



IACMI Member Participation in IACMI Projects

Dale Brosius
Chief Commercialization Officer
September 12, 2023

Convene. Connect. Catalyze.

Connecting the Composites Industry

Professional Societies

SOCIETY OF PLASTICS ENGINEERS
sampe
North America

International Consortia

CU
COMPOSITES UNITED
NATIONAL COMPOSITES CENTRE
Innovate UK

Communications Partners

CW
CompositesWorld
JEC GROUP

Trade Associations

American Chemistry Council
ACMA
AMERICAN COMPOSITES MANUFACTURERS ASSOCIATION

Federal and state partners

U.S. DEPARTMENT OF ENERGY
Indiana
A State that Works
COLORADO
Office of Economic Development
PURE MICHIGAN
Michigan Economic Development Corporation
Economic & Community Development
JobsOhio

Workforce Partners and Community Colleges

ACE
AMERICA'S COMPOSITE BODY
ClosedMold Alliance
ABARIS
CORPORATION ONE - A MAP OF M. MICHIGAN TECHNOLOGY
SkillCrafters
BY IACMI

THE UNIVERSITY OF TENNESSEE KNOXVILLE
OAK RIDGE National Laboratory
VANDERBILT UNIVERSITY
PURDUE UNIVERSITY
IACMI
THE COMPOSITES INSTITUTE
MICHIGAN STATE UNIVERSITY
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
University of Dayton Research Institute
UAMMI
UNIVERSITY OF APPLIED MATERIALS AND MANUFACTURING INSTITUTE

IACMI – The Composites Institute

2015-2021

\$70M
of DOE
funding was
matched by
\$130M
of industry,
university,
and state
cost share

Technology

\$200M portfolio
>60 R&D projects
25+ commercial
products

Partnerships

140+ Members
Industry, Universities,
National Labs,
Gov't Agencies

Infrastructure

\$400M Value

Tennessee (4 facilities)

Michigan (2)

Ohio (1)

Indiana (2)

Colorado (1)



Pipeline

100 Internships
100% placement rate

15,000 Trainees
K-12, post-secondary
& adult workers

Jobs

**3,000 Manufacturing
Job Commitments**
by IACMI members
partners

“Anyone looking for a solution should know that IACMI is the place to go”

- IACMI Premium Member

Manufacturing Assets at Relevant Scale



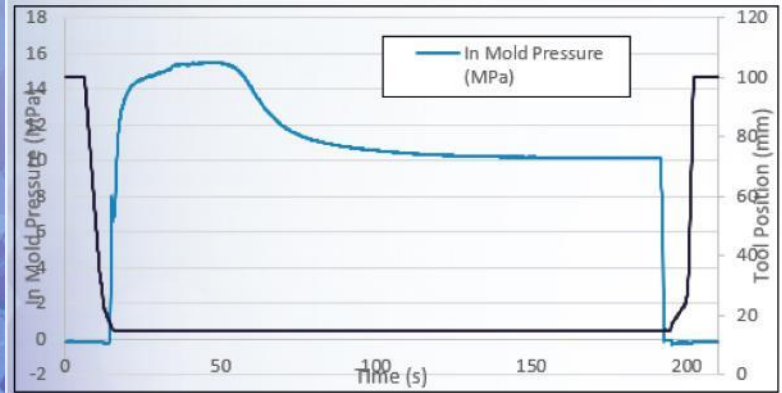
PURDUE
UNIVERSITY.



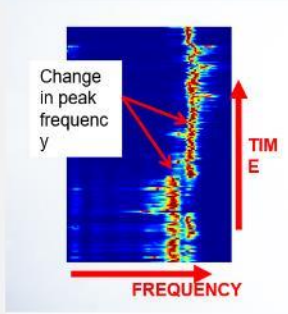
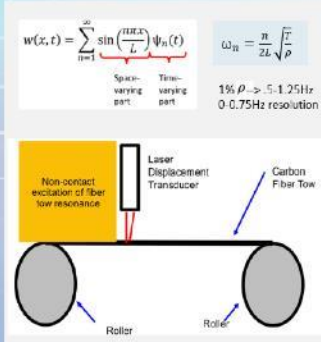
OAK RIDGE
National Laboratory

T
THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

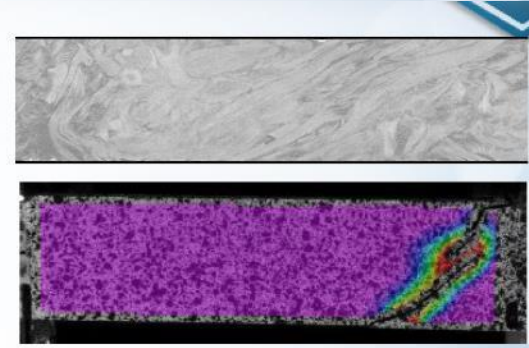
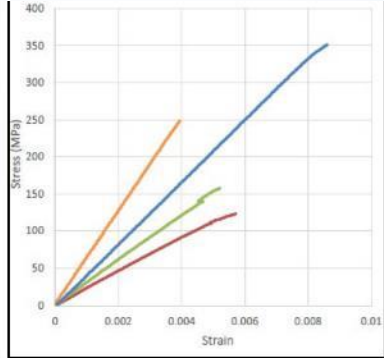
Ford Liftgate Carbon Fiber Inner Panel



Ford Liftgate Carbon Fiber Inner Panel



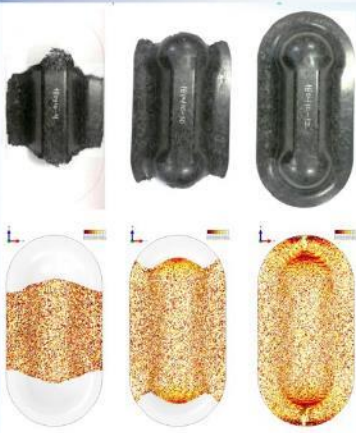
In line non-contact measurement of carbon fiber properties



Mechanical strength testing and morphology



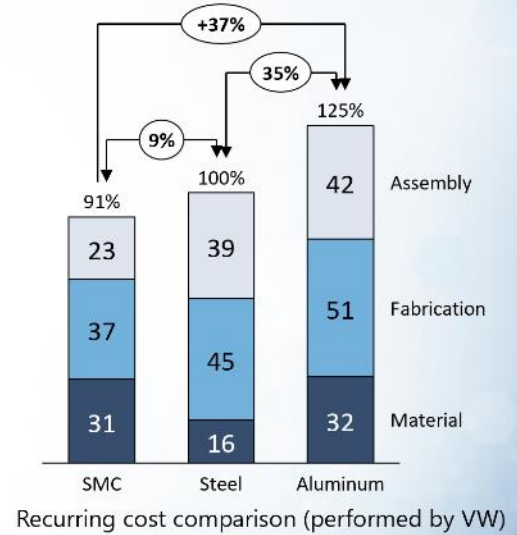
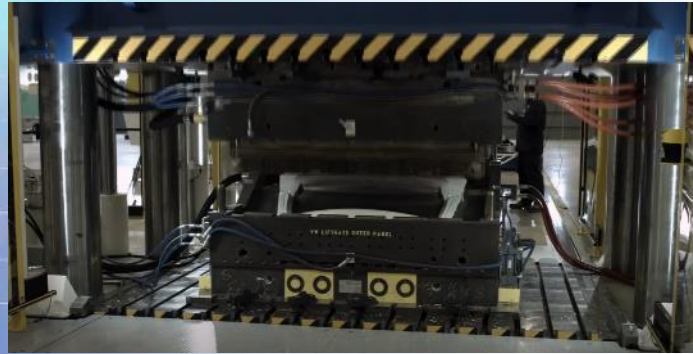
Digital Image Correlation (DIC) for fiber orientation



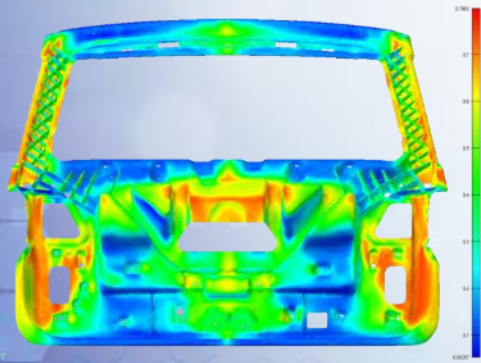
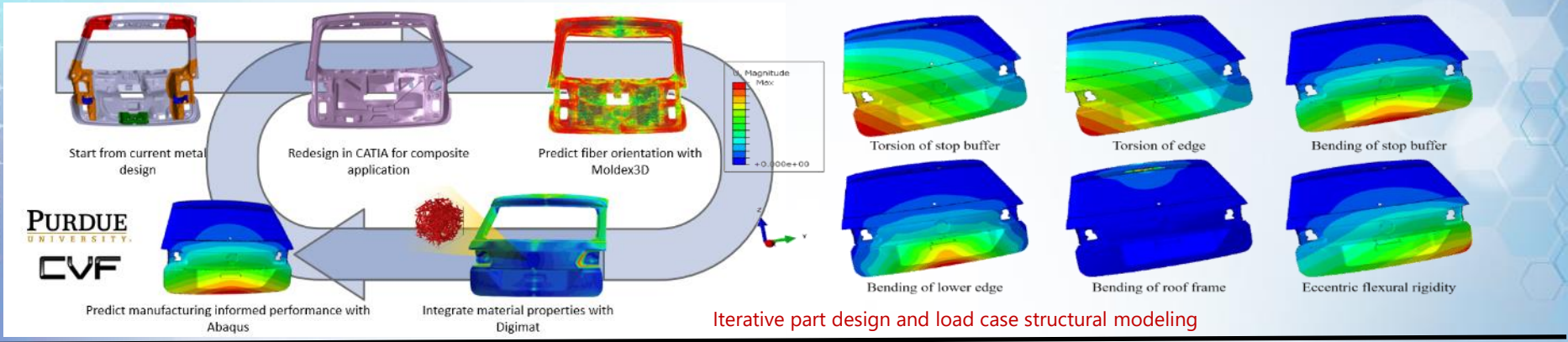
	Layup: [0/90]	Layup: [0/90/90]	PPMC
Literature			
Experiment			

Flow simulation and crash performance correlation

VW SMC Liftgate



VW SMC Liftgate



Fiber orientation prediction and measurement using Digital Image Correlation (DIC)

13 Meter Blade Fabrication



Infusion and Cure



Demolding

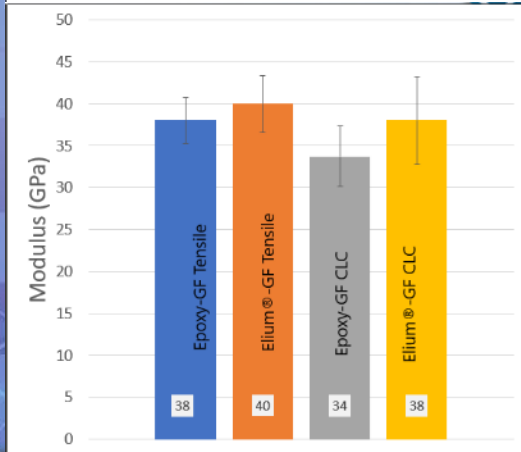
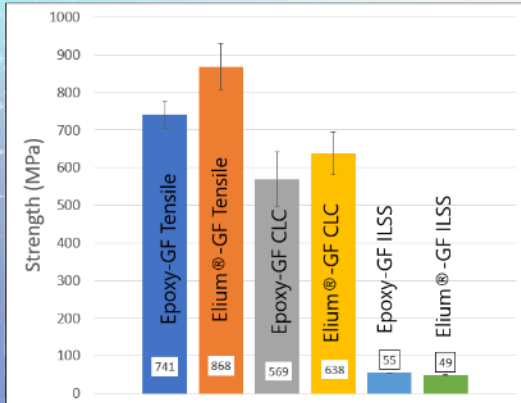


Bonding

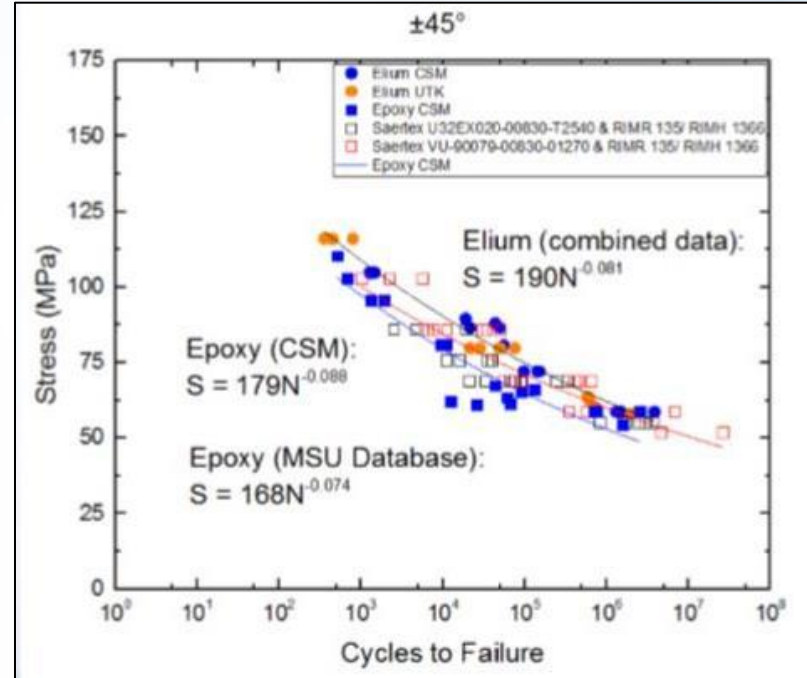


Blade Prep for Testing

13 Meter Blade Coupon Testing



Mechanical property testing compared to baseline



Fatigue testing

13 Meter Blade Testing



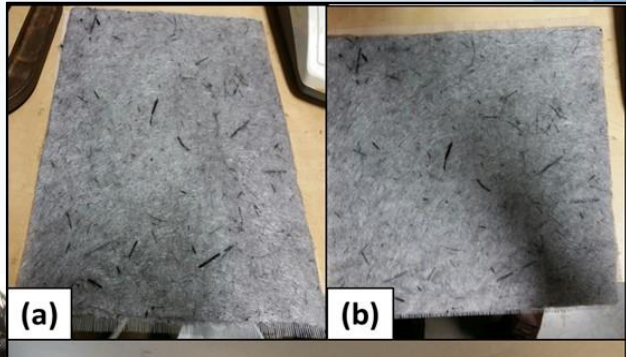
Fatigue Testing

Seven Years of IACMI Recycling Innovation

OLYMPUS BENCH™



TRIDENT BENCH™



April 27, 2021

Braskem Launches Carbon Fiber Reinforced Polypropylene Filament for Additive Manufacturing

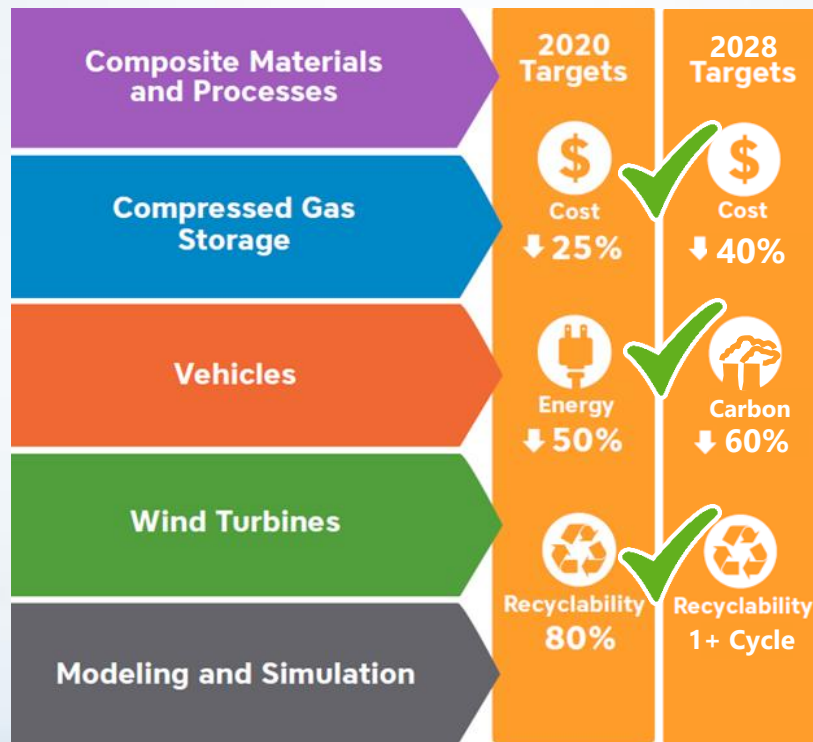




DOE Renewal and Project Scope

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IACMI Technical Goals under DOE Funding



Targets are relative to 2015 baseline

IACMI DOE Priorities under Renewal

IACMI Priorities 2023-2028	
Clean Energy Markets	Wind Energy, Electric Vehicles, Hydrogen Storage
Cross-cutting Technologies	Circular Economy, Digitalization, Materials & Processes
Workforce of the Future	Education and Workforce Development, DEIA
Industry health	Small & Medium Enterprises; Robust, Resilient Supply Chains; Regional Partnerships/Clusters

IACMI Technical Working Groups



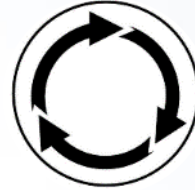
**High Rate
Aerostructures
Fabrication**



**Future Mobility
& Vehicles
Technology**



Wind Energy

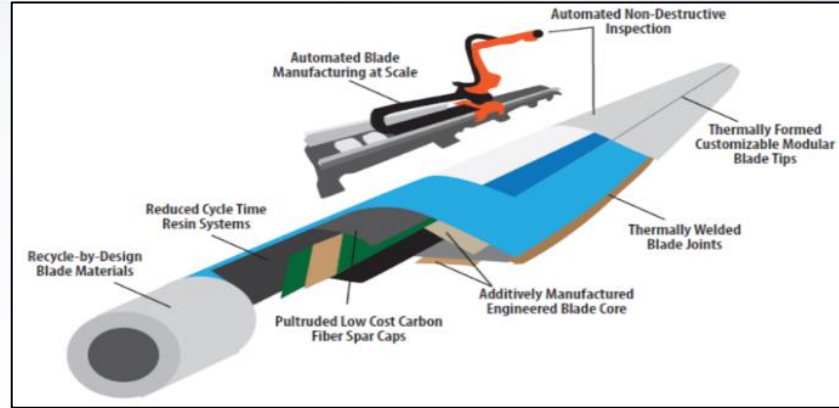
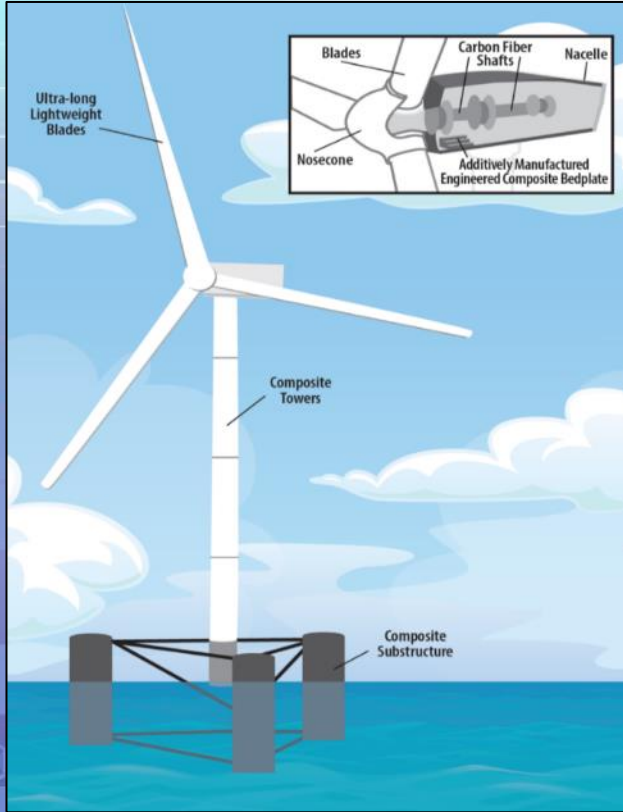


**Recycling
Circular
Economy**



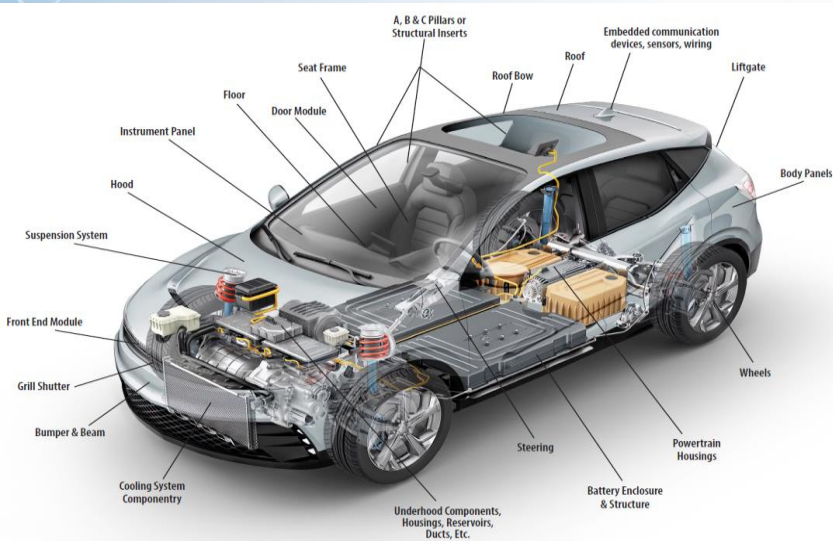
**Infrastructure
& Construction**

Wind Energy



- ◆ **Needs:**
 - Materials and processes that reduce the overall cost of fabrication, inspection, and maintenance
 - Novel blade designs and other wind energy harnessing devices
 - Materials that are inherently circular and easy to recover and recycle
 - Recycling solutions for existing blades due to retire in coming years

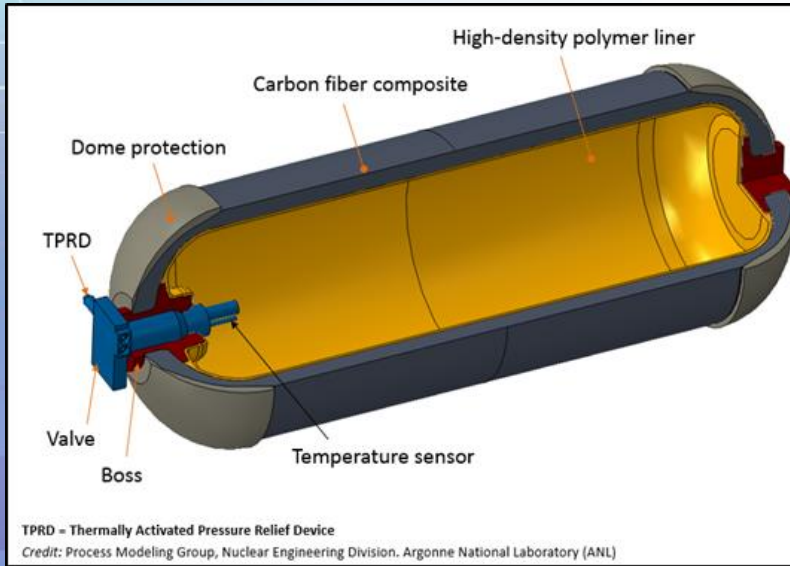
Electric, Connected and Autonomous Vehicles



Needs:

- Materials with lower overall carbon footprint, including bio-based and inherently circular polymers
- Hybrid materials and manufacturing processes like co-molding, overmolding and insert molding to reduce part count
- Multifunctional structures that eliminate steps or secondary components
- Digital integration to optimize design, incorporate sensors and monitor part health

Hydrogen Transport and Storage



Needs:

- Lower cost, high strength carbon fiber or additives that reduce the amount of carbon fiber required for pressure vessels
- Materials that reduce permeation and leakage, especially in liquid hydrogen storage
- Incorporation of structural health monitoring to enable lower factors of safety

Cross-cutting R&D Needs

◆ **Circular Economy and Life Cycle Analysis:**

- Sustainable materials (bio-derived, CO₂-derived, up- and/or re-cycled, etc.)
- Efficient manufacturing techniques (electrification of manufacturing, near-zero waste)
- Design for Sustainability

◆ **Digitalization and Industry 4.0:**

- Digital process twins via simulation, incorporating real time life cycle analysis (LCA) into the design process
- Integration of smart sensing and AI/ML into composite manufacturing processes, supported by digital twins.

◆ **Materials and Processes (in addition to those mentioned previously):**

- Low cost, rapid tooling approaches for composites
- Joining technologies, including bonding, fastening and welding
- NDE techniques

The Landscape

- ◆ **Baseline funding from DOE is \$30M over five years. Assume nominal \$6M per year, but this could change.**
 - Requires \$30M in cost share (combination of state funds and industry) for total project value of \$60M
 - May be opportunities in future years to receive supplemental funding
- ◆ **Projects will require industry cost share, nominally 1:1 against federal funds**
 - Most will be in-kind (personnel, materials, etc.)
 - Cash cost share may be required depending on need for tooling or equipment
 - Projects with multiple industry partners provide greatest leverage on cost share
- ◆ **Projects will need to complete a technoeconomic analysis (TEA) or Life Cycle Analysis (LCA), or both, on a pro-forma basis at the start and based on results at the end. This will form part of the project screening process.**

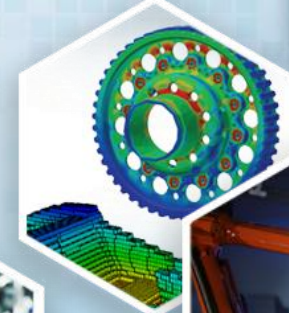
IACMI Wants Your Input and Ideas!

- ◆ **If you have an idea for a full project, including potential core IACMI R&D and industry partners:**
 - Download and fill out the Initial Idea Paper for consideration (from IACMI website)
 - Be prepared to engage with IACMI headquarters and various R&D partners to more fully flesh out the details
- ◆ **If you have products or technologies that you believe can help IACMI achieve the DOE goals, and are looking for help identifying a project and potential partners:**
 - Download and fill out as much of the Initial Idea Paper as you can
 - Note your interest in participating in a future project
 - Identify where your product or service can bring value, including market applications
 - IACMI will add this to a portfolio of available industry technologies and make all core partners aware

Project Development & Selection

Erin Brophy
IACMI CCO

September 12, 2023



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Project Development Steps



1. Idea Paper
Development
& Review

2. Full Project
Plan

3. Review &
Approve Full
Project Plan

4. Contracting

5. Kickoff
Project!

***Proposal lead must be IACMI member in good standing**

Convene, Connect & Catalyze

- IACMI Website
- Working Groups
- IACMI HQ Leadership
- Technology Area Directors



- IACMI Newsletter
- Members Meetings
- Social Media
- Innovation Insights

Develop Idea Paper

Engage IACMI Core Partners



- ✓ Identify the opportunity
- ✓ Work with IACMI Technology Area Directors, Working Groups, and IACMI HQ Leadership
- ✓ Complete Idea Paper & submit to IACMI

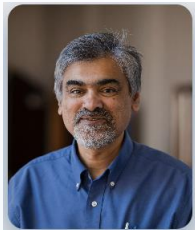
World Leading Resources in Composites Manufacturing



Chad Duty
IACMI CEO



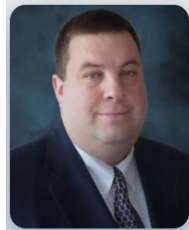
Dale Brosius
IACMI EVP, CCO



Uday Vaidya
IACMI CTO



Ray Boeman
Vehicles TAD



Derek Berry
Wind TAD



Brian Rice
High-Rate Aero
& CGS TAD



Byron Pipes
DMS TAD



Vlastamil Kunc
M&P TAD

Develop Idea Paper

Write & Submit the Idea Paper



Team Members

Project Description

Targeted IACMI goals

Initial TEA/LCA

ROM Budget Summary

IACMI Idea Paper

It is strongly recommended for proposers to work with an IACMI core partner(s) to formulate a project idea. Upon completion, please submit this Idea Paper to IACMI's Chief Operating Officer at ebrophy@iacmi.org with the Subject Line---"Idea Paper" + Project Title

Date:

Project Title:

Project Partner Lead Organization:

POC Name:

E-mail:

Phone:

Core IACMI R&D Partner(s)

POC Name:

E-mail:

Phone:

Additional Project Partners:

Project Summary (2-3 paragraphs):

Provide a short summary of the project (i.e., problem to be solved, need for a solution, market opportunity that will be addressed).

Please answer the following questions (1-2 pages total):

Which IACMI goals does this project idea support (cost, carbon footprint, recycling, new materials)?

Provide a high-level technoeconomic analysis (TEA) that supports this project idea. *detailed TEA showing calculations will be required at the next stage of the project.*

Examples:

The use of recycled carbon fiber instead of virgin fiber is estimated to reduce the carbon footprint of the finished part by 50% and reduce costs by greater than 15% versus practice.

The combination of a 50% reduction in cycle time and reduction of material waste 5% is estimated to reduce recurring part cost by 25% and tooling investment cost.

The use of a high strength glass SMC, augmented with local continuous reinforcement in cycle times of 120 second, will result in a part that is cost competitive to welded with a similar mass as aluminum.

What is new or innovative about this project idea (i.e., How is it different than what has been done before)?

***Expected Duration: (months):**

***Rough Order Magnitude Budget Summary (this is not a formal budget):**

Estimate each funding type on a "per partner" basis. If all partners are not known in a specific funding category, please note.

IACMI Federal Funding:

State Funding:

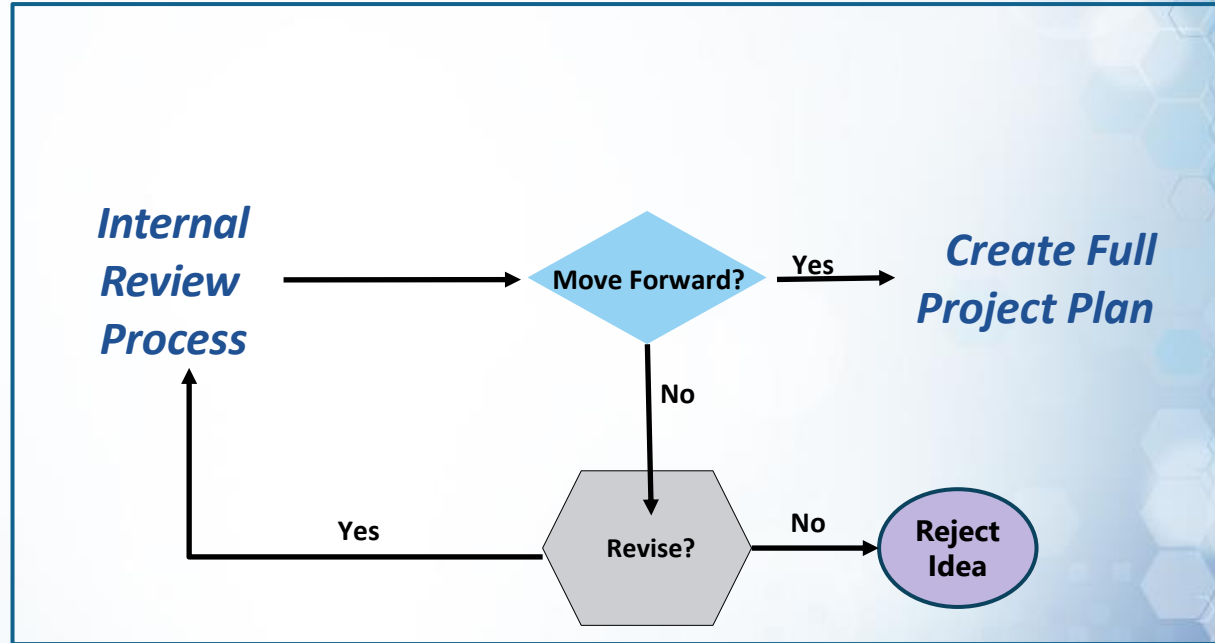
Industry cash cost share:

Industry in-kind cost share:

**The Expected Duration and Rough Order Magnitude Budget Summary are not formal declarations, but rather estimates to give the project some general boundaries during the review of this Initial Idea Paper (IIP).*

IACMI HQ Leadership & TADs will review:

- ✓ Relevance and Impact
- ✓ Technical Merit
- ✓ Resources
- ✓ Cost Share
- ✓ Initial TEA/LCA

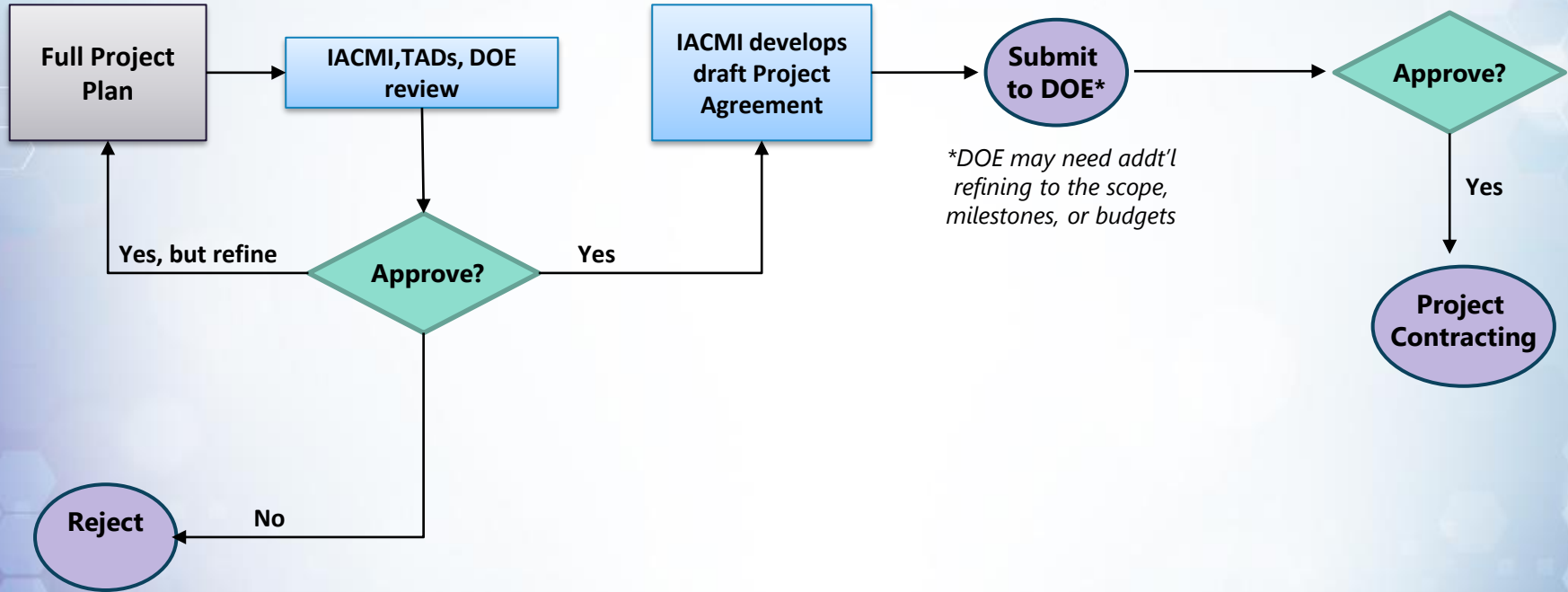


FULL Project Plan Includes:

- Relevance
- Broader impact
- Technical merit
- Required resources
- Partnering strategy
- Consent to IP Terms
- Commercialization Plan
- Task descriptions & Milestones
- Budget (including CS)
- Full TEA, LCA

The Full Project Plan will be used to directly populate the Project Agreement (contract) between IACMI and the Project Partners.

Review/Approve Full Project Plan





Getting our ducks in a row....

Project Agreement (PA)

IACMI <-> Project Partners
One per **PROJECT**

Project Partners sign

IACMI
signs and
Executes

PA contains contract information such as:

- Partners & Period of Performance
- SOW & Budgets
- IP Terms
- Commercialization Plan
- Equipment Purchases
- Payment terms
- Termination terms
- Flow-down Ts&Cs

Project Kickoff!



DOE approval has been given

All Project Partners have signed the Project Agreement

Project Kickoff!!!



Thank you!



Questions?

Erin Brophy
Chief Operating Officer

ebrophy@iacmi.org

projects@iacmi.org