance into a graduate program
- **34** interns have been placed at more than 5 locations throughout Tennessee every year since the Internship Program launched in 2016 Tennessee internship host locations include 4X Technologies, Local Motors, Volkswagen, and Oak Ridge National Laboratory