# Looking Ahead: What's Next for IACMI

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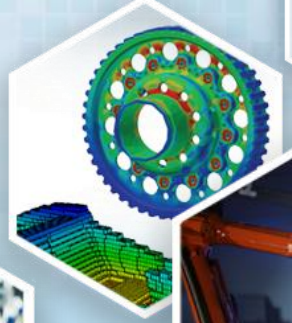
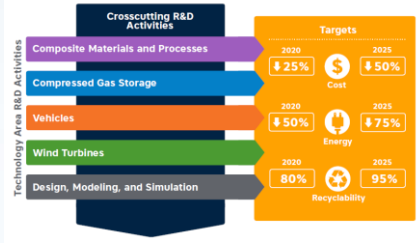
February 18, 2021



THE COMPOSITES iacmi INSTITUTE

# Facilities, Resources, & Models for Use

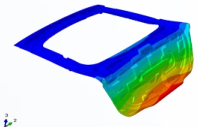
- Consortium
- DOE Goals
- Materials
- Processes
- Digital Tools
- Talent Development



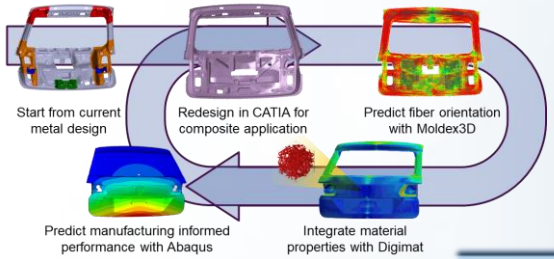


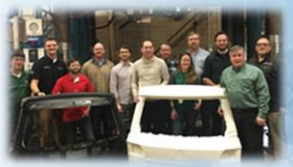
Flow Orientation

Static Stiffness



Crash Performance

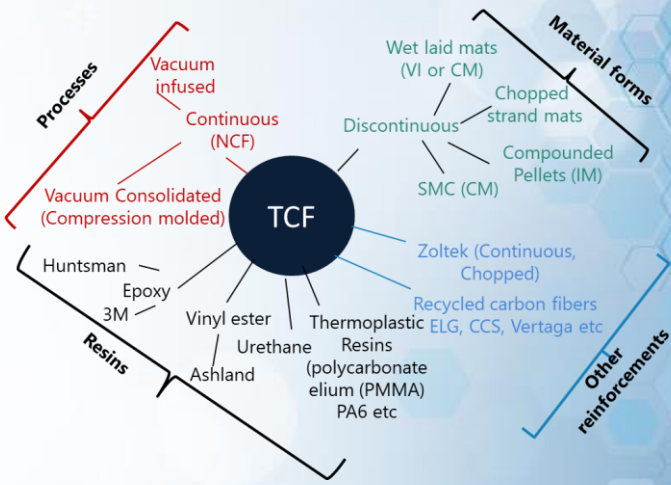


# Aggregate Momentum

- Consortium
- DOE Goals
- Chemistry
- Processes
- Digital Tools
- Talent Development






Elevate™ BY IACMI

ace America's Cutting Edge

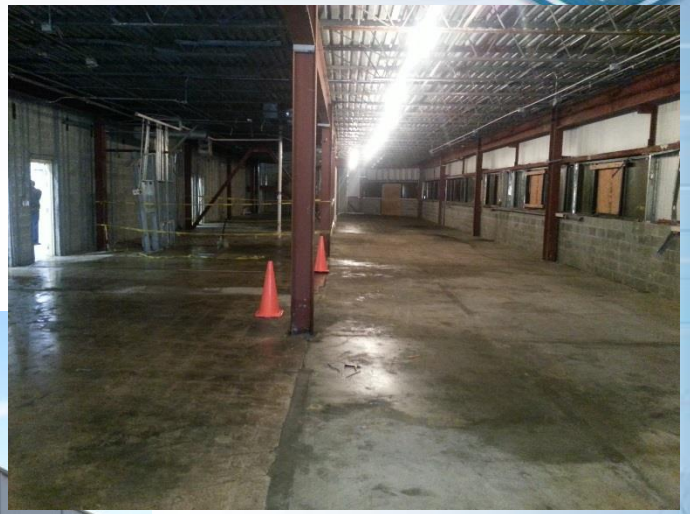
accp™ BY IACMI Advanced Composite Career Pathways

# IACMI: Five years after founding…

- World class capabilities for composites manufacturing and testing established



# MSU SURF Facility

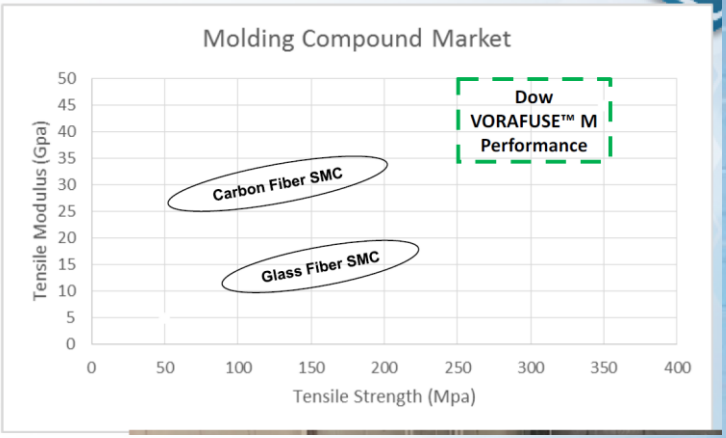
April, 2014

# MSU SURF Facility - Today




# Ford carbon fiber liftgate inner panel

- New carbon fiber discontinuous material with tensile strength of Aluminum
- Over 35% less expensive than traditional prepreg baseline
- Sub 3-minute cycle time
- Ford material specification issued




# VW Atlas Liftgate

- 36% lighter than steel baseline
- 9% less expensive than steel baseline
- Sub 3-minute cycle time
- Meets e-coat and performance requirements

# IACMI Wind TA Composites Manufacturing and Education Technology (CoMET) Facility

- Manufacturing space focused on composite manufacturing innovation
- 55’ x 200’ – 10,000 sq. ft.
- Adjacent to blade test facility
- Full-scale blade component manufacturing

June, 2016

# IACMI Wind TA Composites Manufacturing and Education Technology (CoMET) Facility


January 2017

# 9-meter thermoplastic blade with textile CF spar cap

## 2020 R&D 100 Award Winners

R&D 100 AWARDS

**Special Recognition: Market Disruptor – Services**

CAMX THE COMPOSITES AND ADVANCED MATERIALS EXPO

A NEW CAMX FOR A NEW TIME

COMBINED STRENGTH. UNSURPASSED INNOVATION

OCTOBER 18-21, 2021 | DALLAS TX

## FINALISTS ANNOUNCED FOR 2017 CAMX AWARD

**Combined Strength Award acknowledges a product that incorporates advanced materials that solve a problem through teamwork and collaboration**

JEC GROUP

JECawards

PRESS RELEASE

Paris, January 30, 20

**JEC Innovation Awards 2018:**

**30 finalists exemplify the best of composite innovation worldwide**

*The JEC Innovation Awards ceremony will take place on March 7, 2018 at JEC World 2018, Paris Nord Villepin*

# 13 meter blade

# From Cornfield to Indiana Manufacturing Institute

June 23, 2015

July 26, 2016

# Integrated Workflow Apps

Additive Manufacturing

CATIA | SIMPLIFY3D | eXstream ENGINEERING MSC Software Company | SIMULIA

Injection Overmolding

CATIA | LS-DYNA | Moldex3D MOLDING INNOVATION | eXstream ENGINEERING MSC Software Company | LS-DYNA

HP-RTM

CATIA | PAM-RTM | PAM-FORM | CONVERGENT MANUFACTURING TECHNOLOGIES | SIMULIA

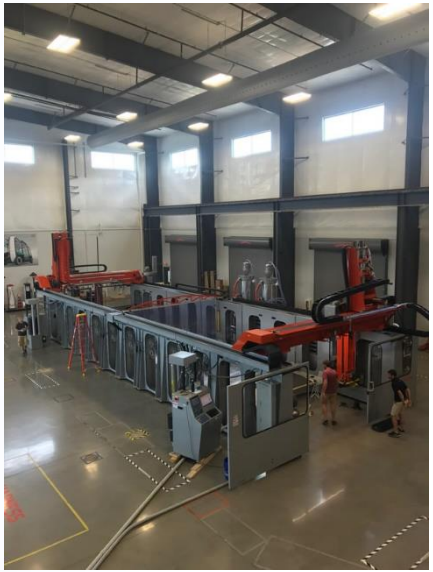
Compression Molding

CATIA | PAM-FORM | Moldex3D MOLDING INNOVATION | eXstream ENGINEERING MSC Software Company | PAM-CRASH

# Local Motors Olli Autonomous Shuttle

Early 2017 – Local Motors opens Knoxville Microfactory

local motors by

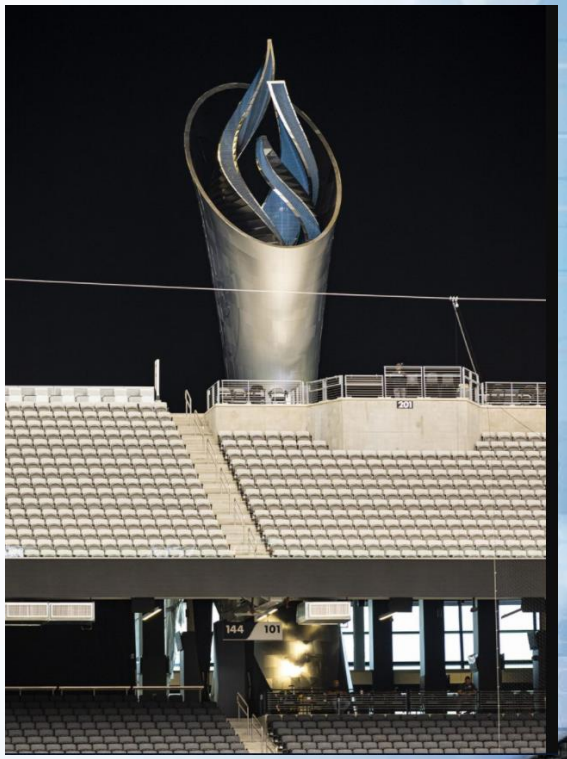


Mid-2018 – Local Motors installs world's largest 3D printer from Thermwood


Mid-2019 – Serial Production of Olli 2.0 commences

# 3-D Printed Al Davis Memorial Torch (Las Vegas)

- 93 feet tall spanning two levels
  - Seeking Guinness record for largest 3-D printed structure
- 225 3-D printed blocks assembled on aluminum lattice structure
  - Printed on Thermwood (IACMI member) LSAM machine at Dimensional Innovations (Kansas City)
  - 100,000 lbs of CF/PC material supplied by Techmer (IACMI member)
  - Structural analysis completed by Purdue (IACMI core partner)
- Clad with reflective aluminum skins

# UT-ORNL Facilities

UT Fibers and Composites Manufacturing Facility

ORNL Carbon Fiber Technology Facility

UT-ORNL National Transportation Research Center & Manufacturing Demonstration Facility


UT-ORNL Joint Institute for Advanced Materials

# Friendship Bell pavilion – Oak Ridge

# Seeking Answers?

*We're a small company with a great product/process. How do I get an introduction to the right people?*

*We're a small company needing to do some modeling and simulation. Is there a place we can get this work done?*

*I would like to hire college graduates with some understanding of composites. Where can I find them?*

*Where can we make the prototypes our customer needs for validation?*

*Who has testing capabilities that we can trust?*

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

*- IACMI Premium Member*

# IACMI investments expanding *Composites Technology* opportunities in broader areas

- Catalog approach based on sector(s)
- Working groups
- Technical advisory group

# Deployment and Implementation

## Transportation

Ground



Aerospace

Marine

## Infrastructure

Turbines

Buildings

Roads & Bridges

Waterways

# Vehicles

## Vehicles work within IACMI domain

Ligthweight energy efficient structures

Hybrid composite metal optimized primary structures

Underbody, door inners, bumpers, energy absorbing non-appearance stru

Class A finish exterior

Automotive interior, trim, functional

Under the hood structures

Advanced joined structures

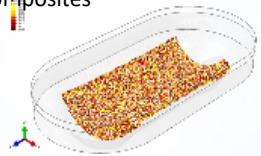
Biocomposite intensive designs

Nano-functional structures

Recycling and end of life

## Current (2021) status of IACMI's core competencies

- ✓ Small to full scale assets – compression molding, injection molding, pre-preg winding, fast tape lay-up, high speed RTM, SMC/BMC, pultrusion
- ✓ Carbon fiber technologies (low cost, textile grade)
- ✓ Intermediates with range of length scales and hybridization
- ✓ Composite overmolding and optimized designs
- ✓ Thermoplastic technologies
- ✓ Reinforcement expertise in carbon, glass, aramids, organic and other fibers
- ✓ Advanced resins & additives: thermoset, thermoplastic
- ✓ Damage tolerance, crashworthiness, fatigue
- ✓ End of life, recycling portfolio in pyrolysis, solvolyis, thermolysis and shredding
- ✓ Fire retardant resins and composites
- ✓ Sandwich structures
- ✓ Embodied energy analysis



- ✓ NDE, inspection, standardization & qualification
- ✓ Noise, vibration harshness reduced components

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Robotic and Manufacturing 4.0
- ➢ Advanced battery and autonomous enabled composites
- ➢ 3D printing technologies for tools and critical parts
- ➢ Hybrid structures – 'Materials By Design'

- ➢ Advanced and more refined NDE & qualification in-situ
- ➢ Rapid joining and assembly innovations
- ➢ Circular economy and 100% recycling established
- ➢ Low cost carbon fiber in commercial vehicles
- ➢ Advanced low cost high performing material systems
- ➢ Innovations in interiors – functional, adaptive, tailored
- ➢ Expanded coalition with ACC, Auto & Truck OEMs, SMEs, Material Suppliers
- ➢ Target 20 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for vehicles

# Infrastructure

## Infrastructure Technologies within IACMI domain

Resilient infrastructure

Disaster resiliency


Modular building Elements

Smart buildings

Architectural innovations

Modular bridge

Culverts and piping

Corrosion resistant

Mobile medical facilities

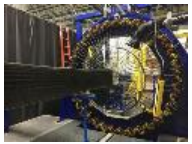
Precast elements

Energy efficient construction

## Current (2021) status of IACMI's core competencies

- ✓ Pultrusion, Braiding, Filament winding, preforming
- ✓ Large panel compression, Double belt lamination.
- ✓ Injection molding

- ✓ Large scale infusion, liquid moldi
- ✓ Carbon fiber technologies (textile grade, pitch)
- ✓ Recycling technologies



- ✓ Sandwich technologies
- ✓ NDE and inspection technologies
- ✓ Material intermediates, new resins, additives, fibers
- ✓ Advanced thermoplastics
- ✓ Additive manufacturing – molds, concrete printing. freeform winding

- ✓ Hybrid manufacturing
- ✓ Design, modeling & simulation generative designs

## VISION 2025 – IACMI enabled technology, work force & economic development

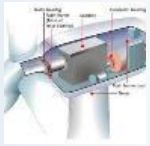
- ➢ Hybrid pultrusions – varying and curved
- ➢ Robotic winding AM, windings
- ➢ Hybrid structures – 'Materials By Design'
- ➢ Rebar technologies
- ➢ Precast – inserts, smart elements, rapid erection
- ➢ Repair and retrofit for culverts and piping
- ➢ Concrete-composite advances
- ➢ 50% of greater recycled content enabled
- ➢ Automation, sensing advanced structures, NDE established
- ➢ Modular standardized building elements
- ➢ Retrofit and new construction for natural disaster resiliency-tornadoes, hurricanes, earthquakes
- ➢ Mobile medical facilities infrastructure
- ➢ Close ties to ACMA, construction network
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for infrastructure

# Wind Energy

## Wind energy work within IACMI domain

40-100 m FRF turbine blades

Nacelles and turbine hardware



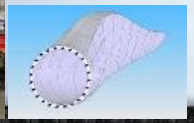
Towers & poles

High cycle fatigue characterization

Blades recycling End of Life

Segmented blades

Transport technologies



## Current (2021) status of IACMI's core competencies

- ✓ Large scale vacuum infusion technologies
- ✓ Thermoplastic wind blade innovations
- ✓ Glass fiber sizing, coatings
- ✓ Fire retardant resins and composites
- ✓ Toughened thermoset resins
- ✓ Pultrusion & Hybrids
- ✓ Sandwich structures

- ✓ Design and Simulation for blade optimization
- ✓ End of life recycling technologies
- ✓ Techno economic analysis for wind energy
- ✓ Fabric technologies, textile preforming, nonwovens
- ✓ Carbon fiber technologies (textile grade, pitch)
- ✓ NDE, inspection and structural health monitoring technologies

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Hybrid processes
- ➢ Robotic winding AM, windings
- ➢ 3D printing technologies for wind blades

- ➢ Hybrid structures – 'Materials By Design'
- ➢ Advanced and more refined NDE and structure health monitoring standardized
- ➢ Circular economy and 100% recycling established
- ➢ Hybrid joining and fastener less joining
- ➢ Advanced low cost high performing material systems
- ➢ Multi-approach surface tailoring

- ➢ Resilient wind infrastructure
- ➢ Close collaboration with NREL, Wind OEMs like Siemens, GE Wind, Vestas, Gemesa and SMEs
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for wind energy

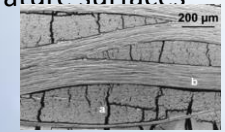
# Aerospace

## Aerospace Applications within IACMI domain

- Carbon fiber primary structures
- Electronic enclosures
- Urban air mobility
- Drones

- Rotor blades
- Honeycomb structures
- Tanks

- Braking housing
- High temperature surfaces
- Hypersonics




- Weapon systems
- Cargo aircraft

## Current (2021) status of IACMI's core competencies

- ✓ Injection & compression molding
- ✓ Additive manufacturing and innovative high temperature tooling
- ✓ Fire retardant resins and composites
- ✓ Thermoplastic technologies
- ✓ High rate aerospace manufacturing
- ✓ Pre-pregs, hybrid intermediates, laystitch
- ✓ Advanced joining
- ✓ Rapid curing, toughened resins
- ✓ Carbon-carbon and Carbon-SiC composites
- ✓ Design, modeling, simulation, optimization
- ✓ Recycling technologies, pyrolysis, solvolysis
- ✓ Fabric technologies, textile preforming, nonwovens
- ✓ Carbon fiber technologies (textile grade, pitch)
- ✓ NDE and inspection technologies, diagnostics
- ✓ Autoclave & OOA
- ✓ Stitching, tailored sandwich composites, hybrid structures

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Hybrid pultrusion – varying and curved
- ➢ Robotic winding AM, windings
- ➢ 3D printing of metals, polymers and composites
- ➢ Hybrid structures – 'Materials By Design'
- ➢ High speed filament winding, extrusion-compression
- ➢ Hybrid joining and fastener less joining
- ➢ Hydrophobic and chemical resistant surfaces
- ➢ Morphing structures through orientation tailoring
- ➢ 100% aircraft recycled, end of life
- ➢ High temperature thermoplastics such as C-PEEK, PEK
- ➢ Carbon-carbon hypersonic materials & structures
- ➢ Close collaboration with AFRL, aerospace OEMs Boeing, LM, Airbus, suppliers to Aerospace
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for aerospace

# Marine & Ship Structure

## Marine work within IACMI domain

Ship structures

Nacelles and turbine hardware

Decks, piles

Moisture and water ingression, durability, fatigue, sea water environment, Damage tolerance

Thick section composites

Shipping cont

## Current (2021) status of IACMI's core competencies

- ✓ Large scale vacuum infusion technologies
- ✓ Compression molding

- ✓ Thermoplastic technologies
- ✓ Glass fiber sizing, coatings
- ✓ Damage tolerance toughened thermoset formulations
- ✓ Fire retardant resins and composites
- ✓ Pultrusion and hybrid processes
- ✓ Hydrophobic coatings

- ✓ Sandwich structures
- ✓ Blast & ballistic resistant structures
- ✓ End of life recycling technologies
- ✓ Techno economic analysis for wind energy
- ✓ NDE, inspection and structural health monitoring technologies

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Hybrid processes

- ➢ Robotic winding AM, windings
- ➢ 3D printing technologies of large wind blade tools
- ➢ Hybrid structures – 'Materials By Design'
- ➢ Advanced and more refined NDE and structure health monitoring standardized
- ➢ Circular economy and 100% recycling established
- ➢ Hybrid joining and fastener less joining
- ➢ Advanced low cost high performing material systems
- ➢ Multi-approach surface tailoring

- ➢ Resilient wind infrastructure
- ➢ Close workings with ONR, NSWC, Ship OEMs
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for marine

# Power Transmission & Energy

## Power & Energy within IACMI domain

Ligthweight energy efficient power structures

Hybrid composite-metal optimized primary structures

Carbon fiber cables

Composite cross-arms, gain plates and poles

Disaster resiliency

Turbine components

Transformer/electrical enclosures

Biocomposite intensive designs

Recycling and end of life

Fatigue, moisture, weathering resistance

## Current (2021) status of IACMI's core competencies

- ✓ Pultrusion, compression, additive manufacturing
- ✓ Carbon fiber technologies (low cost, textile grade)
- ✓ Intermediates with range of length scales and hybridization
- ✓ Reinforcement expertise in carbon, glass, aramids, organic and other fibers
- ✓ Advanced resins & additives: thermoset, thermoplastic
- ✓ Damage tolerance, crashworthiness, fatigue
- ✓ End of life and recycling
- ✓ Fire retardant resins / composites
- ✓ Embodied energy analysis
- ✓ Technoeconomic analysis
- ✓ NDE, inspection, standardization & qualification

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Robotic and Manufacturing 4.0
- ➢ Advanced battery and autonomous enabled composites
- ➢ 3D printing technologies
- ➢ Hybrid structures – 'Materials By Design'

- ➢ Advanced and more refined NDE & qualification in-situ
- ➢ Rapid joining and assembly innovations
- ➢ Circular economy and 100% recycling established
- ➢ Low cost carbon fiber in commercial vehicles
- ➢ Advanced low cost high performing material systems
- ➢ Expanded coalition with power companies such as TVA, Southern Company, Georgia Power etc
- ➢ Target 20 small businesses incubate from IACMI
- ➢ 1000 work force trained in composites for vehicles

# Defense

## Defense work within IACMI domain

Personnel protection, helmets, tourniquets, armored gear

Weapon systems, bullet jackets, training rounds, launch rails, trajectory correction

Ground tanks and vehicles

Aviation and Missile Defense

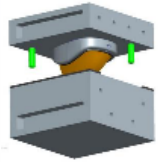
Hypersonic environments

Ballistics and blast protection

Hybrid systems

## Current (2021) status of IACMI's core competencies

- ✓ Composite design and modeling optimization
- ✓ Lightweighting expertise * Multimaterial design
- ✓ Compression molding, Extrusion-Compression, Injection, SMC/BMC, Pultrusion, Hybrid forming
- ✓ Advanced pre-pregs, preforms and damage tolerance fabric technologies
- ✓ Reinforcements expertise – carbon, glass, aramid, organics and ceramics
- ✓ Damage tolerance toughened thermosetand thermoplastic formulations
- ✓ Fire retardant resins and composites
- ✓ Carbon-carbon, Carbon-SiC hypersonic
- ✓ Additive manufacturing for tooling & defense parts
- ✓ Deep draw complex integrated shapes
- ✓ Fatigue, impact, high strain rate time dependent response
- ✓ Sandwich structures
- ✓ Blast & ballistic resistant structures
- ✓ NDE, inspection and qualification



## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ 3D printing technologies of large wind blade tools
- ➢ Extrusion-compression, overmolding and multiformat intermediates for materials by design
- ➢ High temperature, extreme environment response
- ➢ Hybrid joining and fastener less joining
- ➢ Impact resistant, damage tolerant structures
- ➢ Complex near net shape manufacturing and design
- ➢ Hypersonic composite materials advancements
- ➢ Advanced low cost high performing material systems
- ➢ Integration into Defense Manufacturing Communities and alignment with all branches of DoD and agencies like ARL, AvMC, TARDEC, ARDEC, NSWC, AFRL
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for defense

# Transportation

## Transportation work within IACMI domain

Ligthweight energy efficient structures

Hybrid composite-metal optimized primary structures

Truck cabs, trailers, decking, hoods

Large modular structures

Interior trim and functional surfaces

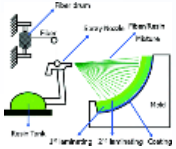
Under the hood structures

Advanced joining structures

Biocomposite designs

## Current (2021) status of IACMI's core competencies

- ✓ Small to full scale assets – compression molding, VARTM, SMC/BMC, transfer molding, RIM, SRIM, pultrusion
- ✓ Carbon fiber technologies (low cost, textile grade)
- ✓ Intermediates with range of length scales and hybridization
- ✓ Composite overmolding and optimized designs
- ✓ Thermoplastic technologies
- ✓ Reinforcement expertise in carbon, glass, aramids, organic and other fibers
- ✓ Advanced resins & additives: thermoset, thermoplastic
- ✓ Damage tolerance, crashworthiness, fatigue
- ✓ End of life, recycling portfolio in pyrolysis, solvolyis, thermolysis and shredding
- ✓ Fire retardant resins and composites
- ✓ Sandwich structures
- ✓ Embodied energy analysis
- ✓ NDE, inspection, standardization & qualification
- ✓ Noise, vibration harshness reduced components



## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Robotic and Manufacturing 4.0 in automotive
- ➢ Advanced battery and autonomous enabled composites
- ➢ 3D printing technologies for tools and critical parts
- ➢ Hybrid structures – 'Materials By Design'
- ➢ Advanced and more refined NDE & qualification in-situ
- ➢ Rapid joining and assembly innovations
- ➢ Circular economy and 100% recycling established
- ➢ Low cost carbon fiber in commercial vehicles
- ➢ Advanced low cost high performing material systems
- ➢ Innovations in interiors – functional, adaptive, tailored
- ➢ Expanded coalition with ACC, Auto & Truck OEMs, SMEs, Material Suppliers
- ➢ Target 20 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for vehicles

# Oil & Gas, Offshore

## Oil & Gas Applications within IACMI domain

Resilient structures

Disaster resiliency

Modular elements

High- and low-pressure tubing

Modular walkways, gratings rails

Piping and vessels & tanks

Personnel equipment such as helmets and protective equipment

Subsea structures

Fire blast panels

Piles & dock elements

Well heads, manifolds

Large cables and housings

## Current (2021) status of IACMI's core competencies

- ✓ Pultrusion, Braiding & overbraiding
- ✓ High speed Filament winding, preforming
- ✓ Vacuum infusion, large scale liquid molding
- ✓ Large scale injection molding & thermoforming
- ✓ Carbon fiber technologies (textile grade, pitch)
- ✓ Recycling technologies

- ✓ Sandwich technologies
- ✓ NDE and inspection technologies
- ✓ Material intermediates, new resins, additives, fibers
- ✓ Advanced thermoplastics

- ✓ Additive manufacturing – molds, freeform winding
- ✓ Hybrid manufacturing

- ✓ Design, modeling & simulation designs

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Hybrid pultrusions – varying and curved
- ➢ Robotic winding AM, windings

- ➢ Hybrid structures – 'Materials By Design'
- ➢ Rebar technologies
- ➢ Precast – inserts, smart elements, rapid erection
- ➢ Repair and retrofit for culverts and piping
- ➢ Concrete-composite advances
- ➢ 50% of greater recycled content enabled
- ➢ Automation, sensing advanced structures, NDE
- ➢ Modular standardized building elements
- ➢ Retrofit and new construction for natural disaster resiliency- tornadoes, hurricanes, earthquakes
- ➢ Mobile medical facilities infrastructure
- ➢ Target 10 small businesses incubate from IACMI enabled
- ➢ 1000 work force trained in composites for oil & gas

# Health care & Biomedical

## Health care & Medical Applications within IACMI domain

- Personnel protection equipment
- Innovative reusable masks, ventilators, faceshields
- Rapidly deployed medical facilities
- Testing equipment such as tubes, caps, pipettes, well trays
- Dental and orthopedic devices
- Filters for personnel and buildings
- Patient barriers and protection
- Smart gear

- Orthopedic implants
- Rehabilitation systems
- Mobility and transport aid

## Current (2021) status of IACMI's core competencies

- ✓ Injection molding
- ✓ Additive manufacturing and innovative tooling
- ✓ Thermoforming, rotomolding, extrusion, compounding

- ✓ Advanced thermoplastics, Range of materials know-how
- ✓ Design, modeling, simulation, optimization

- ✓ Biomaterials and bio-composites
- ✓ Filtration materials
- ✓ Fabric technologies, textile preforming, nonwovens
- ✓ Carbon fiber technologies (textile grade, pitch)
- ✓ NDE and inspection technologies, diagnostics
- ✓ Material intermediates, new resins, additives, fibers
- ✓ Hybrid manufacturing
- ✓ Strong collaboration with the medical community

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Hybrid pultrusion – varying and curved
- ➢ Robotic winding AM, windings
- ➢ Hybrid structures – 'Materials By Design'
- ➢ Lightweight rapid construction, functional building elements, modularized construction

- ➢ Surgical implants
- ➢ Litters, tourniquets, collapsible, inflate able structures
- ➢ Hydrophobic and chemical resistant surfaces
- ➢ Materials with highly phobic surfaces to deter viruses
- ➢ Biodegradable and environmentally friendly filters
- ➢ Automation, robotics, sensor technologies
- ➢ Retrofit and new construction for natural disaster resiliency- tornadoes, hurricanes, earthquakes
- ➢ Mobile medical facilities infrastructure
- ➢ Close collaboration with hospital systems, health care facilities, state organization, States
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 workforce trained in composites for health care

# Chemicals Process & Corrosion

## Chemical Process Applications within IACMI domain

- Very large chemical vessels
- Pipes, elbows, bends
- Pressure vessels and gas tanks
- Walkways, grills, ladders
- Scrubbers & Reactors
- Fluid & gas storage tanks
- Cables & Housings

- Conduits
- Platforms
- Natural Disasters Resiliency

- Corrosion Resistant Structures

## Current (2021) status of IACMI's core competencies

- ✓ Wet lay up and large scale windings
- ✓ Glass fiber sizing, coatings

- ✓ Fire retardant resins
- ✓ Toughened thermoset resins
- ✓ Large scale vacuum infusion, pultrusion, braiding
- ✓ Sandwich structures
- ✓ Design and Simulation of large pressure vessels
- ✓ Fabric technologies, textile preforming, nonwovens
- ✓ Carbon fiber technologies (textile grade, pitch)
- ✓ NDE and inspection technologies
- ✓ Structural health monitoring

- ✓ Structural & functional coatings
- ✓ Adhesion and joining science

## VISION 2025 – IACMI enabled technology, work force & economic development

- ➢ Hybrid pultrusion – varying and curved
- ➢ Robotic winding AM, windings
- ➢ 3D printing technologies for corrosion protection

- ➢ Hybrid structures – 'Materials By Design'
- ➢ High speed filament winding
- ➢ NDE and structure health monitoring standardized
- ➢ Hybrid joining and fastener less joining
- ➢ Advanced low cost high performing material systems
- ➢ Hydrophobic and chemical resistant surfaces

- ➢ Multi-component liners
- ➢ Resilient infrastructure for large structures
- ➢ Close workings with NACE, companies like Augusta Fiberglass, Southern Company, FRP material suppliers
- ➢ Target 10 small businesses incubate from IACMI enabled work
- ➢ 1000 work force trained in composites for chemical processes

# Working groups have been introduced

| Working groups | Lead(s) |
|---|---|
| Recycling/Circular Economy | Soydan Ozcan, Ed Pilpel |
| High rate aerostructures fabrication | Brian Rice |
| Simulation/Digital twin | Jonathan Goodsell, Wenbin Yu |
| Wind energy | Derek Berry, Steve Nolet |
| Infrastructure & Construction | Joe Fox, John Unser |
| Future mobility / Vehicle technology | Raymond Boeman, Brian Knouff |

# Working Groups…

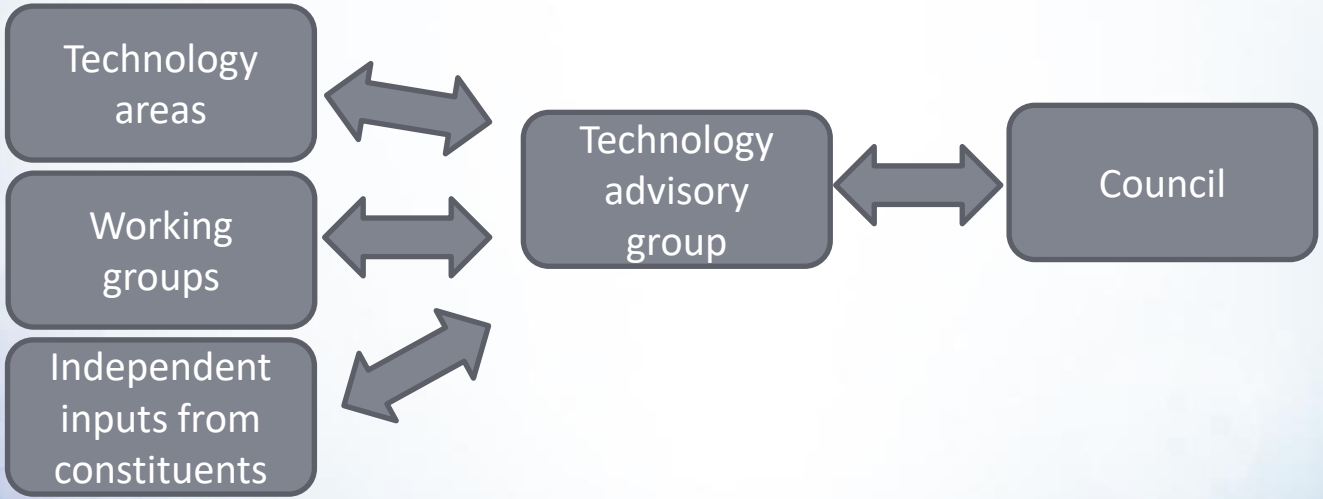
- 80-140 participants in each of the working groups
- Sub-committees within each to be shaped by the leads
- Quarterly meeting (can be asynchronous w.r.t. IACMI meetings)
- Should we add more working groups? What areas?
- Membership(s)?
- How best can working groups provide high value to the composites community?

# Consortium Working Groups (formal role)

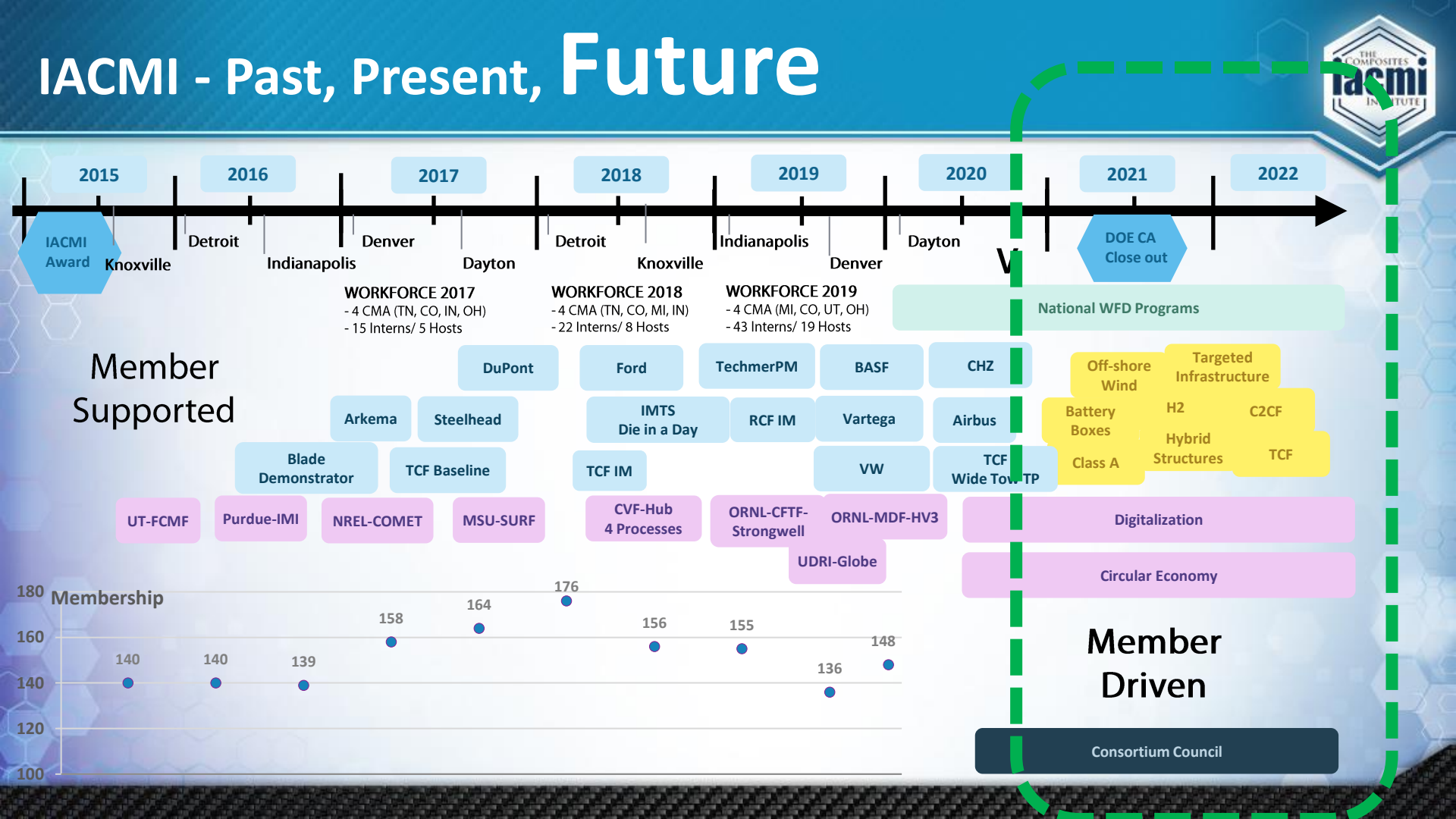
- **Mission – Focus on addressing technoeconomic barriers to mass adoption of composites in partnership with similarly aligned organizations**
- **Formation**
  - Topic based, formed organically from the membership
  - Members include industry, academic, laboratory at all levels of consortium
  - Elect chair, meet at least 4x per year, more if needed
  - Opportunity to align with external entities (ACMA, ACC, other organizations)
- **Principal Activities**
  - Conduct roadmapping as needed specific to topical market or technology focus
  - Inform funding agencies (DOE, DOD, etc.) of priority R&D needs
  - Propose projects for funding – using working group funds or pool funding
  - Propose mini-conferences or other activities, possibly with outside entities
  - Report activities and successes at IACMI member meetings and other forums, including trade press and conferences

# Technical Advisory Group

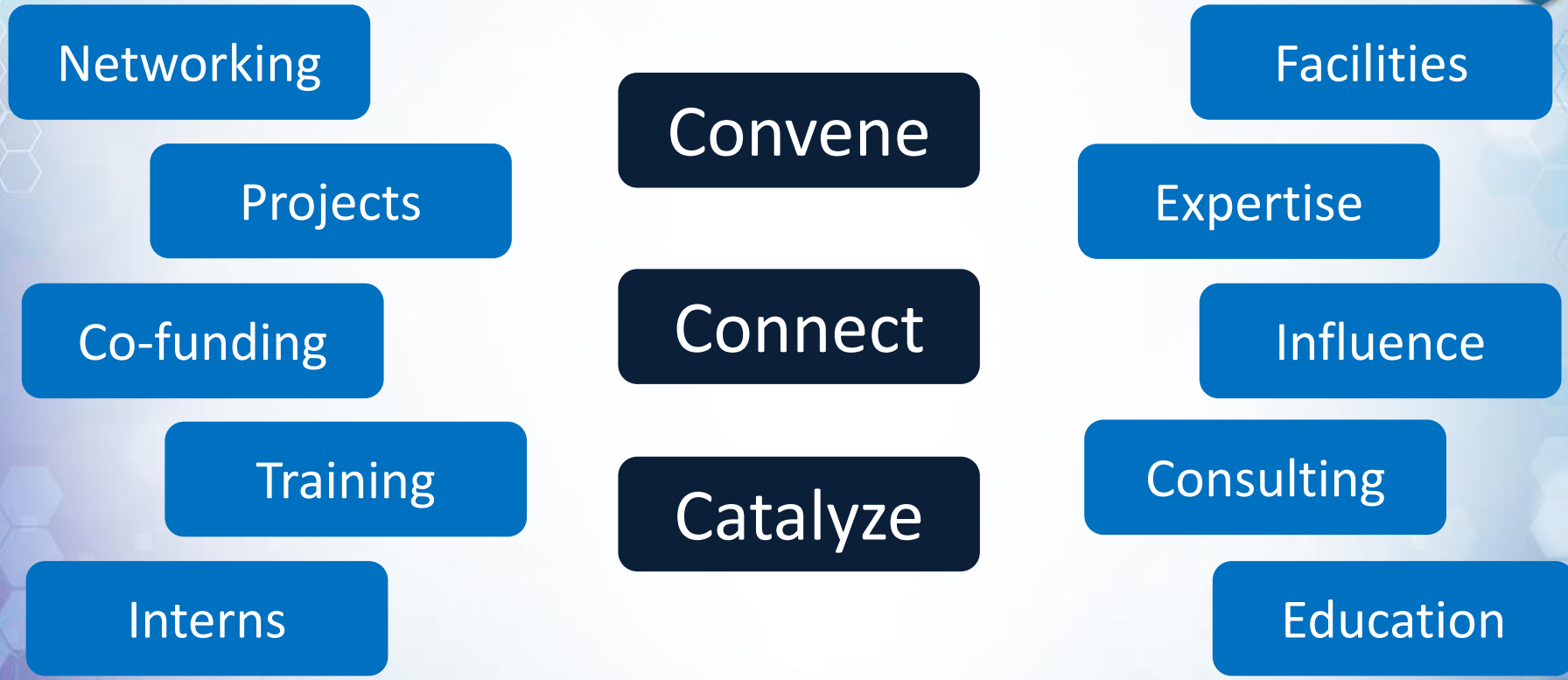
- Recall we had the IACMI TAB (in the IACMI 1.0 phase)
- IACMI now has a governance through a consortium
- A *Technical Advisory Group* (akin to the TAB) to serve as a Segway on state of the art technology areas and investment opportunities to the Council



# IACMI - Past, Present, Future



# IACMI - A Broad Value Offering to Members



# A Connected Community

# An integrated strategy for the next five years

Low energy carbon fiber
Fast processing chemistries
Bioderived composites
New products enabled by greater performance/price ratios

Efficient design
Technoeconomic assessment
Functional optimization
Digital twin
AI driven process control

**Digitalization**

Design, modeling, simulation
In-line Diagnostics
Digital Twin-Industry 4.0
Life cycle analysis

**Materials**
Textile carbon fiber
Alternate precursors
Recycling

**Process & Automation**
High rate
Repeatable
Optimized design
Digital Integration
Waste minimization

**Validation**
High rate, large scale demonstrations

**Sustainability**

Recycling
Waste minimization
Life cycle costing

High rate handling of fiber forms
Multi-process connectivity
Large scale manufacturing
Improved consistency in fabrication
Multi-material/multi-format manufacturing

Reduction in energy and costs
Viability for reuse & repurpose
Reduction of waste and landfill
Demonstrated resiliency
Lower lifetime carbon footprint

**Novel wind blades**
**Horizontal drilling tools**
**Low cost airframes**
**Bonding and repair**

**Multi-material structures**
**Low cost, rapid tooling**
**Large-scale resilient structures**
**Long-life bridges**

***Fulfilling Agency Missions & Supporting National Interests:*** ***Energy*** ***Defense*** ***Transportation*** ***Commerce/NIST***

# Current/Future Funding Opportunities

## Core project funding

- Wrapping up initial 5-year DOE agreement
- Positioning IACMI for possible re-funding for FY22 onward.

## Other federal funding

- Contracts in hand – DOE, DOD, NASA
- Funded projects enabled by IACMI created assets and capabilities
- IACMI support for companies seeking funding under FOA process

## IACMI Consortium enabled funding

- Consortium resource pool derived from member fees
- Working to establish state matching funds for private funded work (single/multiple entity) at core partners.

## Private and co-funded projects

- IACMI supported private project contracting and administration
- Projects funded in partnership with other organizations

# IACMI Consortium Council Roles/Responsibilities

- Member Driven
- Help set IACMI strategic direction
  - IACMI mission
  - Technical focus areas
  - Member meeting format/frequency and communications priorities
- Annual Business Plan/Budget Review and Recommendation
- Resource pool project approvals/rejections for projects >$15,000 total budget
- Review proposed changes to membership fees, rights or privileges

# IACMI Consortium Council - 2021

**Ex officio Members**

Executive Director
Dale Brosius - IACMI

Chief Technology Officer
Uday Vaidya – IACMI/UTK

CCS BOD Liaison
Tom Drye

UT Research Foundation
Andreana Leskovjan

# IACMI Consortium Council - 2021

**Premium Members**

Gina-Marie Oliver
American Chemistry Council

Dana Swan
Arkema

Mohamed Bougettaya
BASF Corporation

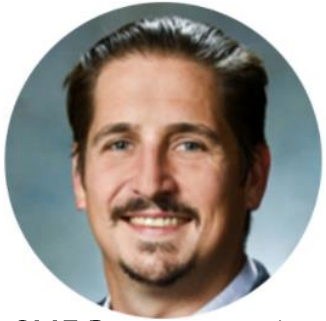
Rani Richardson
Dassault Systèmes

Steve Nolet
TPI Composites

# IACMI Consortium Council - 2021

## Elected and Appointed Members

Large Entity Representative
Dr.-Ing. Hendrik Mainka - VW



SME Representative 1
Peter Hedger – CAG

SME Representative 2
Dustin Davis – Norplex-Micarta

State/Lab/Academia Representative
Katie Woslager – Colorado OEDIT

Executive Director Appointee
Joe Fox – FX Consulting

Executive Director Appointee
Glenn Richardson – Jobs Ohio

# IACMI Consortium Council - 2021

**SME Representative 2 Runoff Election – Week of February 22**

Dustin Davis
Norplex-Micarta

Hicham Ghossein
Endeavor Composites

Andrew Maxey
Vartega Composites

# SAVE THE DATE

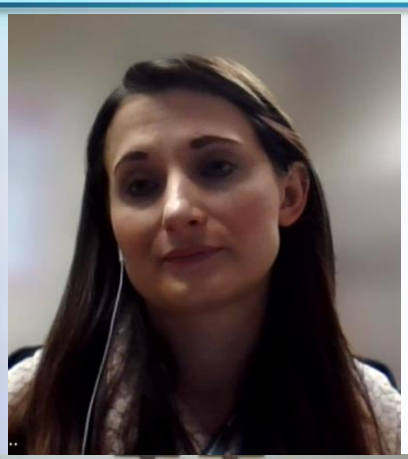
FALL 2021 MEMBERS MEETING

The Henry Hotel

Dearborn. Michigan

October 5TH - 7TH, 2021

# Shout Out and Thank You to our Team!



Deborah Robbins

Kim Hoodin

**MISSION CONTROL**

# Shout Out and Thank You to our Team!

Kaitlyn Farmer

Terri Lester

Mark Morrison

# Questions?

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uvaidya@iacmi.org