CALLAC: Consortium for Accelerated Innovation and Insertion of Advanced Composites

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Roadmapping Workshop
November 5th, 2014

“KAYAK”
NIST AMTech Planning Grant

Advanced Manufacturing Technology (AMTech) Program will spur consortium-planned, industry-led R&D on long-term, pre-competitive industrial research needs. The program aims to eliminate barriers to advanced manufacturing and to promote domestic development of an underpinning technology infrastructure.
CAIIAC Program Deliverables

Two Outcomes Are Required from Our Planning Grant Effort:

- A complete and ready to implement technology transfer roadmap that clearly shows each composite technology readiness for transfer to key industrial markets and government

- An identifiable consortium organization that is ready to implement the CAIIAC mission
What Is “CAIIAC”? 

“CAIIAC” is currently a consortium concept for advanced composites being validated and planned that will result from a technology roadmap exercise to be presented to the National Institute of Standards and Technology.
Since 1960...

- Composites have grown 16 times
- Aluminum has quadrupled
- GDP has nearly quadrupled
- Steel has doubled

Sources:
“… greatest shortcoming of the human race is our inability to understand the exponential function…”
Albert Allen Bartlett
Grand Technical Challenges

CAIIAC Starter Set Based on Polling Key Leaders:

- Scalable and reproducible out-of-autoclave processes and affordable tooling
- Structural health monitoring of life cycle performance
- Inclusion of nanomaterials for improved performance
- Quick and reliable joining and repairs
- Standardized composite design and testing for faster and more affordable certifications
- Recycling and reuse of composites
The potential business benefits of next generation advanced composites are compelling; however, no single company has the financial resources or the technical depth to make it a reality any time soon.

*It takes a community...*
Vision

- CAILAC will create a domestic, innovative manufacturing ecosystem to accelerate innovation and industry adoption of advanced composite products.

- CAILAC is committed to significantly shortening composite development cycles and providing “right-the-first-time material yields”.

- CAILAC will enable rapid technology transfer resulting from both advanced technologies coupled with an improved understanding of business environments.
Mission

- Accelerate innovation and assist rapid insertion of advanced composites
- Develop broad-based applications for advanced composites
- Encourage “invent here, build here” in the United States to improve U.S. competitiveness and sell advanced composite products globally
How CALLAC Differs

- **Technology maturation** - concurrent maturation of TRL, MRL, business cases and an ecosystem to accelerate innovation and insertion as well as to ensure that the new technology is "invent here, build here in the US"

- **Full value chain engagement** - involving small- and medium-sized enterprises that support OEMs in a wide range of sectors

- **Innovative technology** – a fully integrated experimental and computational approach to dramatically reducing the "time to full readiness" of, e.g., novel nanomaterials, out-of-autoclave processes, rapid certification and recycling of composites
Product “Tech Transfer” Successfully Occurs Only When Technology and Business Factors Are Ready

Some readiness level metrics are well known – others are not but needed:

- **TRL** from NASA and **MRL** from the DoD
  - Extensive use in aerospace - less in commercial activities

- Business cycle may not be in step with technology
  - Expected funding is slow to come or never does
  - Technology projects die In “The Missing Middle”
  - Markets are slow to develop

- Metric needed for Business Case (**BcRL**) and Regional Manufacturing Infrastructure Readiness, or Eco-system Readiness (**EcRL**)
xRL is a Top Tier Metric that Defines Technology Transition Readiness to Industry

xRL consists of four distinct readiness level metrics to support CAIIAC mission:

- **TRL**: used by public-private sector technologists to communicate readiness level for technology use
- **MRL**: used primarily by defense community to assess readiness risk of the industrial base
- **BcRL**: used by Georgia Tech to engage industry and government customers to assess market opportunities, impact and risks of technology/manufacturing maturation and product development
- **EcRL**: used by Georgia Tech and regional manufacturing clusters to identify “build here” capabilities for job and business creation and retention
CAIIAC Technology Maturation Approach

1. Discover in U.S. & Globally
   - Basic research
   - Single & multi-disciplines
   - Technology pipeline

2. Early stakeholder engagement
   - Business case orientation
   - Application pipeline

3. Build where decision
   - Tech/mfg for market opportunities
   - Bridging the missing middle
   - Reaching tipping point onto full scale market insertion

4. Accelerate Translation
   - BcRL starts

5. BcRL tipping point
   - Insertion
   - Deployment
   - Commercialization

6. Build here decision
   - Supply chain readiness
   - Workforce development
   - Build here, sell globally

7. Build Here in U.S.
### Business Case Readiness Level

<table>
<thead>
<tr>
<th>Phase</th>
<th>BcRL</th>
<th>Readiness Level Definitions</th>
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<tr>
<td>Phase 3: Reaching the “Tipping Point” and on to Full Scale Market Insertion</td>
<td>9</td>
<td>Full Rate Production into National Markets – Future Product Improvements Planned</td>
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<td>8</td>
<td>Full Rate Production into Local Market – Confirmation of Financial Metrics Estimate</td>
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<td>Product Insertion into one Target Market – Positive Market Focus Group Response</td>
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<td>Phase 2: Bridging the “Missing Middle”</td>
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<td>Market Ready Research Prototype Vetted to Outside Entity and Key Customers</td>
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<td>Financial Issues Defined – ROI Required, Margin, Funding Source (Internal, External, or Both)</td>
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<td>4</td>
<td>Research Concept /Target Markets Presented to Industrial Partners – Fit to Strategic Plan Goals</td>
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<tr>
<td>Phase 1: Technology/Manufacturing for Market Readiness</td>
<td>3</td>
<td>Research Concept Vetted to Outside Entity (ADTC, Incubator Board, etc.) for Review</td>
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<tr>
<td></td>
<td>2</td>
<td>University Team Review and Validation of Potential Research Concept Market Insertion</td>
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<td>1</td>
<td>Research Concept Proven in Laboratory – PI Defines Usage of Potential Market Value</td>
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xRL Readiness Maturity with Time

TRL

MRL Materials Maturity

MRL Materials Availability

MRL Materials Supply Chain

MRL Materials Handling

MRL Process Modeling

MRL Process Yields

EcRL Alignment

EcRL Build Here

BcRL

As-Is

To-Be
CAIIAC Membership Activities

1. Identified Key Potential Partners in the Composites Industry – Many are Here Today
2. Established Database of Potential Partners
   1. Highlights Composite Expertise
   2. Identifies Market Segment Represented
   3. Covers Technologists to Business Specialists
3. Contact via F2F, Phone, Text and/or E-mail
4. Gratis Membership During Planning Grant Duration
Takeaway messages

- Linear, material substitution approach will not work
- Accelerate material development by integrating physical and computational experimentations
- Simultaneous maturation of technology, manufacturing and business cases is key
- Develop a shared facility for companies of all sizes to co-invest in new technologies on a pre-competitive basis