The Future of Mobility

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VP, Analytics
June 22, 2016
Our Vision

To radically change the way organizations design products and make decisions
# We Work with Some of the Best

<table>
<thead>
<tr>
<th>Automotive</th>
<th>Aerospace</th>
<th>Heavy Equipment</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford</td>
<td>BAE SYSTEMS</td>
<td>ALSTOM</td>
<td>AIST</td>
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<td>TOYOTA</td>
<td>Boeing</td>
<td>BOEING</td>
<td>NASA</td>
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<td>CHRYSLER</td>
<td>Airbus Group</td>
<td>JOHN DEERE</td>
<td>Los Alamos National Laboratory</td>
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<td>GM</td>
<td>Bombardier</td>
<td>JFE</td>
<td>ENSCAE</td>
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<td>RENAULT</td>
<td>Embraer</td>
<td>CATERPILLAR</td>
<td>Air Force</td>
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<td>HONDA</td>
<td>Honeywell</td>
<td>OSHKOSH</td>
<td>Stafford</td>
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<td>BMW</td>
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<td>National Research Council Canada</td>
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<tr>
<th>Life/Earth Sciences</th>
<th>Electronics/Consumer Goods</th>
<th>Energy</th>
<th>Architecture</th>
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<tbody>
<tr>
<td>BASF</td>
<td>Acer</td>
<td>ABB</td>
<td>AECOM</td>
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<tr>
<td>Bayer</td>
<td>Intel</td>
<td>Chevron</td>
<td>SOM</td>
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<td>Dow</td>
<td>IBM</td>
<td>Valero</td>
<td>SOM</td>
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<td>Alcoa</td>
<td>LG</td>
<td>ConocoPhillips</td>
<td>WA</td>
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<td>Merck</td>
<td>BOSCH</td>
<td>ExxonMobil</td>
<td>Worley Parsons</td>
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5,000 customers worldwide
Automotive’s Only Award Dedicated to Vehicle Lightweighting

Honoring the greatest achievements in automotive vehicle weight saving each year; to inspire interest from industry, engineering, policymakers, educators, students and the public; to create further competition for new ideas in the industry; and to provide an incentive to share technological advances.

Nomination Deadline: 20th May 2016

In Partnership with:
Key Takeaways

Light weighting is a Key Countermeasure to recent industry challenges

It’s a Multi-Material World

AM is here to stay
Several trends mentioned above are achievable through lightweight vehicle construction. As a result, global automotive OEMs are in the process of downsizing their vehicle weight by using alternative (lightweight) materials in their vehicle construction.
CO₂ emission regulation and the CAFE regulation are the key drivers of weight reduction.
According to the Kyoto protocol, the most industrialised countries have to achieve an emission reduction of 5.2 per cent, as compared against the level in 1990, between 2008 and 2012.
Possible Countermeasures

**Engine Efficiency**
- Direct Injection
- Downsize Engine

**Reduce Weight**
- Use Less Material
- Use Lighter Material
- Redesign

**Reduce Frictional Losses**
- Reduce Aero drag
- Rolling resistance

**Reduced Parasitic Losses**
- Thermal efficiency
- Electrical efficiency

**Hybrid/EV**
Weight Reduction Techniques

**Unibody design and BIW**
1.7 kg reduction by use of high-strength steel and new structural adhesives

**Downsizing and Turbocharging**
- Engine downsizing of 30 per cent reduces 10-20 per cent of the total weight of the car and 10-20 per cent CO₂ emissions.
- For example, Ford’s replacement of its V8 engine with V6 engine and 6 cylinder with 4 cylinder

**Lightweight cooling system**
Modular integration of radiator and cooling fan and modular integration of air conditioning and transmission coolers leads to approximately 1-5 kg weight

**Aluminium brake callipers**
- Replacement of steel by aluminium
- Weight reduction by 3.4 kg
- Used in Ford Focus

**Laminated glazing**
Thinner and stronger laminated glass windshield or windows, Approximately 10-12 per cent weight savings

**Hollow seat frames and thin seat foams**
Weight reduction of 4.9 kg in the 2008 Ford Focus by the use of hollow seat structure and lightweight foam

**Adopting hydro-forming technology on chassis frame**
- Offers 20 per cent weight reduction

**Aluminium steering knuckles**
- Offers approximately 50 per cent weight reduction
- Use of aluminium wheels by two-thirds of Ford’s fleet

**Aluminium wheel**
- Offers 10 kg of reduction

**Aluminium in rear suspension control arm**
- Offers up to 45 per cent weight reduction

**High-strength steel in McPherson strut**
- 20 per cent reduction with structural components built using high-strength steel
- 40 per cent reduction by use of hollow piston rods

**Electric power steering**
- Removal of mechanical components
- Use of aluminium and magnesium in the steering components
- Weight savings of approximately 4-5 kg

**Key**
- Powertrain
- Chassis
- Interior and Exterior
Material Usage Implementation & Past Trends

Source: SAE, McKinsey
Ford F-150

ALUMINUM-ALLOY BODY AND STEEL FRAME

Over 10 million miles of cumulative testing in the making.

- Class-exclusive cab and box fabricated from high-strength, military grade, aluminum alloys
- Fully boxed frame with eight crossmembers (five through-welded) made of up to 78 percent 70,000-psi high-strength steel (up from 23 percent in the 2014 F-150 frame); up to 60 lbs. lighter with state-of-the-art roll-forming process that minimizes weight
- Vehicle weight up to 700 pounds lighter than before resulting in better fuel efficiency, greater towing and payload capacities, improved power-to-weight ratio for faster acceleration, enhanced handling and braking responsiveness

Golf Ball Test
Some Industry Examples

Volvo XC-90

Cadillac CT-6
Is it Just About Weight?

CFRP wheels offer many advantages due to the reduction of weight

- Reduced rotation mass
- Less unsprung mass

- Reduced fuel consumption
- Increased acceleration
- Potentially reduced road noise
- Reduced stopping distance
- Improved mechanical grip
- Improved steering and handling
- New designs
Is it Just About Weight?

Since carbon fiber composite is much stiffer and stronger than steel, it was easier for the i3 to eliminate the B-pillar, the vertical support between the front door and rear door. The front doors open normally while the rear doors are hinged at the back. These “coach doors” make it easier to load child car seats, groceries, and more, and contribute to a sense of spaciousness and accessibility.
Why we look at Additive Manufacturing Technology?

“Do you benefit from the structural freedom?”
Potential Applications of AM in Automotive

• Drivers:
  • More Materials Amenable to AM
  • Improved AM manufactured product quality and reduced post-processing

• Challenges:
  • Economics of AM limited to low volume production
  • Manufacturing large parts
  • Talent Shortage
  • IP Concerns

Source: Deloitte
Local Motors, Olli and Urbee, GE
The future…

Homes

Replacement Organs
Key Takeaways

- Light weighting is a Key Countermeasure
- It’s a Multi-Material World
- AM is here to stay
Thank You