THANKS FOR ATTENDING THE KICKOFF MEETING FOR THE AUTOCOMPOSITES COMMERCIALIZATION LAUNCHPAD

KEY FINDINGS & NEXT STEPS:
KICKSTARTING THE WIDESPREAD ADOPTION OF AUTOMOTIVE CARBON FIBER COMPOSITES

As discussed in the section "Business Case Evaluation," there is a viable business case today for making some well-chosen parts from carbon fiber composite. Getting started will take a highly cooperative team(s) with expertise and production capability at each link of the supply chain (Figure 13).

PARTS CAMPAIGN

A Parts Campaign could include a number of discrete steps:

1. HOLD A FOLLOW-up MEETING
   The first step will be to bring together interested parties from across the supply chain to solicit interest in pursuing specific parts. The teams will ultimately develop proprietary solutions for a competitive and profitable product. RMI is well positioned to host this initial meeting.

2. IDENTIFY A LEADER
   Finding the right leadership is likely the most important ingredient. The effort should be led from either the OEM or the Tier 1 level in order to ensure a practical understanding of the production part development and incorporation process. The leader should be dedicated to the project and held accountable for the project results and schedule.

3. BUILD THE TEAM
   The team should be built on the unwavering premise of production intent of a carbon fiber composite part on a particular vehicle, for profit. It should be lean and limber and consist of 6–8 top experts, covering each link in the supply chain: fiber producer, resin provider, intermediate form supplier (if different from resin provider, e.g. prepreg), tooling/equipment maker, Tier 1 and OEM.

Acknowledgements

Rocky Mountain Institute thanks the Smith Richardson Foundation and other donors, as well as Munro & Associates, for their generous support of this work.

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PUBLISHED JANUARY, 2013.
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Autocomposites Workshop Report

KEY INGREDIENTS

NEXT STEPS

Post Workshop Meeting

Find Strong Leadership at Tier 1 or OEM level

Assemble "A-Team" Partners Across the Supply Chain

Create Funding Plan/Structure

Part & Process Design

Work Towards Implementation

Contribution:
Strong leadership, understanding of production part design process

Contribution:
Manufacturing equipment design & expertise

Contribution:
Material expertise, investment in growth market

Contribution:
Access and expertise related to predictive tools

Contribution:
Funding, coordination, integration with existing DOE programs

You are here.
Findings from post workshop survey:

- Respondents were from across the supply chain: OEMs, Tier 1s, material suppliers, equipment and tooling suppliers, government, universities, national labs, and industry consultants.

- 18 of 21 respondents indicated they are “very interested” in a carbon fiber composite part commercialization effort.

- Respondents were willing to contribute to the effort:
  - 14 said they could support with in-kind equipment, material, or labor
  - 3 said they could support with a direct financial contribution
The meeting will build from workshop outcomes and focus on a pathway to commercialization.

**Phase-gate Development Process:**

- **Scoping**
- **Build Business Case**
- **Development**
- **Testing & Validation**
- **Launch**

Focus of November workshop:

- Complete
- Mostly complete

Where we’re headed: pathway to commercialization
### Meeting Goals

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Produce a commercialization plan based on the part development process</td>
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<tr>
<td>2</td>
<td>Identify and address technology and funding gaps on the pathway to part implementation on a model year 2018 vehicle at 50k units per year or more.</td>
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<tr>
<td>3</td>
<td>Identify and assign initial team roles and responsibilities and develop a plan to bring a large Tier 1 or OEM on board.</td>
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Pre Read Table of Contents

1. Vision for Collaboration
2. Summary of the Parts Approach
3. Key Questions
THE MEETING WILL BUILD FROM WORKSHOP OUTCOMES AND FOCUS ON A PATHWAY TO COMMERCIALIZATION

Pre Read Table of Contents

1. Vision for Collaboration
2. Summary of the Parts Approach
3. Key Questions
A COLLABORATIVE APPROACH WITH STAKEHOLDERS FROM ACROSS THE SUPPLY CHAIN CAN OVERCOME BARRIERS TO COMMERCIALIZATION

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>OEM</th>
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<tbody>
<tr>
<td><strong>Contribution:</strong></td>
<td><strong>Guidance:</strong> production part design process and requirements</td>
</tr>
<tr>
<td><strong>Value Derived:</strong></td>
<td><strong>Access to a scale-capable supply chain team focused on high value applications</strong></td>
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</tbody>
</table>

**Tooling Providers**

- **Contribution:** Manufacturing equipment & expertise
- **Value Derived:** Develop and demo equipment in customer-driven environment

**CAE Software Providers**

- **Contribution:** Predictive tools & expertise
- **Value Derived:** Develop and demo analysis capabilities for specific large-scale applications

**Fiber + Resin Producers**

- **Contribution:** Material systems & expertise
- **Value Derived:** Access to growth market

**Gov’t / DOE / ORNL**

- **Contribution:** Active collaboration with current programs (NNMI, VTP, CTF)
- **Value Derived:**
  - Fossil fuel reduction goals advancement
  - U.S. manufacturing competitiveness
  - Bridging from pilot to commercialization

Potential roles to be discussed at meeting
Key technology and funding gaps can be identified by understanding the OEM production part approval process (PPAP).

Illustrative
The AutoComposites supply chain will need to work together to cover upfront costs on the path to commercialization.

**Estimated Program Cost (thousand $)**
Big investments in design, equipment/tooling, and testing would traditionally fall on the OEM and large Tier 1 suppliers.

**Illustrative**
Pre Read Table of Contents

1. Vision for Collaboration
2. Summary of the Parts Approach
3. Key Questions
A few parts, implemented at mainstream volume, can drive significant scale and investment while paving the way for composite-intensive vehicles.
The parts approach focuses on near term commercialization while making barriers to CF adoption tangible.

The parts approach:

Start with a well-chosen part + segment
- Find CF applications with high weight savings and tangible value
- Target and tailor to mainstream adoption w/ initial volumes 50-100k model year 2018
- Enable total transformation over time

The parts approach can turn the laundry list of barriers to CF adoption into a strategic, concrete list of near-term deliverables.
THE PARTS APPROACH OFFERS A STARTING POINT TOWARD CAPTURING THE FULL VALUE OF CF IN THE LONGER TERM
WE EXPLORED THE PARTS APPROACH IN A WORKSHOP SETTING WITH STAKEHOLDERS ACROSS THE AUTCOMPOSITES SUPPLY CHAIN
Criteria were developed to select the right part, segment, material specification, and volume.

**Criteria:**
- High weight reduction potential
- Stiffness-driven
- Part count reduction
- Tangible customer value
  - Safety potential
  - Space savings
  - Ease of use
- Manufacturable at scale with current/forthcoming processes
- Avoids near-term safety challenges
- Readily adapted to additional models and platforms

**Part Candidates**
- Rear hatch inner
- Door inner + intrusion beam (van/cargo van in particular)
- Seat structure (stowaways in particular)
- Engine cradle

**Segments**
- Performance
- EVs
- Fleets

**Material**
- Large tow, non-cosmetic

**Volume**
- 50–100k w/ integration into existing plants
The meeting will build from November workshop outcomes and focus on a pathway to commercialization. Workshop participants identified several manufacturing pathways well-suited to automotive needs and capable of meeting volumes of 50-100k.
INITIAL RESULTS SUGGEST THAT WELL-CHOSEN CF COMPOSITE PARTS OFFER EQUAL OR BETTER VALUE RELATIVE TO THE STEEL PARTS THEY WOULD REPLACE

*For EVs, 3yr fuel saving block will be reduced by two thirds, however roughly the same amount will be replaced by upfront battery cost savings
COMMERCIALIZATION PROJECTS CAN BOTH BENEFIT FROM AND CONTRIBUTE TO A BROADER COMPOSITES INNOVATION HUB (OR INSTITUTE FOR MANUFACTURING INNOVATION)
Collaboration will be key. Co-opetition and co-funding can help overcome complex, cross-disciplinary development challenges.

1. Complex, cross-disciplinary challenges
   - New material
   - New design
   - New Process

2. Decision making interactions across the supply chain
   - Precursor
   - Production Process
   - Fiber
   - Resin
   - Form
   - Mnfg Process
   - Assembly & integration w/ rest of vehicle
   - Volume, Marketing, & Allocations
   - Material suppliers
   - Mnfg: Tier 1, Tooling & Equipment suppliers
   - OEM
Pre Read Table of Contents

1. Vision for Collaboration
2. Summary of the Parts Approach
3. Key Questions
The meeting will build from November workshop outcomes and focus on a pathway to commercialization.

Commercialization will face technology barriers:

- New Material
- New Process
- Complex interactions across the supply chain

Technical Challenges:

- CAE tools
- Assembly
- Finishing
- Cycle times
- Repair & Replacement
- Material data
- Crash safety
- Recyclability
Where are the key technology gaps? How and when can they be overcome?

• Prioritize top challenges
• For each: who’s involved and how can we work together to overcome?
Where are the key funding gaps and how can they be overcome?

**Estimated Program Cost (thousand $)**

Big investments in design, equipment/tooling, and testing would traditionally fall on the OEM and large Tier 1 suppliers.

**Illustrative**

- Consider:
  - Which partners will incur the highest costs?
  - Do they have the money to invest?
  - Do they have enough incentive to invest? Is risk aligned with reward?
## How will this effort differ from existing Industry Consortia and Commercialization-focused Initiatives?

<table>
<thead>
<tr>
<th>Organization</th>
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HOW WILL PROGRAM PARTICIPANTS MANAGE IP AND THE TENSION BETWEEN COLLABORATIVE AND COMPETITIVE?

Pre-Competitive
- Collaboratively address shared challenges
- Limited info sharing and guarded discussion
- Access to public funding

Competitive
- Small teams focused on near-term commercialization
- IP protection and detailed design & development
- No access to public funding

Co-opetition
- At what point will the commercialization effort need to cross into the competitive space?
- What types of agreements will be needed in order to protect information while still driving innovation and progress?
How can we quickly bring an OEM or large Tier 1 on board?

Potential “Road Show” Campaign to recruit an OEM:

- Capable team from across supply chain
  - Fiber
  - Resin
  - Process
  - Software & Design
  - Etc.

1. Assemble roadshow team
2. Create Pitch
3. Present Opportunity

OEM
OEM
Tier 1
OEM