Institute for Advanced Composites Manufacturing Innovation (IACMI – The Composites Institute)

Contract No. DE-EE0006926

Project Team: Collaborative Composite Solutions Corporation

Project Period: June 2015 – May 2020

John A. Hopkins, CEO

U.S. DOE Advanced Manufacturing Office Program Review Meeting

Washington, D.C.

June 11 – 12, 2019

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Overview

TIMELINE

- June 2015 – May 2020
- Project 80% Complete
- Total Budget: $157M

BUDGET

	BP1	BP2	BP3	BP4	Total
DOE Funded	$4.8M	$14.2M	$19.2M	**$21.2M**	**$59.4M**
Cost Share	$4.2M	$19.4M	$35.0M	**$39.7M**	**$98.3**
Total	$9M	$33.6M	$54.2M	**$60.9**	**$157.7**

BARRIERS

- High cost of carbon fiber reinforced polymers (CFRP)
- Low rate-of-production for creating CFRP and advanced composites
- High embodied energy for manufacturing CFRP
- Low recyclability of CFRP
- Lack of trained workforce to support composites industry

KEY PARTNERS

National Laboratories

- National Renewable Energy Laboratory
- Oak Ridge National Laboratory

Key Regional Partners

- Utah Advanced Manufacturing & Manufacturing Initiative
- Composite Prototyping Center
- Composite Recycling Technology Center

Universities

- Michigan State University
- University of Dayton Research Institute
- University of Tennessee
- Vanderbilt University
- University of Kentucky
- Purdue University
- Colorado School of Mines

Trade Organizations

- American Composites Manufacturing Association (ACMA)
- JEC Group
- American Chemistry Council
- CompositesWorld
- SAMPE

State Partners

- Tennessee Dept. of Economic & Community Relations
- Michigan Economic Development Corp.
- Indiana Economic Development Corp.
- Colorado Office of Economic Development & International Trade
- JobsOhio

MEMBERSHIP As of 5/1/19

154 current members representing academia (10%), associations (3%), government (5%), LE (28%), and SMEs (53%)

IACMI Provides Production-relevant Environments for Innovation

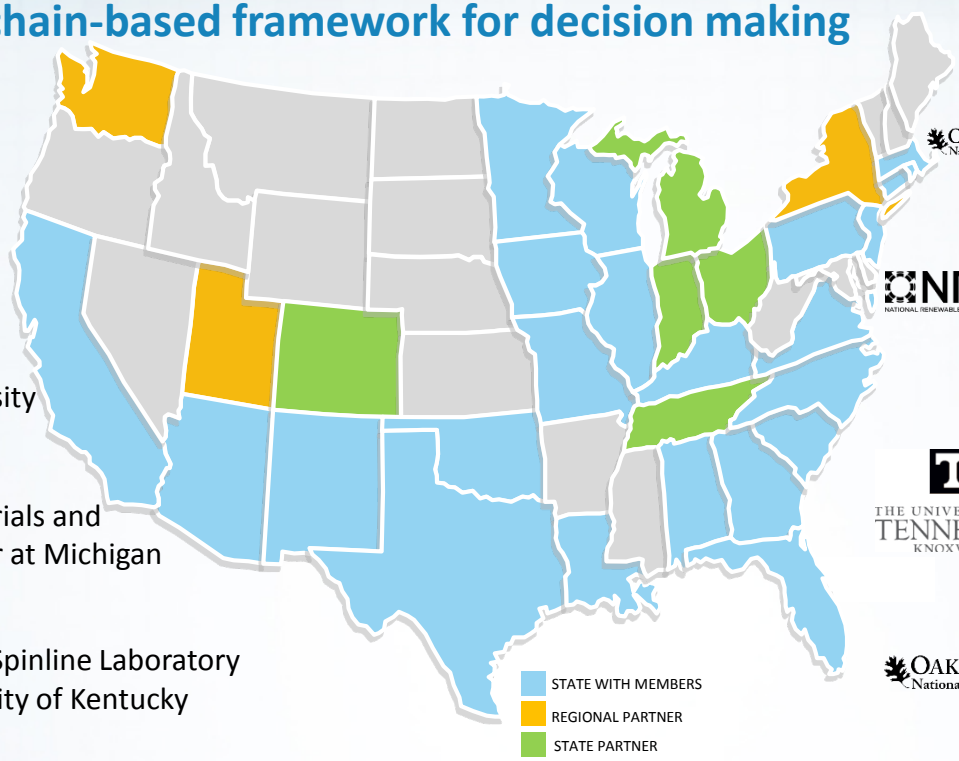
Supply chain-based framework for decision making

Modeling & simulation

Establishing business viability

Prototyping & testing

Full-scale production implementation



PURDUE UNIVERSITY — Indiana Manufacturing Institute

VANDERBILT UNIVERSITY — Laboratory for Systems Integrity and Reliability at Vanderbilt University (LASIR)

MICHIGAN STATE UNIVERSITY — Composite Materials and Structures Center at Michigan State University

University of Kentucky — Carbon Fiber Spinline Laboratory at the University of Kentucky

UDRI University of Dayton Research Institute — Composites Laboratory at UDRI

OAK RIDGE National Laboratory — Carbon Fiber Technology Facility at ORNL

NREL National Renewable Energy Laboratory — Composites Manufacturing and Education Technology Facility (CoMET) at NREL

THE UNIVERSITY OF TENNESSEE KNOXVILLE — Fibers and Composites Manufacturing Facility at the University of Tennessee, Knoxville

OAK RIDGE National Laboratory — Manufacturing Demonstration Facility at ORNL

MICHIGAN STATE UNIVERSITY — Scale-Up Research Facility (SURF)

Regional Partners

- Composites Recycling Technology Center
- Utah Advanced Materials and Manufacturing Initiative
- Composites Prototyping Center

Trade Organizations

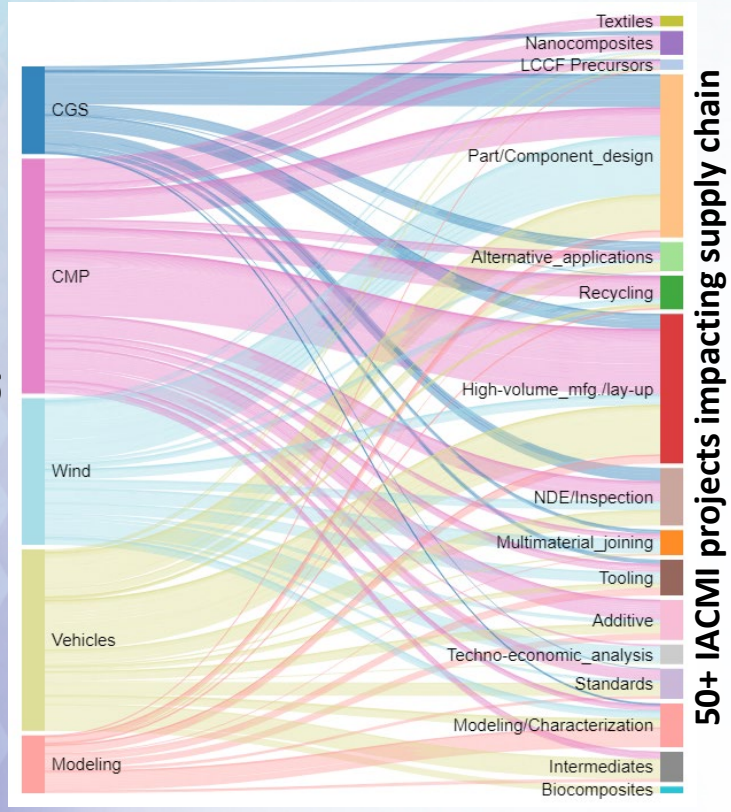
- American Composites Manufacturers Association
- American Chemistry Council

154 MEMBERS REPRESENTING **31** STATES
130 COMPANIES **17** ACADEMIC INSTITUTES

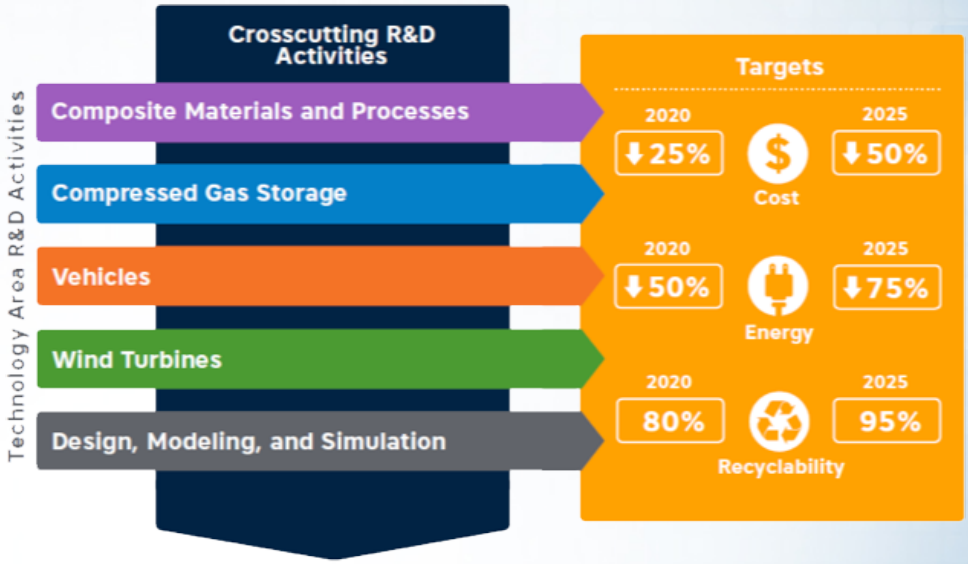
IACMI Supports Local Ecosystems and Connects them Nationally

Project Successes: Meeting DOE Goals and Beyond

IACMI projects impact entire supply chain



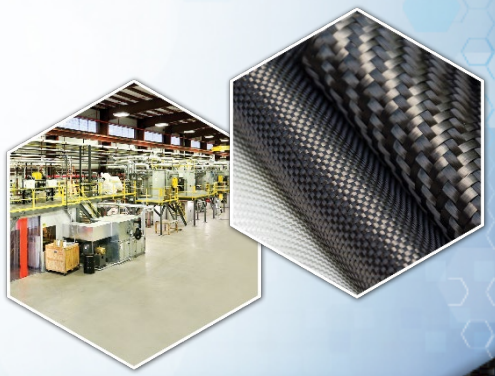
Projects meeting DOE goals



Supply chain impact leads to:

- Workforce development training, focused on composites technicians, STEM, and future engineers
- Economic impact with job creation announcements

Creating new materials, developing new processes



Results and Accomplishments

SME Expansion Outcome from IACMI Technical Project for Material and Process Validation

Technical Project Challenge:
Improve material options and printing processes for additive that enables Local Motors to commercially produce its 3D printed vehicles

SMEs Involved in Project:
Techmer PM: Material supplier SME
Local Motors: 3D printed vehicle SME

Project Outcomes:

Techmer PM

- Significant sales of new products serving additive composites markets (expect doubling of sales in 2019)
- Customer demand led to installation of a new multi-million dollar manufacturing line. ***Ribbon cutting in May 2019.***

Local Motors

- Installed world's largest 3D printer at their Knoxville microfactory
- Beginning commercial production of Olli 2.0 in July 2019

> "Our participation in IACMI allowed us to develop new technologies that have contributed to Techmer PM's growth in the additive manufacturing ecosystem."
> – Tom Drye, TechmerPM

Serving Workforce Needs

9,000+ K-12 Students ***2,000 Composites Training*** ***100 Interns***

100% of IACMI interns have graduated with a job offer in industry or acceptance into a graduate program

Dept. of Energy Goals

Recyclability
✓ Demonstrated greater than 80% recyclability of polymer composites

Carbon Fiber Production Costs
✓ Reduced production costs of carbon fiber composites by over 25%

Carbon Fiber Embodied Energy
✓ Reduced embodied energy of carbon fiber composites by 50%

Large-Scale Composites Adoption
✓ More than 3,000 jobs in composites industry announced with a $400M investment in eight states

Meeting DOE goals has established a foundation for economic growth through a strong collaboration network, manufacturing innovation, and workforce training.

10+ New products commercially available because of IACMI collaboration outcomes

New products are:

- Saving cost through rapid curing
- Extending product longevity
- Increasing recyclability

Transition Planning: Building on Success

Runway

- ✓ Established IACMI brand across markets
- ✓ Working models for collaboration in place
- ✓ Demonstrated value and leadership established in core partners
- ✓ Momentum in serving member consortium

Strategic Innovation Assets

- ✓ Core partners of universities and national laboratories
- ✓ New core partners
- ✓ Consortium members
- ✓ Industry trade and workforce development partners
- ✓ Other strategic resources

Funding & Support

- ✓ Membership, projects, shared assets
- ✓ States and core partners
- ✓ Workforce, special programs, leveraged
- ✓ Federal: DOE, DOD, NASA, NIST
- ✓ Other

Future Operations

- ✓ Focus on Consortium: Industry member relations, partitioned collaboration spaces with proven operating models and unique resources
- ✓ Further integration of workforce programs with industry working environments
- ✓ International collaboration on pre-competitive to near competitive topics
- ✓ Fast access to physical and digital resources
- ✓ User model approach with emphasis on outcomes and impact
- ✓ Innovation validations for higher TRL projects
- ✓ Low-volume prototyping
- ✓ Business development support for innovation-based market growth

Questions?

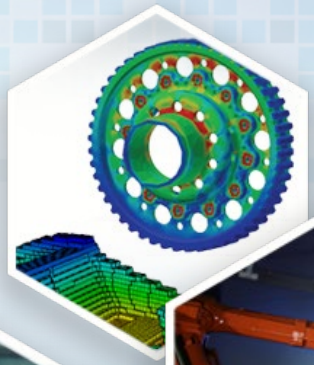
Contact info:

John A. Hopkins

Chief Executive Officer

IACMI – The Composites Institute, managed by Collaborative Composite Solutions Corporation

Website: www.iacmi.org



THE COMPOSITES iacmi INSTITUTE