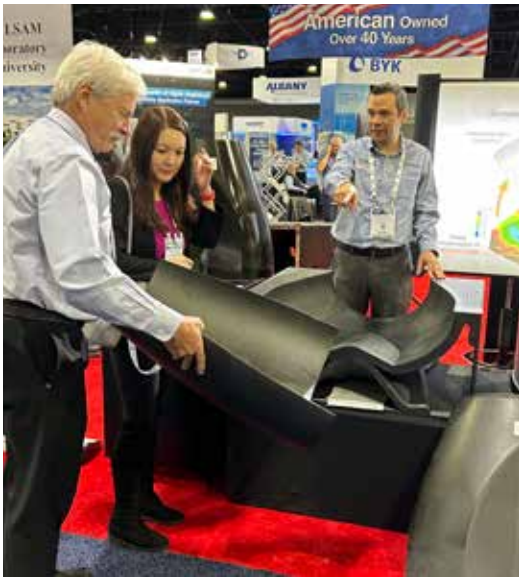
TENTH ANNIVERSARY

THE COMPOSITES INSTITUTE

2015 iacmi 2025

TENTH ANNIVERSARY



A DECADE OF INNOVATION *IACMI's Impact*

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The Institute for Advanced Composites Manufacturing Innovation (IACMI) is headquartered in Knoxville, Tennessee, and is managed by the Collaborative Composite Solutions Corporation (CCS). CCS is a not-for-profit organization established by the University of Tennessee Research Foundation.

IACMI was established in 2015 by the Advanced Materials and Manufacturing Technologies Office (AMMTO) in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. AMMTO supports a globally dominant U.S. manufacturing and industrial base for a resilient energy system and secure supply chain.

In partnership with the Department of Defense's Manufacturing Capability Expansion and Investment Prioritization office, IACMI manages national training programs – America's Cutting Edge (ACE) and Metallurgical Engineering Trades Apprenticeships & Learning (METAL) – to build a skilled and robust workforce to secure the nation's defense and industrial base.

IACMI is one of 18 Manufacturing USA® Institutes, a national network created to secure U.S. global leadership in advanced manufacturing through large-scale public-private collaboration on technology, supply chain and education and workforce development.

Convene. Connect. Catalyze

On behalf of the entire IACMI staff, I am pleased to share with you some highlights of "*A Decade of Innovation: IACMI's Impact*." On January 9, 2015, the White House and Department of Energy (DOE) announced the launch of IACMI, the fifth of now 18 Manufacturing USA® institutes. Our focus has remained on revitalizing American manufacturing and strengthening the nation's defense industrial base.

For 10 years, IACMI has played a pivotal role in America's reindustrialization, aiming to secure its position as a global leader by implementing a formula that works: **Technical Innovation + Workforce Development = Economic Growth**. Reshoring initiatives have been key to bolstering U.S. economic and national security. Through multiple national workforce programs sponsored by DOE and the Department of Defense (DoD), IACMI has been inspiring, educating, and training a skilled workforce to help address the projected 4.6 million open manufacturing jobs in the coming decade.

IACMI's impact for economic growth has been clear in four primary ways:

- Public-Private Collaborations
- Technical Innovation
- Workforce Development
- Leveraging Resources

Timelines of some of our success stories in this report lay out how investments in facilities, expertise, and collaborative projects have led to results in commercializing products and advancing technology readiness. Shared infrastructure in key states like Colorado, Indiana, Michigan, Ohio, and Tennessee has enabled IACMI to create research-at-scale, production-relevant spaces for innovation and workforce development in advanced composites manufacturing. I'm proud that IACMI has harnessed the power of public-private partnerships to improve products, processes, and people's lives through composites. With steadfast investment and support from industry members and government partners, notably DOE and DOD, IACMI has empowered domestic manufacturers to accelerate design and commercialization, fostering a more reliable, secure, and competitive U.S. economy.

Today, these capabilities uniquely position IACMI to build on past achievements, de-risk future research, and accelerate onshoring efforts and job creation in the United States. Over the next few years, IACMI and its partners will leverage their full-scale facilities and equipment and significantly expand programs. IACMI will continue to convene, connect, and catalyze the U.S. composites community by attracting startups and small enterprises while creating opportunities with large companies, national labs, and universities. Our ecosystem of innovation remains ready to advance American manufacturing. ⬢

Sincerely,

Chad Duty, PhD
CEO, IACMI

Vision:
Leading advanced composites innovation and novel workforce solutions to strengthen American manufacturing and national defense

Mission:
To improve products, processes, and people's lives through composites innovation and workforce solutions that secure America as a global leader in advanced manufacturing

2024 Members Meeting | Indiana

The Power of
Convene. Connect. Catalyze.

IACMI's Proven Formula for Composites Industry Collaboration and Technology Advancement

A decade ago, on June 17, 2015, hundreds of composites experts from industry, government, and academia gathered in Knoxville, Tenn., to launch the Institute for Advanced Composites Manufacturing Innovation, or IACMI. With a signing ceremony between the U.S. Department of Energy and IACMI representatives, the Institute was officially open for business.

Since that first Members Meeting, IACMI has spent 10 years living its mission to Convene, Connect, and Catalyze. More than 4,500 participants have joined Members Meetings, creating a powerful network across the composites supply chain. Each gathering reinforces IACMI's national leadership in technology innovation, commercialization, and workforce development. Members Meetings are a microcosm of all IACMI stands for and a welcoming forum for newcomers and long-time members.

DOE-IACMI signing June 17, 2015

IACMI 2.0: Relevant and Impactful

"With the advent of IACMI 2.0, there's been a broadening of the aperture," says Dan Beattie, Dassault Systèmes. "It's important to achieve broad-based energy goals — you have to take a whole-of-life approach."

One core objective for IACMI 2.0 is making composites more affordable. Reducing costs and improving efficiency requires both customer education and manufacturing advances. The industry must address misconceptions about composites' sustainability while developing radically new products and processes.

2018 Members Meeting | Michigan

'A Powerful Triangulation'

IACMI's tiered-membership model puts access to state-of-the-art equipment and top composites minds within reach for small, medium, and large organizations alike.

"IACMI brings together industry, universities and federal labs. That's what's truly unique — a powerful triangulation," says Joe Fox, FX Consulting LLC. Other members echo Fox's view:

"There's a fantastic collection of subject matter experts excited to talk about challenges and opportunities," says Adam Halsband, formerly with Forward Engineering North America.

"The meetings offer engagement across academia, manufacturing, materials suppliers, and technical experts," says Scott Farrisee, Polygon Company.

2020 Members Meeting | Ohio

"IACMI has found the secret sauce to connect people, create partnerships, and advance composites use," says Caio Lo Sardo, MITO Material Solutions. "As a small company, it's a great place to become part of the industry workforce and new materials developments."

Collaborating vs Competing

The IACMI members meeting attracts hundreds — not thousands.This cultivates a more intimate collaborative setting in which to tackle key issues, make meaningful connections, and learn about R&D, technologies and trends.

"It's about working together, even among competitors, to advance the industry," says Hicham Ghossein, Endeavor Composites.

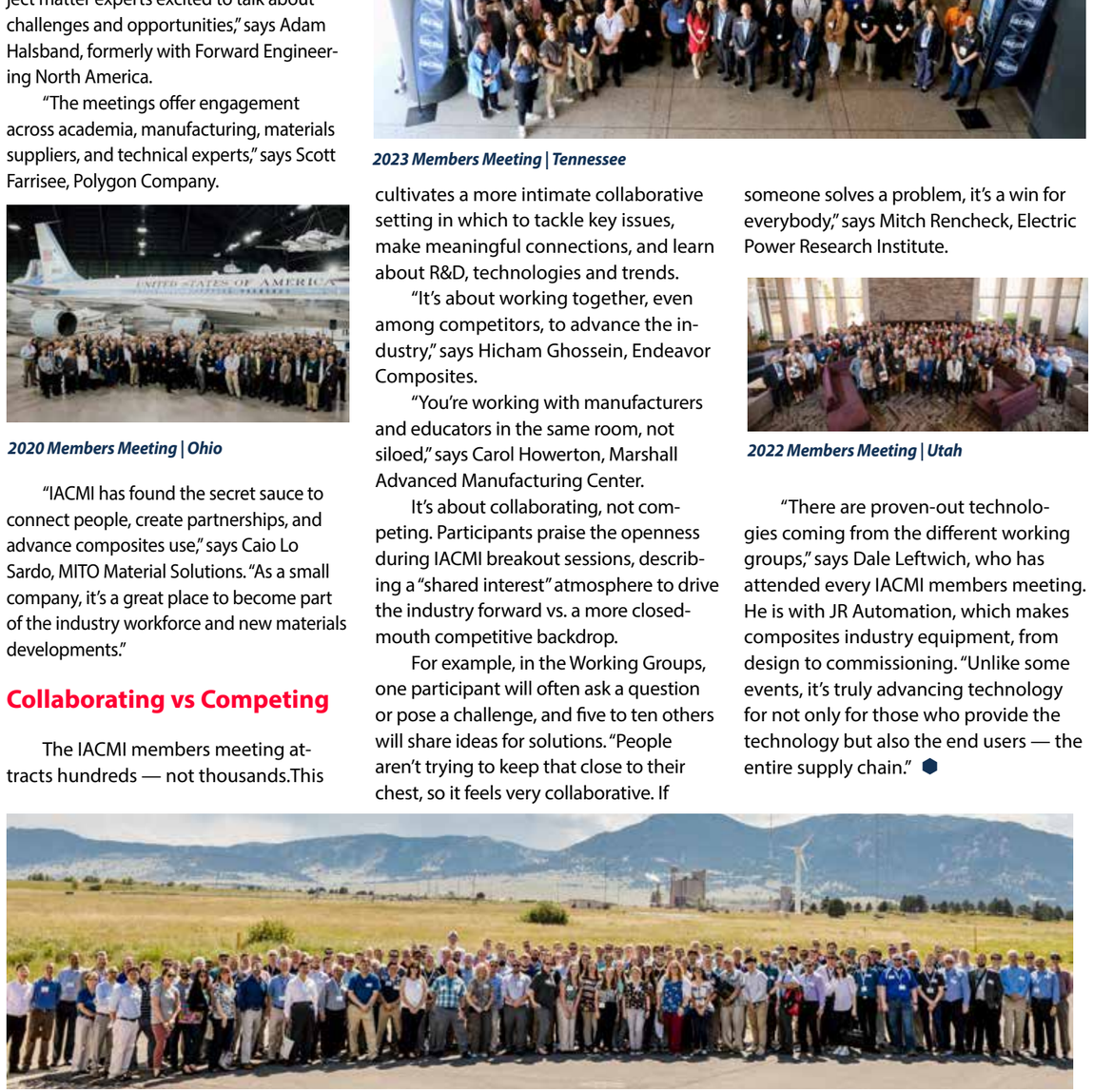
"You're working with manufacturers and educators in the same room, not siloed," says Carol Howerton, Marshall Advanced Manufacturing Center.

It's about collaborating, not competing. Participants praise the openness during IACMI breakout sessions, describing a "shared interest" atmosphere to drive the industry forward vs. a more closed-mouth competitive backdrop.

For example, in the Working Groups, one participant will often ask a question or pose a challenge, and five to ten others will share ideas for solutions. "People aren't trying to keep that close to their chest, so it feels very collaborative. If someone solves a problem, it's a win for everybody," says Mitch Rencheck, Electric Power Research Institute.

2022 Members Meeting | Utah

"There are proven-out technologies coming from the different working groups," says Dale Leftwich, who has attended every IACMI members meeting. He is with JR Automation, which makes composites industry equipment, from design to commissioning. "Unlike some events, it's truly advancing technology for not only for those who provide the technology but also the end users — the entire supply chain."



2019 Members Meeting | Colorado

A NETWORK OF INNOVATION

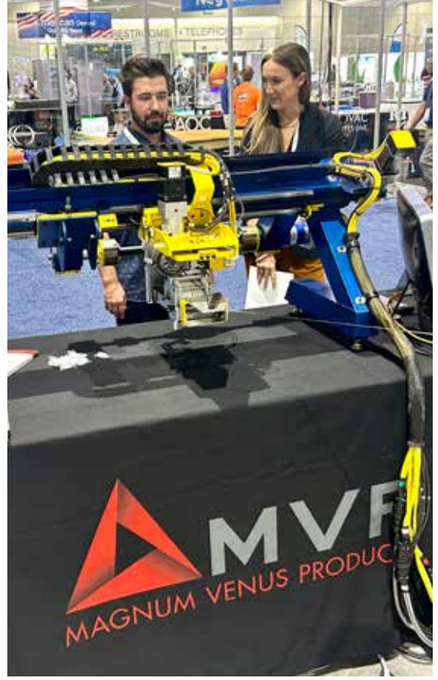
As a consortium of nearly 200 manufacturers, universities, national labs, trade organizations, and government agencies, IACMI harnesses the power of public-private partnerships to drive innovation, bolster domestic supply chains, and cultivate a skilled workforce to secure America as a global leader in advanced manufacturing.

AIRBUS
American Chemical Council
DASSAULT SYSTEMES
NORTHROP GRUMMAN
tpi
ABARIS TRAINING
ACMA
Advanced Structures & Composites Center
AGILE ULTRASONICS
ALAMANCE
ALIGNED VISION
ALEXANDRIA Technical & Community COLLEGE
AlphaSTAR
AUTODESK
ANOKA TECHNICAL COLLEGE
Appalachian Ohio AOMC MANUFACTURERS' COALITION
Applied Composites
ARKEMA
AvPro Technology Inc
AXEL
Baylor University
berndorf BAND GROUP
BLADE REPAIR ACADEMY
BOEING
BUSHING FOUNDATION
BRYAN CTEC
BEN BARBER INNOVATION ACADEMY
CALHOUN COMMUNITY COLLEGE
CAMBIUM
CAPE FEAR COMMUNITY COLLEGE
CARBON FIBER CONVERSIONS
CARBON RIVERS
CFR
CHAMPIONS
CHOMARAT
COLORADO Office of Economic Development & International Trade
CAG COMPOSITE APPLICATIONS GROUP
COMPOSITES ONE
CompositesWorld
Concordia FIBERS
CROWN PLASTICS
CRG
DEAKIN UNIVERSITY
DBTech
BAS
EarthEn
ECTC
ej
ENDEAVOR COMPOSITES
Environmental Living Industries
EPRI
get it right
ETEC
ExxonMobil
FIBREGLAST
FORWARD ENGINEERING
X47G
FREUDENBERG PERFORMANCE MATERIALS
FX Consulting
GEMINI GROUP
GEN2 CARBON
gm
GE VERNOVA
GrapheneTX
GREENE TECHNOLOGY CENTER
Harper
Hawkeye Industries
HELICOID INDUSTRIES INC.
Hennecke GROUP
HEXAGON
iCOMAT
IDI Composites International
IRSC INDIAN RIVER STATE COLLEGE
INDIANA BOLD
IsoTruss
iwa
JAMES CROPPER
JEC CONNECTING THE WORLD WITH COMPOSITES
JobsOhio
Joby
JR AUTOMATION A Hitachi Group Company
Krauss Maffei Pioneering Plastics
LAMAR UNIVERSITY
LITZLER DRIVEN BY RIGHT
LOCKHEED MARTIN
LYB LyondellBasel
LYTEN

ManufacturingUSA
AMVP MAGNUM VENUS PRODUCTS
ADVANCED MANUFACTURING CENTER
Michigan Technological University
McCLARIN
McCOY an Automate Controls, Inc. Company
MF MINIFIBERS
MICHELMAN
MICHIGAN ECONOMIC DEVELOPMENT CORPORATION
MILACRON
MISSISSIPPI STATE UNIVERSITY ADVANCED COMPOSITES INSTITUTE
mlp
Moldex3D MOLDING INNOVATION
MSC
NAWAH
NETZSCH
NORPLEX MICARTA
North Carolina Agricultural and Technical State University
NORTHEAST
NREL
OAK RIDGE National Laboratory
The Ohio State University CENTER FOR DESIGN AND MANUFACTURING EXCELLENCE
OSU
mobility
ORBITAL COMPOSITES
Orenco SYSTEMS
ORION
OWENS CORNING
PELLISSIPPI STATE COMMUNITY COLLEGE
PennState Behrend
PF DesignLab
plasmatreat
POLK STATE COLLEGE
POLYGON
PURDUE UNIVERSITY
RAMACO
REVOLIN SPORTS
RISE BUILDING PRODUCTS
Roane State
ROCTOOL
RTX
RTRC RTX Technology Research Center
sampe North America
ST. CLOUD STATE UNIVERSITY
SCHULER
SensThys
Shape Process Automation
SOLVAY
SOUTHERN UNIC
SOUTHWEST TENNESSEE COMMUNITY COLLEGE
SOUTHWESTERN ILLINOIS COLLEGE
STRONGWELL
Structural Composites
SUPERIOR
TEIJIN AUTOMOTIVE TECHNOLOGIES
TEIJIN CARBON AMERICA, INC.
Temper
TCAT KNOXVILLE
TN Department of Economic & Community Development
TEXAS A&M UNIVERSITY
THERMWOOD
'TORAY' Toray Performance Materials Corporation
TRANE TECHNOLOGIES
trimer
UAB
University of Dayton Research Institute
UF UNIVERSITY of FLORIDA
UK Center for Applied Energy Research
UMASS LOWELL
UNT UNIVERSITY OF NORTH TEXAS
THE UNIVERSITY OF TENNESSEE KNOXVILLE
U.S. DEPARTMENT of ENERGY
Valeo
VANDERBILT UNIVERSITY
vartega
VIRGINIA TECH
VITRIFORM3D
VOLKSWAGEN GROUP OF AMERICA
WABASH
WABASH CARVER
WEAV3D
Windlift
WINONA STATE UNIVERSITY
WSU TECH
Western Carolina University
WC Women in the Composites Industry
ZOLTEK Toray Group

70% INDUSTRIAL MEMBERS ARE SMEs

Economic Growth

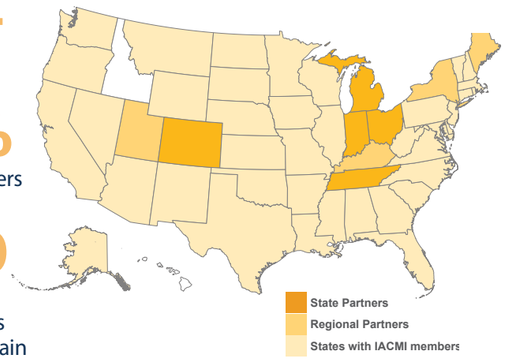


For 10 years, IACMI has implemented a formula that works. **Technical Innovation + Workforce Development = Economic Growth.** IACMI has catalyzed the creation of research-at-scale, production-relevant, shared spaces for innovation and workforce development. IACMI is a Manufacturing USA institute with a 170+ member community of industry, academia, national laboratories, and government agencies

170+
Active IACMI Members

>70%
Industrial members are SMEs

4,500
Professionals convened across industry supply chain



Benefits of Composites

- ✔ Enhanced Strength and Durability
- ✔ Lightweight and Stiff Performance
- ✔ Corrosion Resistance
- ✔ Aesthetics and Design Flexibility
- ✔ Versatility in Transportation, Energy, and Infrastructure

Advanced composites can make aerostructures lighter, cars safer, and bridges last longer.

"Discussions through IACMI trigger thoughts, help connect and formulate relationships. IACMI helped us understand customer pain points and the need for scale."

—Kevin Retz, NAWA America

NAWAH

Impacting Economic Development Across the U.S.

$400M Value of scale up facilities across 8 states

3,000 new manufacturing jobs announced

$150M in Research & Development value

Through investments in facilities across the country, IACMI has catalyzed shared spaces to scale up innovation and workforce development.

Success Story: Infrastructure of Innovation

2015 — DOE invests $70M to set up IACMI

2016 — CoMET opens at NREL

2016 — CMSC opens at Purdue

2017 — SuRF opens in Detroit

2019 — DoD invests $5M in ACCP

2020 — DoD invests $29M for ACE

IACMI supports 60+ R&D projects

2020 — IACMI members combat covid

2021 — BASF's Forward AM opens AMATC at SuRF

2023 — DOE invests $30M for IACMI renewal

2023 — DoD invests $29M for METAL

2024 — DOE awards IACMI & ORNL $2M for novel wind turbine technology

2025 — Innovation South & new IACMI headquarters open

Chad Duty and Jay Rogers (Local Motors), IMTS 2014

IGNITING THE *WHAT IF?*

How Technology Sparked an Institute

Ten years ago, a group of savvy engineers and machinists figured out how to 3D print the first drivable car in the world…in six days. That still boggles the mind, even though those innovators have long since moved onto other impressive feats. But that's just the start of the story. Printing a car is how they ignited the what if? What came next is the real story.

Go Big at IMTS

It all began when a small start-up Local Motors decided to 3D print a car called the Strati during IMTS 2014. The International Manufacturing Technology Show (IMTS) is the largest manufacturing conference in the western hemisphere. For a solid week, everyone who's anyone in manufacturing gathers to show up and show off.

A young engineer named Austin Schmidt in his first job at Caterpillar remembers it well. "I walked into IMTS and right in the lobby was the largest 3D printer I had ever seen, and they were printing a car. I thought, that's really cool, I want to do some of that." That was his moment of igniting the what if?

Within two years, Austin helped start a company focused on a service that commercializes large scale additive manufacturing (LSAM). Additive Engineering Solutions (AES) now has 24,000 square feet of manufacturing space in Ohio, recently hired their 21st employee, and offers a full range of capabilities to produce tooling, end use products, and large-scale prototypes.

Print it Right the First Time

But that's just one success story. Another young machinist named Eduardo Barocio at Purdue University saw that early LSAM technology at Oak Ridge National Laboratory (ORNL)—his igniting the what if? moment--and began working on digital simulation. Eduardo

IMTS 2014

knew as additive printing grew to make larger and larger products, figuring out how to "print it right the first time" would become even more important.

Once the Indiana company Thermwood helped machine the printed car at IMTS, they decided they needed to be in additive manufacturing, but it took them about four more years to buy into the need for digital twins. After three failed attempts at printing a particular part that cost $15,000 in material each time, Eduardo ran the simulation that produced a successful part. They've been on board ever since.

"You can't afford to do LSAM without digital twins," said Eduardo. "We need to shift from recipe-driven manufacturing to analysis-driven manufacturing, equipping engineers with all the information along the way."

Eduardo is now the director of the Composites Simulation Manufacturing Center (CSMC) at Purdue and is working with a consortium to make digital simulation an essential tool across all types of advanced manufacturing.

It was a Mindset Change

One of the group leaders from ORNL working on this project in materials development was Chad Duty. Up until that point, additive manufacturing was small and slow. As in, most projects were smaller than a basketball and took months to print. There was also a lot of warpage that happened, that meant they had to scrap a lot of work.

"Once we made the extruder longer, redesigned some components, and changed material suppliers, we had a solution that worked surprisingly well!" said Chad. "It worked so well that we finished the print within 48 hours and spent the rest of the show printing chairs that people used to sit and chat in front of Starbucks."

Looking back on printing that car, Chad realizes it had a profound impact on

Chad Duty, Members Meeting 2024

manufacturing and his own career path.

"It was a mindset change," he said. "We birthed an industry when it came to tooling. My colleague Lonnie Love liked to say, 'The car is the sizzle that gets people's attention. Tooling is the steak.' I've spent the last ten years working on that steak." As a professor at the University of Tennessee, Knoxville, Chad and nearly 50 students along the way have researched flow mechanics for polymer composites in additive manufacturing.

"I was so pleased to see this past February at JEC that nearly every composites booth was printing tools with the same technology we used to print the car. It's awesome to see it be so commonplace now."

Birthing an Industry and an Institute

But wait, there's more. At IMTS 2014, Chad and Lonnie decided to print another car—this time the famous Shelby Cobra. Within six weeks, they had not only produced a beautiful car; they had pushed technology forward. This project quantified energy efficiency of additive processes, improved techniques for surface finishes, explored new energy absorption processes, and proved the speed at which national labs can work.

Standing next to the Cobra on January 9, 2015, President Obama announced the creation of the fifth Manufacturing USA institute, IACMI—The Composites Institute®, with the goal of expediting composites technology to commercialization. By creating an ecosystem of academia, government agencies, economic development groups, and industry, IACMI was set on a mission to convene, connect, and catalyze. For ten years, IACMI has brought together as members

Eduardo Barocio, Purdue University

all these bright minds from Local Motors to AES, from ORNL to Purdue to work on R&D projects. Oh yeah, and now Chad Duty is the CEO of IACMI.

Whether it's through technical innovation or workforce development programs, IACMI continues to set the spark of possibility. By igniting the what if, we're focused on achieving the what's next.

Public-Private Collaborations

> *"IACMI has a collaborative culture that increases the speed of innovation."*
>
> —Steve Bassetti, Michelman

MICHELMAN

What happens when IACMI ***convenes, connects, and catalyzes***? Effective collaborations. Networking is the heart of IACMI's purpose, bringing together 4,500+ people through Members Meetings. IACMI members and its technical experts tackle the composites industry's toughest challenges through Working Groups focused on key sectors. Together, members forge partnerships, create new supply chains, and build an network of innovation.

IACMI has created an ecosystem where Small Medium Enterprises (SMEs) can thrive.

- ☑ Visibility, exposure to OEMs through projects
- ☑ Access to expertise and specialized equipment
- ☑ Help navigating the "valley of death"
- ☑ Cost-effective demonstration projects
- ☑ De-risking of new technology
- ☑ Validation of business models
- ☑ Recognition and awards

Relationships
Navigating the Valley of Death
Leads
Cooperative Competition
De-risking
Collaboration
Exposure
Networking
leveraging resources
Partnerships
New Opportunities

IACMI Working Groups

Robust model of involvement for members

High Rate Aerostructures Fabrication

Future Mobility/Vehicles Technology

Energy

Infrastructure and Construction

Composites Recycling

IACMI projects in large-scale additive technology have led to the world's largest 3D printed sculpture and fueled investments in additive materials, databases, software, and laboratories.

Success Story: Additive Manufacturing of Composites and Tooling

2016-2017 — IACMI project with ORNL and Local Motors enhances BAAM

2017 — ORNL 3D prints tooling with Techmer material

2019 — Techmer invests to expand 3D printing materials capacity

2019-2021 — IACMI project with Purdue, Techmer, Thermwood creates AM materials database

2020 — Allegiant Stadium installs world's largest 3D printed sculpture

2020 — Dassault Systemes co-locates at Purdue's CMSC

2021 — Purdue opens LSAM lab & forms CAMS consortium

2022 — Purdue begins licensing ADDITIVE3D software

2024 — Thermwood and Purdue demonstrate LSAM at JEC World

Kevin Bacon of Composites

From left: Ryan Spencer, Hicham Ghossein, Dustin Gilmer, Alex Stiles, Uday Vaidya, Pritesh Yeole, Vinit Chaudhary

Inspiring Entrepreneurs and Collaborations

"He encouraged me to do a startup. If he hadn't, I probably wouldn't have done it," says Pritesh Yeole, reflecting on his career journey. The "he" Pritesh is referring to —Uday Vaidya, aka the Kevin Bacon of Composites—has a knack for connecting talent and inspiring entrepreneurs.

"They're like free birds, honestly," Uday describes his latest graduate students starting their own businesses. "Even if a big company is good, there are always protocols that can hold you back. Now, they're free to explore and drive innovation. The more you reduce bureaucracy and red tape, the faster innovation can happen. Otherwise, you're killing it."

Uday would know because he's worn many hats during his career, keeping his finger on the pulse of industry and the cutting edge of innovation. He currently serves as Chief Technology Officer for IACMI and the University of Tennessee–Oak Ridge National Laboratory (UT-ORNL) Governor's Chair in Advanced Composites Manufacturing.

Perhaps giving graduate students space and confidence to be innovators is his secret sauce. In just the past few years, Uday has motivated at least six students to take their research to the next level: commercialization.

Power of the Ecosystem: Aligned Composites Technology

Uday's mentorship has been life-shaping for Pritesh: "He was the first person I met in the U.S." After getting his master's under Uday at the University of Alabama at Birmingham (UAB), Pritesh followed him to Knoxville to complete his PhD at UT.

Today, Pritesh and business partner Vinit Chaudhary are building Aligned Composites Technology (ACT). Together, they have 14 years of experience in composites and are reimagining technical nonwovens to make intermediate materials that are stronger, more affordable, and more sustainable. Their process takes recycled carbon fiber and natural fibers like coir and hemp—often in tangled, unusable states—and transforms them into aligned mats and yarns for use in products such as automotive interiors and cladding systems.

"There's fear in the unknown," Uday says, "but this generation is more open to risk. They're not entirely on their own—they have access to networks and support systems. They're not going to be out in the cold, even if it doesn't work out."

Network of Entrepreneurs: ThermaMatrix, Vitriform3D, Endeavor Composites

That network of support is a recurring theme among other entrepreneurs who have emerged from under Uday's wing: Hicham Ghossein of Endeavor Composites, Alex Stiles and Dustin Gilmer of Vitriform3D, and Ryan Spencer of ThermaMatrix to name a few.

In 2023, Ryan Spencer launched ThermaMatrix, a company focused on rapid inspection for manufacturing. Using non-destructive optical technology, his system is 10 times faster and costs a fraction of traditional X-rays—making advanced inspection more accessible across industries. It works on materials ranging from metals to composites, inspecting everything from aircraft wings to microscopic fibers. By identifying cracks and delamination early, ThermaMatrix could significantly improve safety in applications like fuel storage tanks.

Meanwhile, Vitriform3D, is pioneering the use of recycled glass powder and proprietary binders to create engineered stone through robotic 3D printing. Originally designed for the foundry industry, their equipment now opens doors to sustainable building materials that resemble quartz countertops.

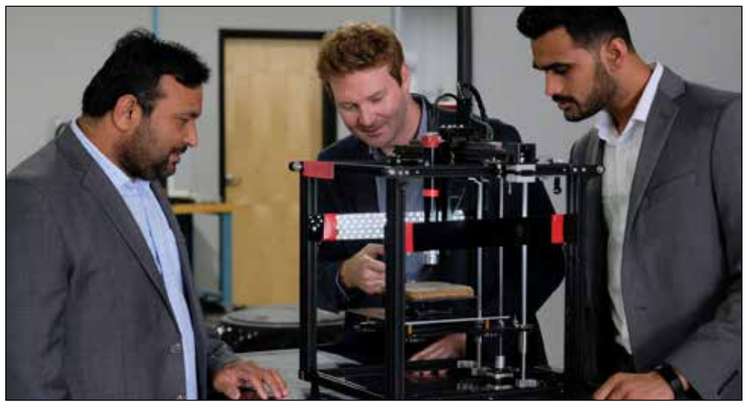
"What makes IACMI unique is that it connects us with both industry and academia," says Alex. "That's critical and a valuable network for commercializing our technology."

Also housed at the IACMI Collaboration Facility is Endeavor Composites, which has been producing high-performance, zero-waste nonwoven composites for five years. With a new wet-laid roll-to-roll line, the company is scaling up production of isotropic nonwoven fabrics. Founder Hicham Ghossein has built a customer base of 32 clients and has created eight jobs—five full-time, three part-time.

"IACMI has been instrumental in connecting us with suppliers, customers, and equipment," says Hicham, active in multiple IACMI working groups. "Being an IACMI member is the best investment we've ever made."

Beyond their individual growth, these companies are beginning to collaborate with each other. Between them, they're tackling hydrogen storage R&D, combining recycled nonwovens with 3D printing, and preparing a cladding panel from recycled glass and natural fiber composite.

Uday Vaidya's impact goes far beyond the research lab—over 32 years, he's empowered more than 10,000 students to be real-world problem solvers.



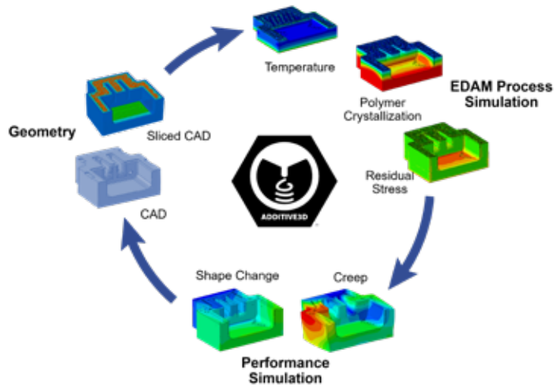
Entrepreneurship is Hard Work

Uday's influence extends well beyond technical mentorship. Over a 32-year teaching career, he's impacted more than 10,000 students.

For these entrepreneurs, he's gone beyond traditional support and has challenged them to be real-world problem solvers. Don't just envision it. Make it happen. He knows they're on a high risk, high reward path. Uday warns, "Entrepreneurship is hard, hard work. You start with a spark, it lights up quickly but many times, it dies away. You encounter financial issues or some glitch in the road. It's very easy to get demotivated."

Their road may not be easy, but they won't be alone. Behind them will be a quiet, humble mentor cheering them on with this important advice: "The value of innovation to benefit society is simply amazing, but determination to succeed is of paramount importance. Keeping that level of optimism is going to be very key. Everything else will fall into place eventually. You must believe in your cause."

Technical Innovation



Technical innovation has been central to IACMI's mission from the beginning, including investments in diverse, scalable composites manufacturing facilities across eight states. Our current focus is leveraging these resources to drive advancements in aerospace, automotive, and infrastructure projects to make energy more affordable, reliable, and secure.

60+ Collaborative and industry-led technical projects

90+ IACMI members participating on technical projects

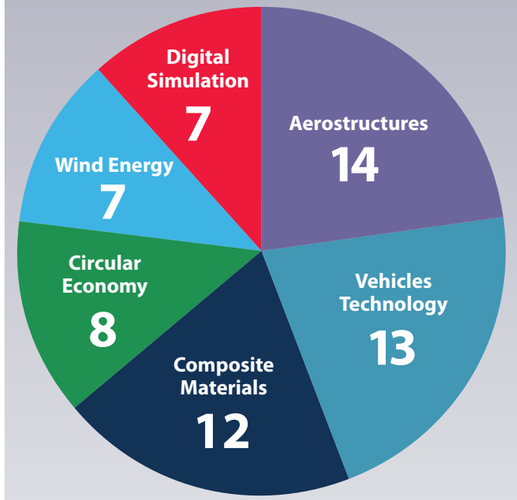
25 new products and technologies commercially available

$150M in research and development value

Saving Money and Improving Manufacturing with Composites

An IACMI-led project created a compression molded composite liftgate for the Volkswagen Atlas, reducing weight by 35% and recurring cost by 9% versus the steel baseline. Across 1.0 projects, IACMI achieved ways to reduce production costs of composites by 25% and 50% lower costs are projected in 2.0 projects.

IACMI 1.0 projects



> *"IACMI's SuRF facility gave us access to equipment and tooling we would never have been able to afford on our own."*
>
> —Andrew Maxey, Vartega

vartega

IACMI automotive projects have led to commercialized products and technologies used in Ford, Volkswagen, and Hyundai vehicles.

Success Story: Production of Composite Parts for Vehicles

2015 — IACMI launches project with Ford & Dow

2016-2019 — Ford & Dow qualify and use Vorafuse CF composites in Ford vehicles

2017 — IACMI/INEOS project develops carbon fiber/vinyl ester prepregs

2017-2019 — IACMI, VW and IDI develop lightweight SMC liftgate

2018 — Michelman launches Hydrosize Carbon product line for sizings

2020 — Volkswagen Innovation Hub Knoxville co-locates at UTK's Innovation North

2020 — IDI Composites commercializes Alluralite & Fortium SMC materials

2020-2022 — Volkswagen Innovation Hub supports improving paintability of SMC parts for Bentley and Lamborghini

2021 — Hyundai uses IDI's Fortium in Santa Cruz truck bed

2025 — Volkswagen Commercial Vehicles releases ID Buzz EV with composite liftgate for US Market

Composite Bridge, Morgan County, TN

Purpose: Demonstrate benefits of composite materials for rural bridgework, offering a solution for 50,000 crumbling bridges across America

Stats:
- Weight is 90% lighter, 16 ft long, 25 ft wide
- Bridge deck installed within hours in February 2021
- Projected to last 100+ years
- Data compiled for 4+ years shows a strong, durable, safe bridge

Technology: This bridge is made of fiber-reinforced polymer (FRP), a composite material that replaces the traditional concrete bridge. Corrosive resistant, modular pieces were made off-site and require minimal maintenance. Temperature and weight on the bridge are monitored by fiber optic sensors 24/7.

Key Partners: IACMI, Composite Applications Group, University of Tennessee, Structural Composites, Luna Innovations, McKinney Excavating, Steffen Structural Engineering, Neel-Schaeffer, Interplastic Corporation, Engineered Bonding Solutions, West System, Superior Fiberglass, METYX Composites, and Compsys, Inc.

*"What we value most about IACMI is the opportunity to connect with **new potential partners** and learn about their innovative technologies."*

—Tim Gaur, Airbus

*"IACMI has been really **critical to MITO's development through the relationships** and established trust we've been able to build across the composites supply chain. This is a very fragmented space, but through this membership, we are able to talk to big and medium sized companies, even small companies like ourselves."*

--Haley Marie Keith, MITO Material Solutions

*"IACMI is an important part of the **'ecosystem of innovation'** that has attracted companies like Airbus and Joby to Ohio."*

—Glenn Richardson, JobsOhio

*"Initially, we looked to bring composite materials into more traditional, industrial markets. Through networking and the vast knowledge of the composites industry that IACMI has brought us, it's allowed us to **penetrate those markets** and have commercial success."*

--Jeff McCay, Composite Applications Group

*"Two things come to my mind – the number of young people IACMI is equipping for the future and the technology the institute is developing. **Bringing the digital revolution into composites manufacturing** is timely and makes the whole process much more economically viable."*

--R. Byron Pipes, Purdue University

*"Since its inception in 2015, IACMI has transformed the composites industry by **driving innovation, fostering collaboration among diverse stakeholders, and prioritizing workforce development**. Its efforts have not only advanced cutting-edge technology but also paved the way for more sustainable manufacturing practices, ensuring a strong foundation for the industry's future."*

- Rani Richardson, Dassault Systèmes

*"IACMI creates a support network that I can lean on. Everybody is trying to work toward a common goal. Even though there are people who generally would be competitors, here they focus together on **advancing the industry** and finding projects that benefit everyone. That's what is beautiful about it."*

--Hicham Ghossein, Endeavor Composites

*"IACMI is what you get when you blend together leading academics, innovative businesses, cutting edge resources, a thirst for knowledge, and unbridled energy -- all fermented together inside a culture of healthy **"Competitive Cooperation**."*

-Tom Drye, Techmer, Orion

*"The students and interns who have been involved with IACMI and our technical projects will have a **'Ripple Effect'** in manufacturing for decades to come."*

- Doug Adams, Vanderbilt University

"When I think of IACMI and the impact it has had on the composites and advanced materials industry over 10 years, it really has been in the way they bring technology to the forefront and make it inclusive for all, from young people to those who are well experienced in their careers."

-Marcy Offner, McCLARIN Composites, Women in the Composites Industry

IACMI 2.0 Project: Smart Machining for Large Composite Structures

Purpose: This project will develop and deploy solutions for automating wind blade finishing operations--for cutting, grinding, and sanding--in domestic wind blade manufacturing facilities.

Goals:
- Reduce cycle time
- Lower manufacturing costs
- Eliminate hazardous conditions
- Improve productivity and energy efficiency
- Prove versatility for multiple large part applications in energy, vehicles, aircraft and infrastructure.

Technology: Building off prior IACMI-led projects since 2016, this "phase 3" research will deploy robotic automation techniques to make meaningful progress toward DOE's goals of improving the productivity and energy efficiency of U.S. manufacturing.

Key Partners: IACMI, National Renewable Energy Laboratory (NREL), GE Vernova

CROSSCUTTING TECHNOLOGY

From Sporting Goods to Aerostructures to Energy Storage

"What's unique about IACMI is that it has five different working groups all generating ideas and the 'what if' factor," says Kevin Retz of IACMI member NAWA America in Dayton, Ohio. "IACMI helps trigger discussions and facilitate collaboration across different industries, and I can talk to people in all those spaces." Multiple uses for cutting-edge technology. Multiple paths to success.

That philosophy of exploring crosscutting technologies for materials and processes has been a driving force for R&D at the University of Dayton Research Institute (UDRI). UDRI's Brian Rice, technical director for IACMI's High Rate Aerostructures working group, has been part of the journey for nearly 40 years. He adds, "IACMI's value is in bridging the innovation valley of death."

Take vertically aligned carbon nanotube technology (VACNT) that's been explored for about 25 years. On a molecular level, this specific alignment showed huge potential in material science across automotive, aerospace, defense needs, sporting equipment, and luxury goods. So, in 2018-2019, IACMI, UDRI, and N12 Technologies collaborated on a project to scale up VACNT in nano-enhanced consumer goods. The goal was to make bike wheels less likely to break.

In 2020, NAWAH Technologies now NAWAH, acquired N12 and set up NAWA America. They immediately joined IACMI to help grow a US footprint while developing the technology and customer base. Their NAWAHStitch product line became commercialized for use in Santa Cruz downhill mountain bikes. NAWAHStitch is a prepreg additive that makes advanced composites tougher, lighter, and more durable. A thin film containing trillions of carbon nanotubes, NAWAHStitch acts as a NANO Structural bridge within the resin layer reinforcing the weakest part of a composite laminate. These bikes were touted to improve shock impacts from rocks like nothing before and reduce wheel failures by 80%. But why stop at sporting goods? The next frontier for this crosscutting technology: aerospace.

Seeking to demonstrate the benefits of NAWAHStitch for eVTOL (electric vertical take-off and landing) aircraft, IACMI, UDRI, Teijin & NAWA America turned to aerostructures in their next project with VACNT. From 2020 to 2021, their overall objective was to see if there was value in adding NAWAHStitch to rapid-cure resin systems in the expanding sector of advanced air mobility (AAM). Their research showed ways to optimize energy efficiency through faster and stronger composite parts that were lower cost to fabricate and maintain. Specifically, composites made with VACNT met real-world specifications in uniformity and endurance by demonstrating successful de-icing for eVTOL propellers with a cost savings of at least 67%. Benefits like these led scientists to explore energy storage.

Thanks to renewed funding from the Department of Energy (DOE) in 2023, one of the first IACMI 2.0 projects is focused on VACNT for cryogenic hydrogen storage. If Airbus is going to build a hydrogen-powered commercial airplane by the late 2030s, they'll need a technology that makes hydrogen storage safer. Since conventional composites microcrack and leak hydrogen, VACNT could be the solution they're looking for in conditions with extreme temperatures. IACMI, UDRI, NAWA America, Airbus, and several other partners are ready to tackle this challenge in ground transportation first, with the ultimate goal of commercialization for aircraft.

Retz confirms his customers today are looking for two things: a stable supply base and cost. "IACMI has helped us understand customer pain points and the need for scale," he says.

IACMI is here to accelerate the journey from lab to market, to turn pioneering research into real-world impact, not just in the future but now.

IACMI DOE 2.0 Project: Advanced Composites for Cryogenic Hydrogen Storage, Dayton, OH

Purpose: To use hydrogen as a fuel replacement, improving ways to store and transport liquid hydrogen is key. Since conventional composites microcrack and leak hydrogen, another option could be a solution: vertically aligned carbon nanotube technology (VACNT).

Goals:

- Build off prior projects that have scaled up production and lowered costs of VACNT
- Explore the benefits of a commercially available additive, NAWAHStitch, for energy storage
- Enable CO2 free aircraft and replace heavy batteries in eVTOL

Technology: The intent is to develop an optimized prepreg material modified with VACNT to minimize hydrogen leakage in storage tanks. This project will focus on material evaluation through laminate level and coupon testing.

Key Partners: IACMI, University of Dayton Research Institute (UDRI), Airbus, NAWA America, Teijin, and Joby Aviation

IACMI projects in sporting goods & eVTOLs have led to a commercialized additive benefitting aerostructures and energy storage.

Success Story: Crosscutting Technologies and Job Growth in Ohio

2016 — JobsOhio commits up to $5M in UDRI—IACMI projects

2018 – 2019 — UDRI-Globe Composites Technology Center w/ RapidClave® locates in Dayton, OH

2018 – 2019 — IACMI / UDRI / N12 for project scales up VACNT for production of nano-enhanced consumer goods

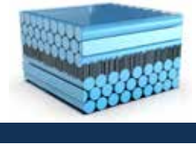
2019 — ZSK tailored fiber placement machine supports multiple IACMI projects

2020 — IACMI creates High Rate Aerostructures working group

High Rate Aerostructures Fabrication

2020 — IACMI leads demonstration projects of RapidClave® with new rapid cure epoxy prepreg

2020 – 2021 — IACMI, UDRI, Teijin & NAWA America project validates NAWAHStitch for eVTOLs



2021 — NAWAHStitch is utilized in Santa Cruz world champion winning mountain bike wheels

2024 — NAWA America announces plant in Ohio to be completed by 2026

NAWAH

2025 — IACMI, UDRI, NAWA America, Teijin, Joby & Airbus launch project on nano-enhanced hydrogen storage

Workforce Development

ACMI's WD programs build a robust talent pipeline from "K to gray" for U.S. advanced manufacturing. Through STEM events, workshops, online courses, and hands-on training, IACMI inspires and educates students about advanced careers in composites (ACCP), CNC machining (ACE), and casting & forging (METAL). We're preparing and connecting next generation machinists and engineers to further education, internships, apprenticeships, and rewarding careers.

> ***"I sought to get everything I could out of my internships, and I feel I'm a strong example of those efforts paying off."***
>
> —William Henken, Volkswagen
> VOLKSWAGEN GROUP OF AMERICA

15,000+
Online training in all 50 states

5,500+ Hands-on advanced manufacturing training

100 Internships with industry collaboration

18,300+ Students engaged in STEM Outreach

Through internships, workshops, outreach engagements, and hands-on training, IACMI has created a pipeline of talent from K to Gray for advanced manufacturing.

Success Story: K-Gray Training in Advanced Manufacturing

2016 — Internship program 1.0 begins

2017 — Composites One workshops begin

2019 — $5M MEEP award for ACCP

2020 — UT Professor Tony Schmitz launches IACMI-ACE online training

2021 — ACE testbed at UTK for hands-on CNC training

2023 — SkillCrafters 1400+ for grades 6-12

2023 — InnoCrate pilot, 2000+ K-12

1000+ trained in composites through ACCP

2024 — METAL launches bootcamps, workshops, outreach, & apprenticeships

2024 — InnoCrate wins CAMX ACE award

2025 — Internship program 2.0 begins

Revitalizing America's Manufacturing Workforce

Training Programs led by IACMI

IACMI cultivates best-in-industry workforce development programs that scale up and connect regional programs to meet the national manufacturing agenda. Supported by the Department of Energy (DOE) and Department of Defense (DoD), IACMI brings together diverse stakeholders and partners in advanced manufacturing. We support training through a variety of programs that create accessible pathways to learning and employment opportunities for everyone.

IACMI Internship Program

Through the IACMI Internship Program, supported by DOE, more than 100 undergraduate and graduate students from across the U.S. have used state-of-the-art manufacturing equipment and interacted with scientists and engineers who are at the top of the advanced composites and manufacturing fields. Over five years, 100 percent of IACMI interns either graduated with a job offer in industry or an acceptance into a graduate program.

- 100+ College Students Trained

Advanced Composites Career Pathways (ACCP)

A shortage of skilled laborers led to the creation of ACCP, which offers training programs with national standards in locations central to the DoD manufacturing supply chain. ACCP prepares current and next generation manufacturing workers through select two-year colleges to produce military systems and components that assure defense technological leadership.

- 1000+ Young Adults Trained

SkillCrafters

SkillCrafters is a "Shark Tank" style program developed by IACMI to engage middle and high school students to brainstorm real products using composites that can solve challenges they encounter in their daily lives. Students learn about advanced composites materials and their processes through classroom curriculum, videos and field trips to meet educational and industry specialists.

- 1400+ in Grades 6-12 Trained

America's Cutting Edge (ACE)

ACE is a national workforce initiative created by DoD to restore the prominence of the U.S. machine tools sector. The training focuses on Computer Numerical Control (CNC) machining fundamentals for both metals and composites but is geared towards anyone interested in manufacturing, from high school students searching for a career to experienced machinists looking to expand their skills.

AmericasCuttingEdge.org

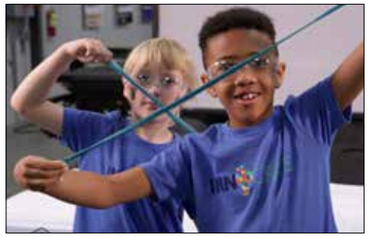
- 15,000+ Online Trained
- 3,500+ In-person Trained

Metallurgical Engineering Trades Apprenticeship & Learning (METAL)

METAL is an industry-led, hands-on program created by DoD to strengthen and diversify the U.S. metal manufacturing workforce, focusing on casting, forging, and plate rolling. Through a national training network, METAL delivers stackable, industry-aligned learning pathways from K-12 outreach to apprenticeships and certifications, empowering the next generation of innovators and builders.

MetalforAmerica.org

- 555 Online Trained
- 421 In-person Trained
- 4,260 Outreach Engaged



InnoCrate

InnoCrate is a composites-based STEM kit designed to spark curiosity in K–5 students and build foundational skills for careers in composites and advanced manufacturing. Developed by UT and distributed by IACMI, each pre-packaged, standard-aligned kit includes all the supplies needed for experiments that will inspire the next generation of engineers and makers. **InnoCrate.org**

- 2000+ K-12 Students Trained

Industry Workshops

In partnership with Composites One and Magnum Venus Products, IACMI has supported more than 10 two-day workshops to share cutting-edge products and techniques to workers in the wind, boating, automotive, and aerospace industries.

- 1000+ Incumbent Workers Trained

Manufacturing Day

Did you know Manufacturing Day is the first Friday in October every year? It was started in 2012 to show students, parents, and the public what modern manufacturing is all about. IACMI has hosted Manufacturing Day events spotlighting composites, CNC machining, and casting & forging in Indiana, Michigan, New York, Tennessee, and Utah.

- 15,000+ K-12 Students Engaged

The Ripple Effect

Workforce Development from IACMI Internships to Incredible Careers

Workforce Director Joannie Harmon with 2018 interns

"The students involved with IACMI projects will have a ripple effect in manufacturing for decades to come." That's Vanderbilt University professor Doug Adams, talking about the exponential impact from IACMI's internship program from 2016 – 2020. We agree and have great stories to back that up.

Jessica's Pivot

Let's start with one of those bright minds, Jessica Lavorata. Finding the right fit between industry and academia is something she knows well. Jessica's IACMI internship in 2017 was at the National Renewable Energy Laboratory in Colorado. She had never lived that far from home, but that was a big step she's glad she took.

Over the next five years, knowledge gained from the 9-meter wind blade research project helped increase Technology Readiness Levels for companies that now manufacture 62-meter blades. NREL and IACMI have had several follow-on R&D projects and are now exploring automation techniques aimed at boosting U.S. wind blade production.

Jessica remembers presenting about fabricating wind turbine components at an IACMI Members Meeting. In one of the sessions, she sat next to a member who listened to her experience and asked about her interests for what's next. He then introduced her to R. Byron Pipes and Johnathan Goodsell at Purdue University. She already had a job offer in aerospace but turned that down to pursue her PhD at Purdue, finding the best of both worlds in her research.

"My thesis focused on high-rate manufacturing of thermoplastic composites in an Industry 4.0 setting," explains Jessica. "Funded by Ford and DOE, the goal was to create a cost-effective lightweight composite structure for electric vehicles."

After finishing her degree, she debated between going into industry or academia. She struggled with, "How do I choose to shape my future? I landed on people vs products that I could have the most influence on. Being able to teach students and get them passionate about something and see what they could do with their lives was my answer."

Jessica is now an assistant professor of engineering at Carthage College in Wisconsin, helping launch a new engineering program and inspiring the next generation.

Internships are more than short-term opportunities—they build the foundation for decades of industry innovation. It's a chain reaction that's a win-win-win. Since 2016, IACMI has placed 100 interns with industry collaboration with 100% securing jobs in the industry or graduate placements. Through DOE partnerships and mentorship programs connecting 1.0 and 2.0 interns, IACMI is proud to continue sparking careers—and creating ripple effects that stretch far into the future.

Trent's Flight

An industry that attracts many to composites is aerospace. That's what drew Trent Bullman for his year-long IACMI internship from 2018 to 2019. By working with a smaller company in Knoxville, he honed a variety of skills.

"Not only did I learn more about composites, but I gained valuable insight into the daily tasks and time management of engineers in the workplace," says Trent. After graduation from the University of Tennessee, he took a job with GE Aerospace and joined a smaller cohort of engineers focused on composites.

For nearly six years, he's rotated jobs within the company every 18 months to gain a broad idea of how they're accomplishing their mission: "future of flight." He was also able to earn a master's degree from one of IACMI's core partners, the University of Dayton Research Institute, while working for GE. Each time he sees new challenges, he's grateful to have a network of experts to tap into that started with IACMI.

Kylie's Full Circle

Not everyone who works in composites has that as a goal early on. Take Kylie Van Aken, who had a rewarding IACMI internship at Vartega in Denver, but then decided to pursue the Peace Corps. She was in Sierra Leone, West Africa, when the pandemic hit and was ordered home. That's when she returned to Vartega fulltime and has been there ever since.

"IACMI and Vartega opened so many doors, allowing me to become a project leader, attend industry events, offer client-facing solutions, and present my work," Kylie says. "I'm confident in my impact on the composites industry in a global capacity."

As a quality manager and mechanical engineer for Vartega, Kylie performs tests to optimize the post processing of carbon fiber recycling. She's been part of their journey from proof of concept and producing 20 kilograms a week to producing 2,000 kilograms a day. She's even on one of their patents. One of the most meaningful areas for her has been her full-circle growth from intern to mentor.

"I first learned about composites over coffee with a mentor named Alice," she says. "She told me about Vartega and encouraged me to apply for the IACMI internship. Fast forward a few years and now I'm having coffee with a Vartega intern named Kendall. She went on to work for a defense contractor designing rockets." Kylie embraces the role of paying it forward.

William's Drive

William Henken has participated in IACMI since 2016 across varied roles, starting as an intern attending Summer Members Meetings, being an IACMI ambassador advocating workforce development, serving in the IACMI Future Mobility/ Vehicles Technology Working Group, and now participating as an industry member on behalf of Volkswagen Group of America.

William took advantage of multiple IACMI internships at various locations, including Purdue's Composites Modeling and Simulation Center and Local Motors in Knoxville, which was 3D printing a self-driving bus in 2018. Hendrik Mainka, senior project lead at Volkswagen, says he met William through an IACMI project and "stole him" to work in the Innovation Hub of Knoxville as a Volkswagen PhD Fellow.

William's education and experience range from aerospace to automotive to civil engineering. The common thread is research in structural aspects of composites, and he's grateful for how internships gave him a taste for a variety of areas early on.

"Internships are vitally important to developing the marketable skills employers are looking for," William says. "As an IACMI intern, I was able to explore the composites industry and realize my interest in it before pursuing a career path."

MEET IACMI 2.0 INTERNS

Merritt Alspaugh

Hometown: Anna, OH

School: Purdue University

Major: Aeronautical & Astronautical Engineering, Junior

Member Internship: Cornerstone Research Group, Dayton, OH

Internship Highlights: "I began working on battery technology R&D, but I am transitioning into aerospace. Trying out novel ideas to new problems and being able to pushing the limits of what we know has been exciting and very educational."

Fun Fact: "I love to cruise around on both my regular and electric longboards"

Kylie Corvin

Hometown: Murfreesboro, TN

School: University of Tennessee, Knoxville

Major: Biomedical Engineering, Senior

Member Internship: Endeavor Composites

Internship Highlights: "I'm producing composites through varying processes, including the novel wet lay, to collect material properties data. I most recently began working with carbon fiber for the first time. It was very interesting to learn the different methods of naming for each type of carbon fiber."

Fun Fact: "I am a raft guide! I work on the Chattooga River during the summer."

Ryan Burden

Hometown: Springboro, OH

School: University of Dayton

Major: Mechanical Engineering, Freshman

Member Internship: Cornerstone Research Group

Internship Highlights: "I'm working mainly on high-flow additive manufacturing. The coolest moment of my internship was successfully printing parts over 6 feet tall."

Fun Fact: "I'm an avid beekeeper."

ACE America's Cutting Edge

SUCCESS STORIES

Macrae Alford
Trained at Texas A&M TEES
Job growth: from plumber to manufacturing specialist, Wolfram Manufacturing; 25% increase in pay

Ashley Egenti
Trained at University of North Texas
Job growth: from college student to engineer at Lockheed Martin

Colton Simpson
Trained at Indian River State College, Florida
Job growth: from Marine veteran to CNC machinist, Pace Machine & Tool

Liz King
Trained at Marshall Advanced Manufacturing Center, West Virginia
Job growth: from college student to trainer for ACE program in Ohio

Robert Chavez
Trained at Texas A&M TEES
Job growth: doubled pay after taking ACE, machinist at NRAO/VLA in New Mexico

Alyssa Byrd
Trained at Texas A&M TEES
Job growth: from college student to production manager, Wolfram Manufacturing

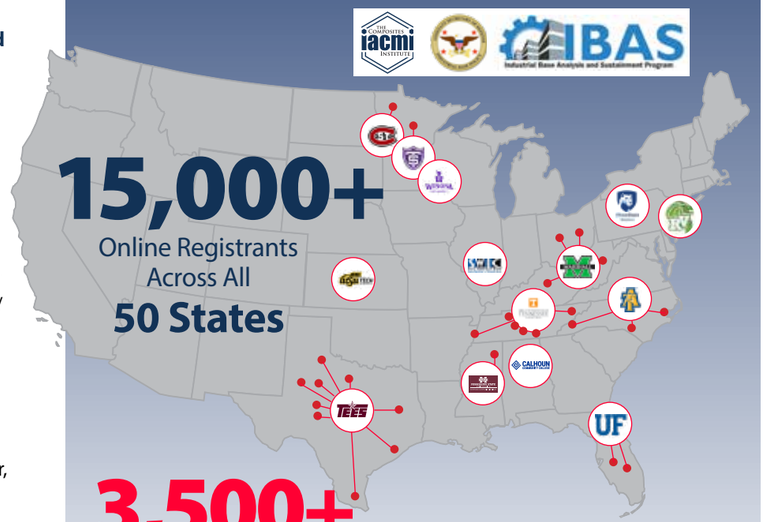
Justin Dendy
Trained at North Carolina A&T
Job growth: from Army veteran to trainer for ACE program in North Carolina

Why Industry Values ACE:

"It saves you money. I went through the routine of advertising and interviewing people. It wastes time. When I go to the school and hire someone out of the ACE program, they're ready to go."
— Monica Dirr, owner of Pace Machine & Tool in Florida

"I see ACE as a recruiting tool. We have an apprenticeship that this could serve as a pipeline to."
— Chance Henke, workforce development manager at Seyer Industries in Missouri

"We've transitioned into developing and growing our own machinists. People that show a good work ethic get opportunities to start training as CNC machinists. What ACE has done for us is give a leg-up to their training and accelerate their exposure. We see it as beneficial for our new machinists or those who show promise to become machinists."
— Craig Barhorst, director of operations at Mayday Manufacturing in Texas



71% of those who complete online training also complete in-person training.

METAL Metallurgical Engineering Trades Apprenticeship & Learning

From Polymer to Powerhouse

Walt and Janelle Jaeger, the dynamic husband-and-wife team behind **Jaeger Technology Group**, are no strangers to innovation. With more than 16 years of experience in 3D printing across industries ranging from medical to aerospace, Walt recently made a bold decision: to stop working for others and build a business on his terms. Today, Jaeger Tech Group in the Huntsville / Birmingham area of Alabama is not only pushing the boundaries of additive manufacturing but also becoming a key player in reshoring American manufacturing, modernizing legacy practices with automation, and contributing to the national defense supply chain.

Their journey recently took a pivotal turn when the couple joined the METAL bootcamp at the University of Tennessee, Knoxville, becoming the first industry professionals to participate in the program. What happened next was transformative.

"Everything they showed us in the class, we went right back to a couple hours later and began applying," Walt said. "In the last several weeks, we've managed to find $20K worth of work since we participated."

Walt is clear that METAL played a key role in this evolution. He emphasized the practical nature of the training—applicable immediately to real-world projects—and praised the program's impact on inspiring the next generation.

"We were the only business owners at the bootcamp, but what's exciting is that we have young people looking at this," he said. "They don't have to work at large foundries; you can have little casting shops like the one I have that do very small parts and probably be very successful."

4,260	Direct Engagement at Outreach Events
445	In-Person Workshop Participants
620	Online Registrants
108	In-Person Bootcamp Participants
36	Interns Placed
15	Pre-apprentices Placed
21	Apprentices Placed

"The shrinking supply chain for critical defense materials demands an immediate response. We must rebuild a modern workforce, technologically adept and capable of meeting the demands of our defense industry with efficiency and innovation."

-Dr. Matthew Draper, Technical Director of Metallurgy and Manufacturing at Office of the Secretary of Defense

New IACMI Portable Teaching Tool Transports Composites Education Kits to Classrooms

"You can see their eyes light up when they learn about something new. Aha, it happened!" shares Vanina Ghossein, her own face beaming. Her enthusiasm for a new curriculum she has helped develop around composites for K-12 is palpable. "I love everything about it--from planning an activity, looking for materials, deciding how students should do it, and seeing the sparks in their eyes for the first time."

IACMI – The Composites Institute® couldn't have a better champion for InnoCrate℠.

What are InnoCrate Kits?

InnoCrate kits are carefully curated educational tools that allow students to explore the science and engineering behind composite materials and manufacturing processes. They're divided by age levels and filled with everything a classroom would need for a set of hands-on activities. Each kit has 12-18 lessons that can be done over time and has a mix of reusable and consumable items.

The goal is to extend educational opportunities to schools that otherwise might miss out due to lack of resources. It's also designed to address the need for job skills in composites and advanced manufacturing in general by introducing students to these ideas early.

"Composite materials are used in everything from aircraft to automotive to sporting goods," says Dr. Uday Vaidya, the brainchild behind this project. Uday serves as IACMI's Chief Technology Officer and the UT-ORNL Governor's Chair for Advanced Composites Manufacturing. "But even at the college level, composites usually don't get that much attention. Every student who works with an InnoCrate will make that connection much earlier to how we use composites every day."

By partnering with educators, engineers, and industry experts, IACMI and the University of Tennessee (UT) collaboratively ensure each kit is grounded in real-world applications and aligned with future job skills in STEM. InnoCrate is supported and deployed by IACMI to spark curiosity and build a strong foundation in materials science and engineering at the K-5 level.

Piloting InnoCrate Kits

Since January 2023, Vanina and her team of UT engineering students have been researching, developing, and piloting these experiments with more than 500 elementary students. Dedicated STEM teacher Jessica Reiner at Beaumont Magnet Academy watched it all and emphasizes why this approach is needed.

"It's so much easier," says Jessica. "Sometimes the hardest part is getting the materials. We don't have big budgets; many teachers spend their own money and time getting these materials. The more readily available something is, the more likely we can implement it."

Working across multiple grades, Jessica sees how these experiments are helping develop necessary skills beyond science. "Abstract thought can be tough, using their imagination," she adds. "Some have physical limitations like dexterity. That's why I like this playdough activity because it strengthens their finger muscles to help them with writing."

Perhaps even more important is simply planting those motivating seeds that science is a way to make processes better and improve everyday life. That's why UT biomedical engineering junior Jordan Oxendine is volunteering at Beaumont. "They're SO CUTE! This is where I fell in love with STEM, in elementary classrooms, doing crafts like these. I want to help the next generation find that, too."

Instructor Romeo Fono Tamo agrees. "The younger ones reacted 'WOW!' all the time. The older ones were thinking more and seemed to appreciate what we were bringing to them."

Third grader Alice has decided she likes the slime best. "It's so cool how it changes color! It's just satisfying how you can turn it from purple to pink with the heat in your hands. If you stop touching it, it won't stay pink." This is the first step in learning about thermodynamics and how temperature and mixing can be key to a material's properties.

Her classmate Eloise was more taken by the homemade car powered by a balloon. "If you give it a source of energy, it can move itself," she observes. "Today I learned about parts of a car, like the axle. I might want to be an engineer. I don't know." Composites are set to make a big impact in the automotive industry, especially as EVs must become lighter and stronger. Could Eloise be a mechanical engineer in the making?

Faces Tell All

One thing is for certain: their faces tell all! Excitement and disappointment. Vanina admits she lets them make mistakes. "If they build the car incorrectly, put the wheels on upside down or wind the rubber band the wrong way, it won't move. It matters how you build something." But when they are they figured out the secret of the world, like they've done something important."

As Vanina reflects on her own journey as a former special education teacher in Lebanon or envisions what lies ahead for her 3 and 7-year-old daughters as second-generation immigrants, she gets emotional. "I came from a country where these opportunities were not there. I was fortunate to have supportive parents, but I can't remember a year living in Lebanon when there was no explosion or war since I was born. Even here in the U.S. there are kids who don't have it easy. This is why I want to reach as many kids as possible. These kits are important because not all the kids have the same opportunities to learn. Not only are we teaching them science, but we're also giving them hope. Assuring them, you can do wonders!"

What will you do with an InnoCrate?

- Make silly putty and color-changing slime from scratch
- Build an air-powered car
- Explore 3D printing
- Drop an egg in a parachute to explore physics
- Build the Eiffel Tower
- Learn to spin fiber on a spindle

InnoCrate wins "Infinite Possibility for Market Growth Award" at CAMX 2024

Leveraging Resources

IACMI has helped members leverage resources in two ways. The first is empowering them with access to equipment, facilities, and expertise they would not otherwise have. The second is enabling companies, universities, and national labs to secure additional funding, building on innovations and resources facilitated by IACMI. Early investments from the Department of Energy paved the way for the Department of Defense to establish critical, scalable training programs in CNC machining, casting, forging, and of course, composites.

> *"IACMI is a vital asset for any company looking to grow their business needs in composites."*
>
> — Dale Leftwich, JR Automation

JR AUTOMATION
A Hitachi Group Company

Catalyzing Additional Funding

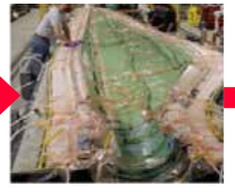
IACMI Member Recipients	Source of Funding	Amount ($M)
Workforce Development (ACCP + ACE + METAL)	DoD	69
R&D $ for universities (Purdue + UTK + UDRI)	NSF, CERN, DOE, DoD	53
R&D $ for federal labs (ORNL + NREL)	DOE	36
Investment in new manufacturing facilities	TPI	25
Investments in startups and SMEs	Innovation Crossroads, Diamond Edge Ventures	17
R&D $ for industry (Ford + GM + SuRF)	DOE	15
Total		**$215M**

Access to equipment, tooling, & expertise at NREL has accelerated the Technology Readiness Level (TRL) for wind blade manufacturing and resulted in additional R&D funding.

Success Story: Manufacturing of Recyclable Thermoplastic Wind Turbine Blades

2016 — NREL demonstrates technology at 9-meter length (TRL 5)

2018 — NREL fabricates 13-meter thermoplastic blade (TRL 6)



2019 — NREL completes validation testing of 13-meter blade (TRL 7)

2022 — LM Wind Power scales thermoplastic blade technology to 62 meters (TRL 8)

A Vision Becomes an *Impactful Community*

Not long after IACMI's founding, Dale and Kelly Visconti (inset) —then IACMI's first DOE Technology Manager—took in a memorable view from 100 meters up atop a utility-scale wind turbine at the National Renewable Energy Lab near Boulder, Colorado.

IACMI is a Global Force in Composites Innovation

For decades, the U.S. invested in advanced composites for defense and aerospace applications, achieving world leading performance with limited adoption in other markets. Concurrently, other countries invested in infrastructure and innovation for composites in high volume, cost sensitive applications such as ground transportation and energy generation.

Following several years of ideation, requests for information, and workshops, the Department of Energy (DOE) issued a Funding Opportunity Announcement in 2014 for the creation of a U.S. manufacturing institute dedicated to advanced composites to serve industrial market applications, with a focus on reducing cost and energy consumption, and fostering new methods to recycle composites.

Led by the University of Tennessee and Oak Ridge National Laboratory, a stellar proposal team was assembled, including leading research universities in composites - Purdue, Michigan State, University of Dayton Research Institute and Vanderbilt – and the National Renewable Energy Laboratory. Key industrial partners were added to the team to ensure the proposed institute would be relevant and focused on addressing the technoeconomic barriers to composites adoption in large volume applications. Foreign institutes were visited as benchmarks, and numerous stakeholders interviewed to identify core technology gaps and needs.

The team developed a vision for IACMI, focused on creating a network of regionally located, open access facilities for innovation. Equipped to manufacture composite materials and parts at multiple scale from test panels to automotive floors to wind turbine components. Testing capabilities for coupons to full assemblies. Expertise to resolve issues involved with scaling for both production rates and part size, including staff with industrial experience to complement deep scientific understanding of composites. Opportunities to validate promising technologies and develop the next generation workforce of engineers and technicians.

On January 9, 2015, the White House and DOE announced that the IACMI team had successfully won the competition to lead the new institute. Following an agreement signing in Knoxville on June 17 of that year, we began operations.

Significant investments were made in expanding technical capabilities and investments continue to be made to push innovation. Early on, we committed to supporting science, not just science projects. Well over 60 industrially driven technical projects have been completed, and new products have been introduced.

Yet IACMI is more – much more – than a collection of buildings, equipment and experts. Beyond the formal projects, IACMI created a community where companies of all sizes could discover each other, find common interests and go off to do business with each other, without any external funding. I believe this is at least as important as the many successful funded projects over the years. The IACMI Consortium, nearly 200 strong, includes industrial companies, from startups to large multi-nationals and academic institutions providing both workforce development and specialty research support. It also incorporates local, state and national government entities supplying co-funding and essential guidance to the IACMI mission.

My own experiences as part of IACMI have been very memorable. Shortly after our founding, I had the opportunity to stand atop a utility scale wind turbine at the National Renewable Energy Lab, 100 meters above the ground. With me was Kelly Visconti, IACMI's first DOE Technology Manager. Always a manufacturing guy, I got my hands dirty helping build the first 9-meter demonstration wind blade using Arkema's novel thermoplastic resin, which was later scaled to 13-meters and fatigue tested, also at NREL. I witnessed 3D printing of Local Motors OLLI autonomous shuttle, and the molding of lightweight liftgate components for Ford and VW at the Scale-up Research Facility (SuRF) in Detroit. I've been to multiple ribbon cuttings, including the SuRF, the CoMET facility on the Flatirons Campus near Boulder, , the Composites Manufacturing and Simulation Center (plus two expansions) at Purdue, and the Fibers and Composites Manufacturing Facility at Innovation South at the University of Tennessee. We've also supported ribbon cuttings and grand openings at multiple IACMI members, including MITO Materials, Vartega (twice) and IDI Composites.

Dale has made it a habit traveling the country – and abroad – boosting IACMI's reputation and global reach, including trade conferences and member and partner groundbreakings, ribbon cuttings and expansions. (Shown here in Colorado, Indiana, and at JEC in Paris.)

Our member meetings are unique events. As a national institute, we move our meetings around the country. We spotlight the technical work we are doing in concert with industry, highlight our student interns and other workforce efforts, and feature small and medium companies looking to connect with each other and much larger companies. When the stage presentations and workshop activities end, our evening networking receptions have become legendary. Imagine having sole occupancy of the Indianapolis Motor Speedway, replete with four professionally driven race cars ferrying our members around the 2.5 mile oval at speeds up to 150 miles per hour. Did that. We've had private access to multiple museums, including the amazing Henry Ford in Michigan, the National Museum of the U.S. Air Force in Ohio, and the Utah Museum of Natural History. Add in the Women's Basketball Hall of Fame in Tennessee and the Indianapolis Zoo, and all these venues provide both learning experiences and the ideal settings for small group networking.

Ten years on, the vision of IACMI has been realized – and more. Diversification of funding, both private and public, has greatly expanded IACMI's impact on technical and workforce frontiers. IACMI has established a strong reputation internationally, competitive with foreign institutes that had a head start. Within the IACMI community, members convene, connect and catalyze not only the present and future of the institute, but the composites industry as a whole. ⬢

Written by Dale Brosius, who has served as IACMI Chief Commercialization Officer since 2015 and was named Executive Vice President in 2023 following one year as IACMI's interim CEO.

Driving Innovation: IACMI's Technical Expertise

IACMI's technical leadership spans from its CEO, CTO, and CCO to distinguished Technical Directors from leading U.S. national laboratories, universities and key partner organizations. Together, they bring more than 200 years of combined experience and have earned nearly every major award bestowed by the U.S. composites industry or its professional societies. These experts are engineers, researchers, and innovators who understand the intricacies of scaling composite solutions for both production rate and part size. Their knowledge blends deep scientific insight with industrial experience.

Derek Berry
Wind Energy
National Renewable Energy Laboratory, Colorado

Ray Boeman
Vehicles
IACMI Scale-Up Research Facility, Michigan

R. Byron Pipes
Design, Modeling & Simulation
Purdue University, Indiana

Johnathan Goodsell
Design, Modeling & Simulation
Purdue University, Indiana

Brian Rice
High Rate Aerostructures & Compressed Gas Storage
University of Dayton Research Institute, Ohio

Soydan Ozcan
Composites Recycling
Oak Ridge National Laboratory, Tennessee

Vlastimil Kunc
Materials & Processes
Oak Ridge National Laboratory, Tennessee

Convene. Connect. Catalyze

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