THE OLDEST AND LARGEST RECOGNITION EVENT IN THE AUTOMOTIVE & PLASTICS INDUSTRIES

47TH-ANNUAL

Innovation Awards Gala

INTELLIGENT
AUTOMOTIVE DESIGN
WITH PLASTICS

NOV 8
2017

Society of Plastics Engineers • Automotive Division
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BASF
Inteva Products
Welcome to the 2017 Innovation Awards Gala

November 8, 2017

Welcome to the 47th-annual SPE® Automotive Innovation Awards Gala, sponsored by the Automotive Division of the Society of Plastics Engineers (SPE). I’m honored to once again lead this annual program, the world’s oldest and largest recognition event in the automotive and plastics industries. Each year we see the latest and best results of cooperative innovation by automotive engineers, designers and their suppliers whose combined ingenuity and creativity reinforce the dynamic nature of the automotive industry. My colleagues in the Automotive Division are excited to offer this tribute to the latest innovation in plastics and composites in ground transportation.

This year’s theme, Intelligent Automotive Design with Plastics, reflects the notion that design and performance of automotive components is an intricate blend of materials, assembly, interfaces and execution. The automotive design and engineering teams, including their partner supply base, continue to find new ways of developing components that deliver on the intended function at lower cost and weight than the preceding technologies while meeting or exceeding the performance of yesterday’s solutions. This Innovation Awards program continues to demonstrate that plastics play an important role in delivering what car buyers ultimately want in terms of performance, fuel economy, safety and comfort through innovations in lighter weight components, powertrain technologies, and surprise & delight features on new vehicle programs. Several of these new technologies, materials, and processes will be presented tonight.

The competition this year was again intense, with nearly 60 nominations across 9 different categories. Tonight’s program will recognize the accomplishments of the people and companies involved in this year’s most innovative use of plastics with awards in the following areas:

- Aftermarket
- Body Interior
- Body Exterior
- Chassis & Hardware
- Environmental
- Materials
- Powertrain
- Process, Assembly and Enabling Technologies, and
- Safety

We will also recognize a new entry into our SPE Automotive Division Hall of Fame, the Vehicle Engineering Team Award that recognizes the efforts of the broader vehicle development team in executing innovation in plastics on a new vehicle program and our newest recipient of the Lifetime Achievement Award, an award that recognizes the technical achievements of individuals whose work – in research, design, and/or engineering – has led to significant integration of polymeric materials on passenger vehicles.

Before we begin tonight’s program, I would like to thank the many volunteers, sponsors, and judges who make this event possible. It is their dedication and commitment – their passion – for innovation that enable the SPE Automotive Division to recognize the industry’s most innovative use of plastics and composites in automotive applications.

Once again, welcome to the 2017 SPE Automotive Innovation Awards Gala. Thank you for joining us and we hope you enjoy the event.

Sincerely,

Jeffrey Helms

Innovation Awards Chair 2010-2017
Global Automotive OEM Corporate Accounts Director
Engineered Materials
Celanese
**SCHEDULE OF EVENTS**

4:00-6:00 pm VIP Reception
4:30-6:00 pm Reception / Preview of Nominated Parts & Vehicle Displays
6:00 pm Seating Begins
6:15-7:00 pm Welcome / Dinner

*Jeffrey Helms*, Celanese, ‘10-’17 SPE Automotive Innovation Awards Program Chair
*Teri Chouinard*, Intuit Group
*Michael Ruby*, Sales Director, Celanese

7:00-9:00 pm Gala Program

**Aftermarket**
David Reed, General Motors Corp. (retired)

**Body Exterior**
Tom Pickett, General Motors Company

**Body Interior**
Yvonne Merritt, Ford Motor Company

**Lifetime Achievement**
Jeffrey Helms, Celanese

**Chassis & Hardware**
Crystal VanHouten, Grupo Antolin

**Environmental**
Rose Petrella-Lovasik, Ford Motor Company

**Hall of Fame**
Kevin Pageau, International Marketing Alliance

**Powertrain**
Joel Meyers, Hyundai-Kia Technical Center America

**Materials**
Suresh Shah, Delphi Corp. (retired)

**Vehicle Engineering Team Award**
Jeffrey Helms, Celanese

**Process, Assembly & Enabling Technologies**
Steven VanLoozen, Celanese

**Safety**
Suzanne Cole, Miller Cole LLC

**Grand Award**
Jeffrey Helms, Celanese

9:00-11:00 pm Afterglow Reception

Everyone Invited to Attend

**BLUE RIBBON JUDGES**

Marc Benevento, Industrial Market Insight

Suzanne Cole, Miller Cole LLC

Fred Deans, SPE Automotive Division

Subi Dinda, Chrysler (retired), Oakland University

Brendan Dooley, IHS

Robert Eller, Robert Eller & Associates

John Fillion, Chrysler (retired)

Norm Kakarala, SPE Automotive Division

Gary Kogowski, Ravago Holdings Americas

David Mattis, General Motors Corp. (retired)

Sean McElroy, Autoline

Al Murray, SPE Emeritus

Ron Price, Global Polymer Solutions

Nippani Rao, Rao Associates

Dave Reed, General Motors Corp. (retired)

Tom Russell, Allied Composite Technologies LLC

Suresh Shah, SPE Automotive Division

Lilli Sherman, Plastics Technology Magazine

Roy Sjoberg, Team R2S LLP

Jim Staargaard, Plasan (retired)

Chris Theodore, Theodore & Associates LLC

Bill Windscheif, SPE Detroit Section

Drew Winter, WardsAuto.com

Conrad Zumhagen, The Zumhagen Company LLC

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Special thanks to our student usher organizers, Teri Chouinard, Crystal VanHouten, and Dave Reed.

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(937) 575.9800
### Plastics Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>acrylonitrile butadiene styrene</td>
</tr>
<tr>
<td>ACM</td>
<td>alkyl acrylate copolymer</td>
</tr>
<tr>
<td>ASA</td>
<td>acrylic-styrene-acrylonitrile</td>
</tr>
<tr>
<td>CF</td>
<td>carbon fiber</td>
</tr>
<tr>
<td>CFRP</td>
<td>carbon fiber-reinforced plastic</td>
</tr>
<tr>
<td>D-LFT</td>
<td>direct-(ILC) long-fiber thermoplastic</td>
</tr>
<tr>
<td>EPP</td>
<td>expanded polypropylene foam</td>
</tr>
<tr>
<td>EVA</td>
<td>ethylene vinyl acetate</td>
</tr>
<tr>
<td>GF</td>
<td>glass fiber (reinforced)</td>
</tr>
<tr>
<td>GMT</td>
<td>glass-mat thermoplastic</td>
</tr>
<tr>
<td>GR</td>
<td>glass fiber (reinforced)</td>
</tr>
<tr>
<td>HDT</td>
<td>heat-deflection temperature</td>
</tr>
<tr>
<td>ILC</td>
<td>inline compounded</td>
</tr>
<tr>
<td>ITR</td>
<td>isophthalate terephthalate resorcinol</td>
</tr>
<tr>
<td>LCP</td>
<td>liquid crystal polymer</td>
</tr>
<tr>
<td>LFT</td>
<td>long-fiber thermoplastic</td>
</tr>
<tr>
<td>MFI</td>
<td>melt flow index</td>
</tr>
<tr>
<td>MFR</td>
<td>melt flow rate</td>
</tr>
<tr>
<td>MIC</td>
<td>molded-in-color</td>
</tr>
<tr>
<td>MPPE</td>
<td>modified-polyphenylene ether (also called MPPO, modified-polyphenylene oxide)</td>
</tr>
<tr>
<td>OOA</td>
<td>out-of-autoclave (process)</td>
</tr>
<tr>
<td>PA</td>
<td>polyamide (also called nylon)</td>
</tr>
<tr>
<td>PC</td>
<td>polycarbonate</td>
</tr>
<tr>
<td>PC/ABS</td>
<td>polycarbonate/acrylonitrile butadiene styrene</td>
</tr>
<tr>
<td>PC/ASA</td>
<td>polycarbonate/acyrlic-styrene-acrylonitrile</td>
</tr>
<tr>
<td>PC/PBT</td>
<td>polycarbonate/polybutylene terephthalate</td>
</tr>
<tr>
<td>PE</td>
<td>polyethylene</td>
</tr>
<tr>
<td>PEI</td>
<td>polyetherimide</td>
</tr>
<tr>
<td>PET</td>
<td>polyethylene terephthalate</td>
</tr>
<tr>
<td>PMMA</td>
<td>poly(methyl methacrylate) (also called acrylic)</td>
</tr>
<tr>
<td>POM</td>
<td>polyoxymethylene (also called acetal)</td>
</tr>
<tr>
<td>PP</td>
<td>polypropylene</td>
</tr>
<tr>
<td>PPA</td>
<td>polyphthalamide</td>
</tr>
<tr>
<td>PPS</td>
<td>polyphthalamide sulfide</td>
</tr>
<tr>
<td>PTFE</td>
<td>polytetrafluoroethylene</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride (also called vinyl)</td>
</tr>
<tr>
<td>PVB</td>
<td>polyvinyl butyral</td>
</tr>
<tr>
<td>PVDF</td>
<td>polyvinylidene fluoride or polyvinylidene difluoride</td>
</tr>
<tr>
<td>SMA</td>
<td>styrene maleic anhydride</td>
</tr>
<tr>
<td>SMC</td>
<td>sheet-molding compound</td>
</tr>
<tr>
<td>TiO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>titanium dioxide</td>
</tr>
<tr>
<td>TPC-ET</td>
<td>thermoplastic copolyester elastomer</td>
</tr>
<tr>
<td>TPE</td>
<td>thermoplastic elastomer</td>
</tr>
<tr>
<td>TPO</td>
<td>thermoplastic polyolefin</td>
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<tr>
<td>TPV</td>
<td>thermoplastic vulcanizate</td>
</tr>
<tr>
<td>CAD</td>
<td>computer-aided design</td>
</tr>
<tr>
<td>CAE</td>
<td>computer-aided engineering</td>
</tr>
<tr>
<td>CLTE</td>
<td>coefficient of linear thermal expansion</td>
</tr>
<tr>
<td>CNC</td>
<td>computer-numerical control</td>
</tr>
<tr>
<td>CUV</td>
<td>cross-over (sport-) utility vehicle</td>
</tr>
<tr>
<td>EA / EAs</td>
<td>energy absorber(s)</td>
</tr>
<tr>
<td>EGR</td>
<td>exhaust-gas recirculation</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FIP</td>
<td>foam-in-place</td>
</tr>
<tr>
<td>FMVSS</td>
<td>U.S. Federal Motor Vehicle Safety Standard</td>
</tr>
<tr>
<td>GOR</td>
<td>grille-opening reinforcement</td>
</tr>
<tr>
<td>HDT</td>
<td>heat-deflection temperature</td>
</tr>
<tr>
<td>HEV</td>
<td>hybrid-electric vehicle</td>
</tr>
<tr>
<td>HIC</td>
<td>head-injury criterion</td>
</tr>
<tr>
<td>HID</td>
<td>high-intensity discharge</td>
</tr>
<tr>
<td>ICE</td>
<td>internal combustion engine</td>
</tr>
<tr>
<td>IP</td>
<td>instrument panel</td>
</tr>
<tr>
<td>LED</td>
<td>light-emitting diode</td>
</tr>
<tr>
<td>Li-Ion</td>
<td>lithium-ion</td>
</tr>
<tr>
<td>MPV</td>
<td>multi-purpose vehicle</td>
</tr>
<tr>
<td>NVH</td>
<td>noise/vibration/harshness</td>
</tr>
<tr>
<td>OEM</td>
<td>original-equipment manufacturer</td>
</tr>
<tr>
<td>PCR</td>
<td>post-consumer recyclate</td>
</tr>
<tr>
<td>ped-pro</td>
<td>pedestrian protection (requirement)</td>
</tr>
<tr>
<td>PHEV</td>
<td>plug-in hybrid-electric vehicle</td>
</tr>
<tr>
<td>PIR</td>
<td>post-industrial recyclate</td>
</tr>
<tr>
<td>SUV</td>
<td>sport-utility vehicle</td>
</tr>
<tr>
<td>TPC-ET</td>
<td>thermoplastic copolyester elastomer</td>
</tr>
<tr>
<td>VOCs</td>
<td>volatile organic compounds</td>
</tr>
</tbody>
</table>

### Automotive Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/C</td>
<td>air conditioning</td>
</tr>
<tr>
<td>AGS</td>
<td>active grille shutter</td>
</tr>
<tr>
<td>BEV</td>
<td>battery-electric vehicle</td>
</tr>
<tr>
<td>BIW</td>
<td>body in white</td>
</tr>
<tr>
<td>BSR</td>
<td>buzz/squeak/rattle</td>
</tr>
</tbody>
</table>

### Other Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D</td>
<td>two-dimensional</td>
</tr>
<tr>
<td>3D</td>
<td>three-dimensional</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter</td>
</tr>
<tr>
<td>CO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>ft</td>
<td>foot</td>
</tr>
<tr>
<td>g</td>
<td>gram</td>
</tr>
<tr>
<td>in</td>
<td>inch</td>
</tr>
<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>kg</td>
<td>kilograms</td>
</tr>
<tr>
<td>lb</td>
<td>pound</td>
</tr>
<tr>
<td>KMPH</td>
<td>kilometers/hour</td>
</tr>
<tr>
<td>km/h</td>
<td>kilometers/hour</td>
</tr>
<tr>
<td>m</td>
<td>meter(s)</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>MM</td>
<td>million(s)</td>
</tr>
<tr>
<td>MPG</td>
<td>miles/gallon</td>
</tr>
<tr>
<td>MPH</td>
<td>miles/hour</td>
</tr>
<tr>
<td>N</td>
<td>Newtons</td>
</tr>
<tr>
<td>sec</td>
<td>second</td>
</tr>
<tr>
<td>SG</td>
<td>specific gravity</td>
</tr>
<tr>
<td>USD</td>
<td>U.S. dollars</td>
</tr>
</tbody>
</table>
**Illuminated Emblem**

2017 General Motors Company
Chevrolet Camaro, Silverado, Colorado

System Supplier: Windsor Mold Group
Material Processor: Emrick Plastics
Material Supplier: Sabic, Arkema
Material / Process: Lexan LS1 PC, Lexan SLX2271T PC, Plexiglas V825, PMMA / 2-shot molding
Tooling Supplier: Windsor Mold Group

Combination of a 2-shot overmolded lens and 2-shot light guide utilizing multiple materials, and laser welding in one package enabled efficient production of this backlit chrome emblem. Two-shot molding the lens eliminated the need for excess material and energy associated with conventional hardcoating processes. A two-shot light guide was developed with selective areas of transparent and diffusion material into a single sub-component. This solved significant technical difficulties to achieve even lighting across a large surface area within a tight packaging space.

**High Desert Tonneau Cover**

2017 General Motors Company
Chevrolet Silverado

System Supplier: Penda Corp.
Material Processor: Penda/Durakon
Material Supplier: A. Schulman
Material / Process: Polytrope TPP1026EU TPO / twin sheet thermoforming
Tooling Supplier: Penda Corp.

Achieving a grain in a thermoformed part that matches the same grain produced by injection molding resulted in an improved appearance with the tonneau cover harmonizing with other thermoformed and injection molded parts on the vehicle. It also enabled a $300/truck savings by enabling an aluminum honeycomb (in the previous vehicle design) to be replaced with a steel bar design. A new scratch resistant thermoformable TPO helped to make this possible.

**Integrated Floor Bedliner Divider**

2017 General Motors Company
Chevrolet Silverado

System Supplier: Penda Corp.
Material Processor: Penda/Durakon
Material Supplier: A. Schulman
Material / Process: Polytrope TPP1026EU TPO / twin sheet thermoforming
Tooling Supplier: Penda Corp.

This first time twin sheet thermoformed bedliner divider is integrated into the bedliner as one piece. A $275 cost avoidance resulted by not having to manufacture a separate floor divider part. The divider incorporates a molded in locking feature to secure the divider into the truck wall when it is raised. It eliminates the need for a cargo net or separate divider allowing the customer to put smaller items in the bed without having the items move and slide around while the vehicle is in motion. Dual textures are achieved on both sides of the part and the design can be applied to different vehicle models and brands via an insert for different logos.

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- **Exxon™ butyl rubber**
  80 years of leading air-barrier technology

- **Santoprene™ TPV**
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exxonmobilchemical.com
**Body Exterior**

**Structural Active Grille Shutter (AGS) w/ Integrated Loose Layer Construction**

2018 Ford Motor Company

Ford Expedition

System Supplier: Magna Plastcoat
Material Processor: Magna Plastcoat
Material Supplier: Celanese
Material / Process: Celstran 40-20 PP / injection molding
Tooling Supplier: Integrity Tool

This, possibly the largest 2-shot Active Grille Shutter (AGS) in production today, was designed with an integrated locating and attaching system for consistent fit between the grille and headlamps eliminating the need for FEM assembly, dunnage and shipping. Savings are estimated at $5 per part system, additional $16 inside cost in addition to $45 markup and shipping, $1 in labor by eliminating 4 fasteners, and in-plant tooling avoidance of $2 Million for a new cell and assembly tooling. A 1 lb weight savings was achieved, plus an additional 3 lb avoidance over a metal/plastic hybrid assembly.

**Functional Spoiler Stanchion**

2018 General Motors Company

Chevrolet Camaro ZL1 1LE

System Supplier: Transglobal
Material Processor: Proper Tooling
Material Supplier: Trinseo
Material / Process: Pulse 2000EZ PC/ABS / injection molding
Tooling Supplier: Proper Tooling

Thermoplastic (ABS+PC) replaced metal to injection mold this spoiler stanchion enabling stylish, aerodynamics and an 86% weight savings while meeting strength/stiffness requirements. An innovative attachment scheme, including long bolts and compression limiters designed to attach the stanchions to the spoiler and to the vehicle without exposing the fasteners, was designed. Unique core out slides in the tool were created to enable the hollow stanchion design.

**Rear Quarter Window**

2017 SAIC General Motors (SGM)

Buick GL8

System Supplier: Shentong
Material Processor: Shentong
Material Supplier: SABIC
Material / Process: Lexan GLX143 PC, Cycoloy XCM830 PC/ABS / 2-shot injection compression molding
Tooling Supplier: Inglass

Global industry’s largest-ever (1200 x 450 mm) 2-component polycarbonate rear quarter window (RQW) on a production vehicle is 40% lighter (3kg lighter) and substantially more impact resistant vs. comparable RQW in glass. It also features design elements that cannot be achieved with glass, contributing to the more innovative exterior of the new-generation GL8.

**Bolster Active Grille Shutter**

2018 Ford Motor Company

Ford Fiesta

System Supplier: Montaplast
Material Processor: Montaplast
Material Supplier: Lanxess
Material / Process: Durethan PA6 35GF / injection molding
Tooling Supplier: Farmington

This integration of an Active Grille Shutter and bolster function into the front end module includes sheet metal bolt on reinforcements in the structure. Injection molding the plastic metal hybrid replaces separate molding of the two systems and a part count reduction of 20 separate parts. This saved 1.76 lbs of weight and enabled an approximate $8 cost savings. This process also improved sealing efficiency to improve heat exchanger performance. It is scalable to other OEMs or vehicle sizes.
**Headlamp Light Curtain**
2016 General Motors Company
Cadillac CT6

- **System Supplier:** Hella KGaA Hueck & Co.
- **Material Processor:** Not available
- **Material Supplier:** Evonik Cyro LLC
- **Material / Process:** Acrylite LD96 PMMA / injection molding
- **Tooling Supplier:** Not available

The lamp appears crystal clear when unlit but has a glowing appearance when lit. The light scattering properties of the new material convert the light guide to a fully illuminated panel, that can be used with any color LED, opening a new degree of freedom for designers. Previously, clear PMMA without this light scattering additive was used, and structures on the surface of the light pipe, along with multiple LEDs behind the part, had to be used. These traditional light guides and light pipes resulted in bright spots and a milky (grained) unlit appearance. The new headlamps give the consumer premium headlamp styling due to a homogeneously lit light function. Safety is enhanced as there is better visibility due to a larger illuminated surface easier to detect with the human eye. A 3D effect can also be achieved.

**D Optic LED Headlamp**
2018 General Motors Company
Chevrolet Traverse

- **System Supplier:** Magna Autosystems
- **Material Processor:** Not available
- **Material Supplier:** Arkema
- **Material / Process:** Plexiglas HT-121 PMMA / injection molding
- **Tooling Supplier:** Not available

This innovative headlamp system features scalable modular design flexibility. The customer can add elements to achieve styling and/or performance objectives. The lenses are single shot thick molded elements, with extremely tight tolerance and high optical clarity requirements. They simplify conventional optical systems in which multiple components (reflector, shield and lens) must be positioned very precisely, with a system of pairing a precisely molded lens with a single 1 x 1 LED light source. A high temperature grade acrylic material enables the modular lenses to be placed very close to the light source, within 300 - 500 micros, to maximize the amount of light captured form the LED. The Traverse headlamp has three vertically large integrated lenses alongside six individual compact lenses.

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Why not?

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Energy Efficient.
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Innovation rarely comes easy. Persistence is required.

We at SABIC put this trait to work when collaborating with automakers and development partners. This combines with one of the broadest portfolios of thermoplastic materials in the industry and a dedicated team of automotive specialists capable of tackling almost any design challenge, for parts and systems across the entire vehicle.

We also understand that there is no substitute for hard work and tenacity, especially when unexpected obstacles hold us back from delivering the best service to you. It is why we are committed to raising our level of performance to meet and beat your expectations. And we will not stop until we do.
**Body Interior**

**Cargo Management Deployable Shelf**

*2017 Ford Motor Company*

*Ford Expedition/Lincoln Navigator*

<table>
<thead>
<tr>
<th>System Supplier:</th>
<th>Valley Enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Processor:</td>
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<tr>
<td>Material Supplier:</td>
<td>Chase Plastics</td>
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<tr>
<td>Material / Process:</td>
<td>PPHSTF2 / HI121 ABS / injection molding</td>
</tr>
<tr>
<td>Tooling Supplier:</td>
<td>Reliable &amp; Reasonable Tool Service LLC, Buiiter Tool &amp; Die, Inc.</td>
</tr>
</tbody>
</table>

This first time use of a multi-functional cargo management system in an SUV provides the customer with dynamic storage options in the rear of the vehicle. It enables the use of the full height of the cargo environment as well as assisting in solving the common customer complaint of items falling out the rear of the vehicle. The system bins, components and actuation linkages are injection molded using various PP and ABS materials to meet new appearance and load requirements.

**Real Wood Interior Door Garnish Using Natural Cork**

*2017 Hyundai Motor Company*

*Grandeur Hybrid*

<table>
<thead>
<tr>
<th>System Supplier:</th>
<th>Seoyon E-Hwa Interior Systems</th>
</tr>
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<tbody>
<tr>
<td>Material Processor:</td>
<td>Seoyon E-Hwa Interior Systems</td>
</tr>
<tr>
<td>Material Supplier:</td>
<td>L &amp; J</td>
</tr>
<tr>
<td>Material / Process:</td>
<td>Not available / film insert molding</td>
</tr>
<tr>
<td>Tooling Supplier:</td>
<td>Seoyon E-Hwa Interior Systems</td>
</tr>
</tbody>
</table>

This is the first real wood film and parts technology using natural cork. It is eco-friendly not requiring cutting down trees (cork is harvested from the bark of living cork oak trees every ten years). It is more cost-competitive than conventional wood parts because of its simple structure and manufacturing process. Conventional wood parts are a multi-layered structure using several layers of wood veneer and require 20 steps of complex molding and machining including milling. Cork wood film is made with lamination equipment and parts are processed via insert injection molding. A 24% weight and a 65% cost savings is achieved compared to wood. Cork's unique honeycomb-structure offers elasticity, insulation and sound proofing.

**Thin Wall Floor Console Carrier**

*2018 General Motors Company*

*Buick Enclave, Chevy Traverse*

<table>
<thead>
<tr>
<th>System Supplier:</th>
<th>NYX</th>
</tr>
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<tbody>
<tr>
<td>Material Processor:</td>
<td>NYX</td>
</tr>
<tr>
<td>Material Supplier:</td>
<td>Celanese</td>
</tr>
<tr>
<td>Material / Process:</td>
<td>Celstran 40-0453 PP GF / injection molding</td>
</tr>
<tr>
<td>Tooling Supplier:</td>
<td>Integrity</td>
</tr>
</tbody>
</table>

This floor console carrier is unique with its 2.0 mm nominal thin wall thickness (with ability to implement lightening holes) and 40% Long Glass Fiber PP construction with first surface quality appearance. A 30% mass savings resulting in a 2.2 lb/99 kg weight savings, and a 15% cost savings was achieved. Lateral stiffness targets were exceeded eliminating the need for metal brackets ($1.50). It is also the first time injection molding was used to process this type of a component.

**Real Wood Interior Door Garnish Using Natural Cork**

*2017 Hyundai Motor Company*

*Grandeur Hybrid*

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**Body Interior**

**Nacelle Cover**  
*2018 Tata Motors Limited*  
*Tata Tiago*

- **System Supplier:** Tata Auto Components  
- **Material Processor:** Abhijeet Tool  
- **Material Supplier:** SABIC  
- **Material / Process:** S3625 PP / injection molding  
- **Tooling Supplier:** Abhijeet Tool

A unique soft touch and feel was achieved for this interior application, while eliminating painting (and its associated costs and environmental impact). A unique recipe with a specially-developed glass fiber and PP combination, delivering equivalent performance of painted ABS, enabled a 30% cost savings by eliminating painting. Additional cost avoidance is possible with a reduction in overall rejections that may come from use of ABS.

**Cargo Protector**  
*2018 Ford Motor Company*  
*Ford Explorer, Lincoln Navigator*

- **System Supplier:** Beach Mold  
- **Material Processor:** Beach Mold  
- **Material Supplier:** ExxonMobil  
- **Material / Process:** 7885 PP / injection molding  
- **Tooling Supplier:** ToolPlas

This cargo protector eliminates a major design flaw on large SUVs by blocking the dynamic progress of rolling containers such as grocery items or objects such as small sports items while preventing them from falling out of the vehicle when the liftgate is opened. It also prevents items from “perching” on the scuff when the liftgate is closed, and avoiding item roll-out when the liftgate is opened by limiting the upper flat surface of the scuff and how it interfaces with the liftgate trim. The scuff’s beveled surface allows much easier removal of cargo items than a square-edged surface which is fairly common on small and mid-sized SUVs and CUVs.

**Instrument Panel Carrier**  
*2017 BMW*  
*Countryman*

- **System Supplier:** International Automotive Components (IAC)  
- **Material Processor:** International Automotive Components (IAC)  
- **Material Supplier:** SABIC  
- **Material / Process:** Stamax PP LGF / injection molding  
- **Tooling Supplier:** Siebenwurst

Long glass fiber PP injection molding via structural chemical foaming with core-back process enabled the production of this part with very low VOC emissions, meeting VDA 278 specification. Extensive CAE work predicting warpage of the foamed part provided valuable insights, allowing for the modification of tooling in advance. Use of foaming means less material is required resulting in a 15% weight savings, fewer emissions and less cost.

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*Inspiration comes from within*  

[www.IACgroup.com](http://www.IACgroup.com)
**Body Interior**

**Storage Box Interlocking Down Stop**

*2018 Ford Motor Company  
Lincoln Navigator*

- **System Supplier:** DMS  
- **Material Processor:** DMS  
- **Material Supplier:** Advanced Composites  
- **Material / Process:** ATX 832N PP / injection molding  
- **Tooling Supplier:** Lamko

An interlock is integrated into the traditional GB down stop design to make the TPO down stop super strong and still achieve very low disengagement effort for service and assembling. For the traditional design, low disengagement effort for service or assembling and robust down stop for customer abuse conflict with each other. Making one better will worsen the other. The interlocking down stop design decouples the two and allows for engineers to lower the disengagement effort and strengthen the down stop as needed. This results in a cost savings of $.90 per vehicle ($0.50 piece price savings and $0.40 labor savings) compared with removable down stops.

**Rear Seat Entertainment System**

*2018 Ford Motor Company  
Lincoln Navigator*

- **System Supplier:** Magna  
- **Material Processor:** Great Lakes Trim  
- **Material Supplier:** Advanced Composites  
- **Material / Process:** ADX 5028 PP / injection molding  
- **Tooling Supplier:** Great Lakes Trim

This Rear Seat Entertainment System was repositioned from the back of the front seat headrest to the upper seat back/lower portion of the head rest area for improved viewing comfort and ergonomics. No change in the existing seat structure was required with this common design for both the driver and passenger seat. The DVD system was removed to enable a larger screen and this resulted in a 30% cost reduction.

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Dr. Suresh Shah Named 2017 SPE® Lifetime Achievement Award Winner

Dr. Suresh Shah, retired, Senior Technical Fellow at Delphi Corporation, formerly General Motors – ACG (Automotive Components Group) has been named the 2017 Lifetime Achievement Award winner by the Automotive Division of the Society of Plastics Engineers (SPE®). Shah is a technical specialist, with over 30 years of experience and more than 45 Intellectual Properties including patents and trade secrets – more than 40% of these are in production, which is far more than the 4% industrial average. Shah advanced plastic processes including gas-assist injection molding, co-injection molding, microcellular molding, hybrid plastic/metal molding, direct (inline-compounded (ILC) long-fiber thermoplastic (D-LFT) composites and thin wall molding. He also advanced material developments involving natural fiber composites, nanocomposites, thermoplastic polyolefins (TPOs) and thermoplastic elastomers (TPEs). This expertise lead to several game changing innovations including the single piece, all plastic door hardware module known as SuperPlug®, and TPO thermoformable skin for instrument panels. He also developed many other innovative applications for exterior, interior and under-the-hood components. His rare combination of expertise in materials, processes, part design and analysis; has earned him a reputation as one of the best problem solvers in the industry. Shah has won more than 20 prestigious awards internationally. He is respected as an industry expert and a key opinion leader and has been interviewed over 30 times by industry trade journals, presented as a keynote speaker more than 15 times and has presented more than 80 technical papers worldwide.

Shah credits his success to his education, work experience and participation in professional trade associations. Shah has four degrees: Ph.D. in Polymer Chemistry/Plastics Engineering, and M.S. in Plastics Engineering, both at UMass, Lowell, Massachusetts., BSc-Tech in Plastic Technology at Institute of Chemical Technology (ICT) University of Bombay, India; and a B.S. in Chemistry, St. Xavier’s College, University of Gujarat, India. He joined General Motors (GM) in 1985 and worked in several technical positions at GM and Delphi Exterior, Lighting, interior, Safety and Thermal Divisions. Before retirement, he worked as Senior Technical Fellow for many years which was the highest technical position in the corporation. Shah is an active volunteer advancing SPE, serving as councilor since 2016, board member since 1990, automotive division chair (2000) and technical committee member or chair for several conferences since 1987. He has also serviced other professional societies, universities and the next generation with his leadership.

His many honors and awards include:

• 2015 SPE International’s most prestigious Research/Engineering Technology Award, one of the highest honors SPE bestows upon an individual every year.

• 2014 Inducted into “Gold Level – Hall of Fame” Innovation Award at Delphi Corporation for his technical contributions and 40+ intellectual properties
A c h i e v e m e n t

• 2011 “SPE Hall of Fame” Product Award for Door Hardware Module, developed in 1993, a game changer and trend setter, used on more than 60 million vehicles

• 2009 Engineering Society of Detroit’s (ESD) “Gold Award” as “Scientist of the Year” in Michigan for outstanding professional achievement, selected among ESD’s 72 Affiliate Societies.

• 2009 A tribute from Governor of Michigan

• 2003 Recognized as the “Honored Service Member” (HSM) by SPE

• 2001 Inducted as “Fellow of the Society” of Plastics Engineers (SPE)

• 2000 Received SPE “Interior Product Innovation Award” for Pioneering TPO skin application for instrument panel - A FIRST in Industry

• 1996 & 1998 Nominated for “General Motors’ Boss Kettering” award for bringing innovation into production and significant impact on corporate profit

• 1997 General Motors: Presidential Council’s Honor Award

• 1995 – 1997 Received Six National and International Prestigious Awards for developing All Plastic One-Piece Door Hardware Inner Module known as “SuperPlug”
  - SPE International’s Highest Award ‘Plastics Industrial Product Design Award’ during ANTEC (Annual Technical Conference) Minneapolis, 1996
  - Modern Plastics International Process Award, Switzerland 1997
  - IBEC Design Award, Detroit 1996
  - DesignFax Magazine Five-star Product of the Month Award 1995

• 1991 SPE Automotive Award for NUMMI Assist Grip Handle by Gas Injection Molding

• 1990 SPI Award of Excellence for Composite Window Guidance Channel by Gas Molding

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Flexible PPS Fasteners for High Heat Applications
2018 Ford Motor Company
Ford F150

System Supplier: Lear Corporation
Material Processor: Hellermann Tyton
Material Supplier: Celanese
Material / Process: Fortron FX72T6 PPS / injection molding
Tooling Supplier: Not available

This first time application allows plastic (PPS – Polyphenylene Sulfide) to replace metal and/or shielded nylon in high heat fastener applications. A 50% weight savings was achieved via elimination of metal fasteners and the elimination of shielding with a cost savings of over $20,000. Flexibility was maintained after high-heat exposure without shielding and assembly and ergonomics were improved. This technology is transferrable to many high-heat harness applications underhood or near the exhaust.

Engine Bracket
2017 Daimler AG
E-Klasse Coupé

System Supplier: ElringKlinger
Material Processor: ElringKlinger
Material Supplier: DuPont Automotive
Material / Process: Zytel 70G50 HSLA PA 66 GF50 / injection molding
Tooling Supplier: Hummel - Formen

Utilization of a 50% glass reinforced polyamide for engine brackets enabled improved NVH in the powertrain. An innovative injection molding tooling concept with 1+1 tooling (including hot runner and pressure transducer for continuous process control for both the left and right side bracket) was developed for production. This is the first time two cavity tooling with a hot runner system plus two pressure transducers for each cavity, enabling the continuous monitoring of the process, have been utilized. A cost savings of, up to 20% compared to metal brackets and up to 15% compared to aluminum brackets, was achieved.

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-Decorating & Assembly
- Electrical & Electronic Engineering Properties & Structure Extrusion
-Failure Analysis & Prevention Flexible Packaging
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**Plastic Clip for Door Integrated Window Regulators**

2017 Ford Motor Company  
Ford Fiesta

- **System Supplier:** Brose  
- **Material Processor:** Brose  
- **Material Supplier:** Omni Plastics  
- **Material / Process:** Omni Lon PA66 / injection molding  
- **Tooling Supplier:** A. J. Raymond

These industry first plastic clip attachments secure the IWR mechanism to the side doors (46 clips/vehicle). They replace metal fasteners and weld nuts for a weight savings of 44 lbs per vehicle. Estimated cost savings include $350K for reduced cycle times, $210K for scrap cost elimination and $250K per plant as no tools are required. Customer benefits include improved fuel efficiency, better crash performance (energy absorption) due to the flexibility of the carrier, improved NVH and acoustic performance of the doors.

**Powertrain Mounting Clevis Bracket**

2017 General Motors Company  
Cadillac XT5

- **System Supplier:** Hutchinson  
- **Material Processor:** Not available  
- **Material Supplier:** BASF Corporation  
- **Material / Process:** Ultramid A3WG10 CR BK00564 PA66+50%GF / injection molding  
- **Tooling Supplier:** Not available

This engine clevis bracket is the first composite mount designed for a 6 cylinder engine, and passing peak loads of 25 Kilo-newtons of force. The injection molded part replaces metallic solutions (stamping, welding and die-casting) used previously resulting in a 45% weight save. NVH was also improved (reduction in cabin noise) due to the damping characteristics of the polyamide compared to aluminum. Corrosion resistance is improved and the part can be recycled at end of life. Seven clevis brackets were developed for different powertrain combinations and there are no warranty claims after 1.5 years of production.

**Door Edge Protector**

2017 Ford Motor Company  
Ford Fiesta

- **System Supplier:** Witte Automotive  
- **Material Processor:** Witte Automotive  
- **Material Supplier:** Washington Penn Plastics Co, Inc.  
- **Material / Process:** H2TF-2B PP / injection molding  
- **Tooling Supplier:** Witte Automotive

This industry first door guard system protects all doors from dings and scratches - and neighboring vehicles as well. The door guard is not visible until it articulates out upon opening of the door. Parts are injection molded and no metal fasteners are needed. This is a marketing feature add on of $100/vehicle offering an estimated $500K warranty savings per year.

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Seat Armrests in Recycled Nylon
2016 FCA US LLC
Chrysler Pacifica

System Supplier: Williamston Products Inc.
Material Processor: AGS Technology Inc.
Material Supplier: AGS Technology Inc.
Material / Process: Injectoblend FPA66235-2RU PA66 33FG Recycled / injection molding
Tooling Supplier: Aalbers Tool and Mold

Part performance was improved and manufacturing costs were reduced using 100% recycled nylon 66 (33% glass-filled) with strength properties exceeding the original 40% long-glass filled polypropylene material’s performance. The recycled nylon was formulated to utilize identical shrink values as the polypropylene (original substrate material) avoiding tooling cost and timing impacts. A cost avoidance of $0.35 per armrest was realized by utilizing recycled glass filled nylon instead of virgin glass filled nylon. A significant safety benefit is also achieved as the recycled material provides the armrest with a 60% increase in breaking strength above FCA specifications.

Use of Soybean Oil in Slap Pad
2018 Ford Motor Company
Ford F150

System Supplier: Rassini
Material Processor: Rassini
Material Supplier: Not available
Material / Process: Not available / compression molding
Tooling Supplier: Not available

This is the first use of soybean oil, to replace up to 40% of the 100% petroleum oil in the natural rubber part. It can be translated to any vehicle line with leaf springs including trucks, vans and SUVs. The current volume of petroleum oil being replaced in this application is approximately 522 gallons/year. This replacement of petroleum oil, with a natural resource, also offers a reduction in noise and an improvement in part durability. This will result in a reduction in warranty replacement of slap pads, estimated as a $2.5M warranty cost avoidance.

Next Generation Sustainable Content Bio Foam
2018 Ford Motor Company
Ford Fusion

System Supplier: International Automotive Components (IAC)
Material Processor: International Automotive Components (IAC)
Material Supplier: BASF Corporation
Material / Process: Elastoflex 3496/102 Resin, 113/4 Iso PU / foam in place
Tooling Supplier: Not available

This application provides a sustainable alternative to conventional petroleum based foams – at a lower weight and cost with more design flexibility. Caster based foam provides for a lower molded density and ability to be foamed in as little as 4 mm cross sections, and superior bond strength to mating materials. Foam in place tooling, where a cast PVC, TPE, or TPU skin is placed in the mold with a hard plastic retainer and the foam is injected between these two components, is used for processing. A weight savings of 20 - 40% (depending on foam thickness) and a cost savings of $2 per average foamed in place instrument panel is achieved.

Closed Loop Plastics & End-Of-Life Resin Use
2017 General Motors
Chevrolet Equinox, GMC Terrain

System Supplier: Windsor Mold Group
Material Processor: Windsor Mold Group
Material Supplier: Lavergne
Material / Process: VYPET VNT 835 35% GFR PET / injection molding
Tooling Supplier: Windsor Mold Group

Folding seat modules and plenum ducts are being produced with recovered 100% PCR PET resin from water bottles from CAMI Assembly Plant. The Lavergne Group Inc. has worked with GM CAMI Assembly Plant’s Global Environmental Compliance and Sustainability - Canada Region to implement the bottle collection program at the Lavergne facility. The recycled PET plastic is washed, flaked and turned into pelletized sustainable engineering resins. Bottle collection started in February 2017. This project is a demonstration of circular economy, bringing water bottles from CAMI, a landfill free, zero waste operation, processing them and returning those bottles in the form of a component to the same plant that generated the bottles.
**Environmental**

**Ultra Capacitor Barrier Shield**  
*2018 General Motors Company*  
*Cadillac CTS*

- **System Supplier:** GDC, Inc.  
- **Material Processor:** GDC, Inc.  
- **Material Supplier:** Not available  
- **Material / Process:** Enduraprene 2390/2195 Re TPO / thermoforming  
- **Tooling Supplier:** GDC, Inc.

This application uses material recycled from tires and plastic caps to make TPE shields to protect the ultra capacitor from the hotter surrounding environment by deflecting heat away from it. This has prevented 5,000 tires and 25,000 lbs of plastics from landfills to date. Die cutting, thermoforming and vibration welding is used to produce this part for the first time, opposed to 2-shot injection molding, resulting in an $80,000 savings in tooling compared to tooling for steel or aluminum used previously. A 16 week same save is also achieved. Consumers benefit as the heat shields keep the battery cool preventing possible battery failure. This application can be translated to other exterior applications.

**Low VOC and Odor Polyurethane Headliner**  
*2018 Ford Motor Company*  
*Ford EcoSport, Fusion & Kuga*

- **System Supplier:** Grupo Antolin  
- **Material Processor:** Grupo Antolin  
- **Material Supplier:** BASF Corporation  
- **Material / Process:** 119M2 ISO/Poly 119M2 / compression molding  
- **Tooling Supplier:** Grupo Antolin

New low VOC and odor regulatory requirements in the Asia Pacific region were achieved on this polyurethane headliner, one of the largest interior trim parts. New materials - ISO and Polyol Process, general foam pouring and curing applications, and wet PU compression molding processing made this possible. Also, a special air ventilation system during foam curing and the slicing process was developed. Chemical additives were added into the wet PU processing to reduce VOC. This project Initiated the commonization of raw materials for headliners across the AP region and has the potential for optimization/globalization of a headliner bill of materials.

**Post Consumer Recycled PA66 for Window Support Bracket**  
*2016 General Motors Company*  
*Chevrolet Silverado, GMC Sierra*

- **System Supplier:** Cooper Standard  
- **Material Processor:** Cooper Standard  
- **Material Supplier:** Ravago  
- **Material / Process:** Enviramid N1335HL 35% GF PA66 / injection molding  
- **Tooling Supplier:** Not available

For this application, 100% PCR (Post Consumer Recycled) PA66 resin replaced virgin PA66 and PP resins to provide high damping properties to reduce or eliminate squeak, rattle and window vibration. As damping properties are inherent in PA 66 resin, no new product development was required. As the same injection molding process used to process the former resins as the new recycled material could be used, no new tooling was required either. This process can be translated to other applications further reducing landfill waste.

**Grill Opening Reinforcement**  
*2017 Ford Motor Company*  
*Lincoln MKC, Ford Fusion*

- **System Supplier:** Montaplast/Magna  
- **Material Processor:** Montaplast/Magna  
- **Material Supplier:** Wellman Advanced Materials  
- **Material / Process:** Ecolon GF3030 PA6 & GF1960 PA66 / injection molding  
- **Tooling Supplier:** Not available

This is the first Grill Opening Reinforcement with 100% Post Consumer Recycled Carpet Fiber Material. The material was a direct drop in with no tooling adjustments required. A 10% cost save was achieved using the recycled material compared to new material. The application recovered 536,667 yards (84 football fields) carpet. The GOR structurally ties the upper rails to the lower frame rails. It provides the general shape of the frontend and absorbs energy during a frontal impact. It also provides for a rigid mount for a crash sensor and facilitates attachment schemes for components such as head lights, hood latch and front fascia assembly.
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The use of thermoplastic polyolefin (TPO) skin on the instrument panel (IP) of the 2000 model year Pontiac Bonneville from General Motors (GM) has been named the 2017 Hall of Fame winner by the Automotive Division of the Society of Plastics Engineers (SPE®). TPO skin provides a leather-like feel with scratch and mar resistance, does not fade or degrade in ultra violet light, and is 100 percent recyclable. To be considered for a Hall of Fame Award, an automotive plastic or composite component must have been in continuous service in some form for at least 15 years and preferably have been broadly adopted within the automotive or ground-transportation industries. This application certainly qualifies, as TPO skin technology was a major new plastics development that has advanced and expanded to numerous other interior applications at most all automotive companies worldwide.

The use of TPO skin on IPs was recognized in the industry in 1999, when GM won the SPE® Most Innovative Use of Plastics Award in the Body Interior category. This application was on the 2000 model year Bonneville instrument panel, developed by Inteva Products LLC, (formerly Delphi Interior Systems). The material innovation by Inteva Products was a co-extruded thin sheet TPO compound from Mytex Polymers (formerly a joint venture between Exxon Mobil Chemical and Mitsubishi Chemical Corporation). The team’s innovation was recognized for five industry firsts in North America. It was the first N.A. OEM TPO Skin instrument panel, first GM IP TPO skin alternative to PVC, first full (Upper & Lower) TPO IP, first TPO “deep draw” IP and first TPO airbag deployable skin/door.

It improved safety by enabling air bag deployments, and reduced windshield fogging with the reduction of VOCs and odors without plasticizers.
and toxic stabilizers also offering environmental benefits. The environmentally friendly all polyolefin system also enabled closed loop recycling and the replacement of PVC while reducing mass 10%. The TPO skin also improved interior quality by preventing brittle cracking, color fading (UV protection is improved by 4 times) and warping. Overall aesthetics were improved by the dry haptic leather-like feel inherent in TPO skin.

Since 2008, when Delphi’s Interior division was sold to Inteva, Inteva has continued further development of TPO skin under the Inteather™ brand and has been recognized with a number of industry awards. Other industry recognition awards for this TPO technology developed and advanced by Inteva include: an SPE “Recycler of the Year” Award from the SPE Recycling Division in 1999; an SPE Automotive Innovation Award for TPE material on an instrument panel on the 2008 Saab 9-7X in 2008; an SPE TPO – Engineered Polyolefin Recognition Award of an All Olefin, Soft Skin, Stitched Full Instrument Panel System in 2012. TPO for interior skin is now the global standard on a variety of interior applications. TPO use has continued to advance rapidly and has become the dominate material for instrument panel skin. Since 2013 the use of TPO for IP skin has increased 54%.

The 2017 SPE Automotive Division Hall of Fame committee was chaired by Nippani Rao, Asahi Kasei Plastics North America, Inc. and co-chaired by Dave Reed, General Motors Corp., retired. Committee members include:

- Bonnie Bennyhoff, ExxonMobil Chemical Co., retired;
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- Kevin Pageau, International Marketing Alliance;
- Tom Pickett, General Motors Company;
- Irv Poston, General Motors Corp., retired;
- Ron Price, Global Composite Solutions;
- Suresh Shah, Delphi Corp., retired;
- Roy Sjöberg, P.E., Team R-Squared S LLP;
- Venkatakrishnan Umamaheswaran, SABIC;
- Bill Windscheif, Advanced Innovative Solutions, Ltd.; and
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Materials

Carbon Fiber Filled PP
2018 Ford Motor Company
Ford Explorer

System Supplier: Windsor Mold Group
Material Processor: Windsor Mold Group
Material Supplier: Borealis Compounds Inc.
Material / Process: Fibermod CB061SY PP / injection molding
Tooling Supplier: Not available

By changing rigid material from ASA to recycled carbon fiber-filled polypropylene, and changing soft material from TEA to TPE, a new material was created specifically for this "A" pillar bracket. The rigid portion of the material is designed to fit existing tooling and be compatible with the new soft material. Significant CLTE reductions were also achieved. The carbon fiber is recycled from various sources including airplane bodies and motorcycles. The resultant new hard/soft material system is more cost-effective for carbon fiber-based applications on exterior and interior trim parts. This new material usage resulted in a 14% component weight reduction and $186,000 annual savings.

Squeak Resistant IP Cluster Bezel
2016 Ford Motor Company
Ford Mustang

System Supplier: Summit Polymers
Material Processor: Summit Polymers
Material Supplier: Techno Polymer America
Material / Process: HUSHLLOY HS301 ABS / injection molding
Tooling Supplier: Not available

This IP cluster was molded with a new, patented low gloss ABS resin that provides parts with a markedly lower coefficient of friction that eliminates squeak and "stick/slip" noises caused by interior components in a vehicle. 22 pieces of felt, 16 Mylar tapes and grease were eliminated in assembly resulting in cost savings of $1.62 per vehicle. There are 9 commercialized applications in North America resulting in $4 Million annual savings. This new material offers "no squeak" properties, drop in usage (replaces general purpose ABS without need for tooling modifications), high flow for larger more difficult to mold parts, and is not additive based. Low gloss appearance eliminates need for painting.

Non-Weakened Skin for Seamless Airbag System
2018 Ford Motor Company
Ford EcoSport

System Supplier & Material Processor: Faurecia Interior Systems
Material Supplier: Haartz
Material / Process: Deploy Bilaminate TPO / injection molding
Tooling Supplier: GS Engineering

This scoreless skin technology eliminates the visible line of the airbag door. A special bi-laminate foil with TPO chemistry for unique tensile, shear and processing characteristics enables an improved surface appearance over previous scored IP skin constructions. Parts are injection molded with in-mold lamination. No high capital expenses ($750,000 cost avoidance) for laser score equipment make this doable globally in low cost, low tech countries. The previous process included injection molding the substrate, cutting and sewing and hand wrapping the top skin cover and laser scoring the composite panel. Streamlining the production results in a $1.5/part cost saving. Since the skin is not weakened by scoring, the underlying substrate can be made weaker to enhance the airbag deployment door opening time.

Brake Light Lenses
2018 General Motors Company
Chevrolet Onix

System Supplier: Olsa
Material Processor: Olsa
Material Supplier: SABIC
Material / Process: Lexan SLX 2271T PC / injection molding
Tooling Supplier: Olsa

Coating elimination, through the use of a standard colored polycarbonate (PC) with specialty copolymers, enabled a cost reduction of $0.80 per part and a program cost avoidance of $145,000 annually. The lenses are weatherable and directly recyclable. Coating elimination avoids VOC emissions and water use (cleaning the paint line) resulting in further environmental benefits.

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Materials

Low Friction Polymer for Chain Tensioner Arms
2017 Ford Motor Company
Ford F150 / Mustang

- **System Supplier:** Borg Warner
- **Material Processor:** Not available
- **Material Supplier:** DSM Engineering
- **Material / Process:** Stanyl HGR2 PA46(+PTFE) / injection molding
- **Tooling Supplier:** Not available

This usage of a modified PA46 resin to enhance stiffness, on vehicles powered by a 5.0L V8 engine, was a drop-in replacement for PA66, for enhanced wear and friction performance. The resultant fuel economy savings (0.4%), from rotational torque reduction in the cam-shaft (0.5N), was equivalent to a 40lb weight reduction, and at 1/10th the cost. Annual environmental benefits include reductions in gas consumption by 12,000 Barrels and greenhouse gas emissions by 5,000 Tons. This innovation is highly translatable, to provide affordable fuel economy improvement, and will be utilized on more Ford vehicles, beginning in 2018. The total potential environmental impact of translations, at Ford, may be multiple times the values noted for the Mustang and F-150.

Battery Enclosure Cover
2017 General Motors Company
Chevrolet Bolt

- **System Supplier:** LG Electronics
- **Material Processor:** Hanwha
- **Material Supplier:** Hanwha
- **Material / Process:** 5145 SMC vinyl ester / polyester / compression molding
- **Tooling Supplier:** Hanwha

The battery pack is a stressed member and weighs 960 lbs/440 kg. It accounts for 23% of the car’s value. The SMC cover is a large lightweight cover that is integral to the pack. A new lightweight high glass loaded vinyl ester/Polyester blend SMC was formulated to meet the high speed stress strain requirements and, for the first time, be incorporated as part of the structural element. A 30% weight savings and a 40% cost savings, over alternative manufacturing methods (steel/aluminum stampings) was achieved.

Grained Roof Ditch Moldings
2017 General Motors Company
GMC Sierra, Chevrolet Silverado

- **System Supplier:** Martinrea International
- **Material Processor:** Martinrea International
- **Material Supplier:** Teknor Apex
- **Material / Process:** Apex 85 - J438N Black 621 PVC / co-extrusion
- **Tooling Supplier:** Rollstar Metal Forming

Usually, a grain appearance in extruded parts is achieved via embossing rollers confining the look to the top surface of the part only. This unique PVC material development has the grain in the material enabling a grain appearance throughout the part, including the sides of the extrusion, without secondary operations required. It is scratch and mar resistant, weatherable, co-extrudable and it also bonds to metal. This enables greater styling options for interior and exterior parts designs at less cost. A 10% direct cost savings is associated with this innovation through process efficiency and lower equipment maintenance costs. Approximately $30K cost avoidance savings annually is directly associated with this innovation.

High Elongation Fabric
2015 Ford Motor Company
Lincoln MKC

- **System Supplier:** International Automotive Components (IAC)
- **Material Processor:** International Automotive Components (IAC)
- **Material Supplier:** CGT
- **Material / Process:** PVC / calendering
- **Tooling Supplier:** CGT

This high elongation PVC coated fabric is formulated and designed for wrapping tight radius parts with no texture lost or deformation. It is designed to support a variety of applications including seating, headrests, map pockets, consoles, doors and instrument panels. This high stretch material provides a leather like look and feel in any color, accommodates high strain without tearing making it easy to implement stitching applications, and meets sun load requirements. The estimated cost is $2 USD a sq. ft. less than leather.
General Motors Company is the 2017 winner of the SPE Automotive Division’s Vehicle Engineering Team Award

General Motors is the 2017 winner of the SPE Automotive Division’s Vehicle Engineering Team Award for significant use of innovative plastic content on the 2018MY Chevrolet Traverse. This award has been designed to recognize the technical achievements of teams made up of automotive designers and engineers, their tier suppliers, as well as materials suppliers, toolmakers, and other members of the supply chain whose work has led to significant integration of innovative plastics content on a notable new vehicle. The Vehicle Engineering Team Award winner was chosen by our Blue Ribbon Judging panel from nominations submitted and presented by automakers. This year marks the eighth time in 14 years that the award has been presented.

The innovative use of plastic technology contributes significantly to the all-new 2018 Traverse which offers more space for comfort yet 350 lbs less weight, compared to the previous model. Fuel economy improves 17% from 18 to 21 mpg in combined city and highway driving!

Three finalists, and a category winner in the Chassis category this year, are just some measures of the plastic innovations brought to market by the winning team.

The team:

- Introduced a first surface appearance, thin wall, structural, long glass fiber polypropylene on the floor console carrier saving the program 30% mass or 2.2 lbs. This eliminated the need for metal reinforcements to take $1.50/assembly out of the part as well.
- Launched the first serial production polyamide clevis bracket reducing the part weight by 45% relative to the previous aluminum design while increasing damping by a factor of 10.
- Developed a new LED headlamp system that includes nine tailorable elements – nine individual lenses on top of nine 1x1 LEDs producing approximately 720 lumens. These lenses include three large lenses (2 low beam / 1 high beam) coupled with six smaller ones (4 low beam / 2 high beam) and enabled lamp performance that is balanced with the customer requirements.
- And extended the use of low density (0.96 g/cc) TPO on the front and rear fascias, wheel opening moldings, claddings and rocker moldings.

The use of plastics and composites contributed to enhanced performance (8% power gain with the 3.6L V6), weight savings (7% lower than the previous program), improved fuel economy (17% increase) with best in class cargo space and up to 14 available advanced safety features making the 2018 Chevrolet Traverse, this year’s winner.
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Intake Manifold with 2-Shot Molded Power Valve
2017 FCA US LLC
Dodge RAM

System Supplier: MAHLE Filter Systems
Material Processor: MAHLE Filter Systems
Material Supplier: DuPont Automotive
Material / Process: Hytrel 3078 HS BKB320 TPC-ET thermoplastic elastomer, a copolyester / 2-shot injection molding
Tooling Supplier: MGS MFG Group

This air intake manifold blade was made via a 2-shot molding process overmolding a thermoplastic polyester elastomer over a 36% mineral filled nylon 66, in the same tool. The previous process required two suppliers - one to injection mold the nylon portion of the blade and another to compression mold a rubber-FKM surround requiring additional assembly. This new process resulted in a 33% direct part savings and additional freight and transit savings using one location to manufacture the part in place of three.

Turbo Charger Outlet T-Joint
2018 Hyundai Motor Company
Genesis G80, Kia Stinger

System Supplier: Hwaseung R&A Co., Ltd.
Material Processor: SEJI Solotech, Inc.
Material Supplier: DuPont Korea Inc.
Material / Process: PA66 / injection molding
Tooling Supplier: Not available

A 42% weight and 35% cost reduction, and improved airflow reducing the pressure drop (-8kPa) to increase fuel economy and improve NVH performance was achieved by designing and molding this part with plastic compared to the previous aluminum die cast part. Air flow noise was also reduced and long term durability increased via the rib pattern design. Special 3-gate positioning tooling was designed to minimize stress in weld-line area for strength and durability and for processing optimization. A new 35% glass fiber reinforced, heat stabilized polyamide 66 resin was developed for good retention of properties over time at temperatures up to 220 degrees C.

Carbon Fiber Torque Tube
2017 Mercedes-Benz GmbH
Mercedes AMG GT R

System Supplier: ACE Advanced Composite Engineering GmbH
Material Processor: ACE Advanced Composite Engineering GmbH
Material Supplier: various
Material / Process: Huntsman 8625 epoxy / resin transfer molding
Tooling Supplier: Not available

This CFRP torque tube is unique in its performance, complexity, dimensions and manufacturing process and has been developed for extreme lightweight construction and vehicle performance. It has extreme lightweight construction (~40%), highest stiffness and NVH performance, high safety reserves, temperature load up to 200 degrees, and monolithic implementation of the complex structure in a one-shot production step. It was produced with a new process (first time in auto industry) that is a combination of resin transfer molding and a process from blow molding flexible tubes. The component was inflated in the interior of the tool by vacuum and overpressure. The injection from the resin takes place from the outside.
Transmission Baffle
2018 Ford Motor Company
Ford Focus

System Supplier: Ford Motor Company
Material Processor: Toledo Molding and Die
Material Supplier: DuPont Automotive
Material / Process: Hytrel 7246 TPE / injection molding
Tooling Supplier: Toledo Molding and Die

Unique part geometry and CFD (Computational Fluid Dynamics) studies led to the design of this new baffle for injection molding enabling seal elements and fluid flow passages for improved transmission performance - not possible before in a stamped metal component. Transmission efficiency was improved by 8% resulting in up to 0.5 mpg economy. A reduction of 50% in weight and 40% in cost ($1 per transmission) was gained compared to a metal part with molded seal elements. The TPE material is recyclable reducing its carbon footprint.

Engine Coolant Control Valve
2016 FCA US LLC
GME-T4 (Alfa Romeo - Giulia/Stelvio)

System Supplier: ITW Powertrain Components
Material Processor: ITW Powertrain Components
Material Supplier: DuPont Automotive
Material / Process: Zytel HTN 51G35HSLR BK420 PPA / injection molding
Tooling Supplier: Not available

This unique product design allows good fluid control and low coolant leakage at the seals on the valve moving components. Dimensional control is provided through innovative molding and assembly processes with the combination of PPA and PPS materials. A 1 lb weight savings and 20% cost savings is achieved, compared to a metal part. An approximate 2% increase in fuel efficiency and reduced emissions result in a reduced carbon footprint.
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### Process, Assembly & Enabling Technologies

#### Part via Preform (PVP) Assembly Carrier
**Volkswagen AG**
2016 Porsche GT3 Cup II

- **System Supplier:** Toho Tenax
- **Material Processor & Supplier:** Not available
- **Material / Process:** epoxy / resin transfer molding
- **Tooling Supplier:** Not available

Part via Preform (PVP) technology enables economical production of carbon fiber reinforced plastic (CFRP) automotive parts. The carbon fiber has been binder-modified to be sprayed into near-net shape preforms without intermediate textile processing resulting in a 30% cost save. High fiber volume content (50% Vf), delivers high mechanical properties. The process can create complex shapes with homogenous material and can be combined with aligned fiber placement (AFP) for part reinforcement. Resin injection of PVP preforms works with high pressure resin transfer molding (HP-RTM) including an in-mold coating step to provide for easy surface painting. The binder on the carbon fiber can be activated, allowing for greater design freedom, and ability to assemble preforms and achieve local thickness variations to exacting specs.

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#### Integrated Sliding Armrest and Hinge Assembly
**2017 Ford Motor Company**
Ford EcoSport

- **System Supplier:** Faurecia Interior Systems
- **Material Processor:** M & N Plastics
- **Material Supplier:** Advanced Composites
- **Material / Process:** ADX 5017 TPO / injection molding
- **Tooling Supplier:** Tri Tech Tooling, Inc.

**Additional console stowage volume with a lid held open to any position (like a laptop screen) is achieved with a single Injection molded upper bin and lid inner using a torque insert to create hinge for the armrest. It includes integrated attachments for a sliding armrest that is interchangeable with a fixed armrest. Using a robotic arm, the torque insert hinge is placed into the cavity of the mold and over-molded with 30% glass-filled nylon 6. Upon mold close, the seal off around the hinge allows for the upper leaf and lower bin to be independently injected at the same time (using sequential valve gating), producing 2 complete assemblies in one press cycle. This eliminates the need for metal hinge systems saving $4.50 and 2 lbs weight per unit.**

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#### Two Shot Interior Decoration Bezel
**2018 Ford Motor Company**
Ford Fiesta

- **System Supplier:** Faurecia Interior Systems
- **Material Processor:** M & N Plastics
- **Material Supplier:** BASF Corporation
- **Material / Process:** Ultramid B3EG6 30% GF PA 6 / injection molding
- **Tooling Supplier:** M & N Plastics

This unique 3-D decorative effect was achieved with 2K ‘reverse’ injection molding (1st shot tinted PC) with overmolding of grained surface with 2nd shot (self colored pigmented ABS). This is the first time this process was used to achieve the 3-D visual effect (color and texture) for a part of this size and geometry. A 30% cost save was achieved vs IMD/IML/high gloss painting and there was a 20% scrap reduction vs conventional 2-layer high gloss piano black appearance.

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#### Winged Spring Clip with 4 Way Locator
**2018 Ford Motor Company**
Ford Expedition, Navigator

- **System Supplier:** Magna Seating
- **Material Processor:** Royal Technologies
- **Material Supplier:** Advanced Composites
- **Material / Process:** ADX 5017 TPO / injection molding
- **Tooling Supplier:** Tri Tech Tooling, Inc.

Metal clips and springs were eliminated by designing an in-molded W shaped plastic clip with a 4-way locator providing efficient attachment per requirements and eliminating additional costs for fasteners and assembly. The plastic part comes out of the tool with the clips molded in. The patented winged spring clip design locates, locks and retains in a single snapping action. A cost save of $0.17 per clip/$2.19 per vehicle resulting in $250K per year; and a 10% weight saving is achieved.
Torsional Welding of PDC Sensors to Thin Wall Fascias
Volkswagen AG
2018 Skoda Octavia

System Supplier: Magna Exteriors
Material Processor: Magna Bohemia Liberec
Material Supplier: SABIC
Material / Process: Sabic 8650 TPO / torsional welding
Tooling Supplier: Changzhou Huawei Mold Co., Ltd.

This is the first application of torsional welding (spin & ultrasonic welding combined) on automotive fascias. It allows welding of PDC brackets without localized thickening of wall stock on 2.5 mm, thin wall, molded fascias. An adjustable TPO material with high melt flow, high stiffness/impact allowed for less material to be used resulting in a 10% reduction in mass for a 7% weight savings with $122,000 direct cost savings in three years. Cycle times were improved and there was no weld read through resulting in a quality appearance. Future applications for this process include fascia support brackets, fog brackets and more.

Paint Racks with Robber Bars for Electrostatic Paint Line
2018 Ford Motor Company
Ford Fusion

System Supplier: Flex N Gate
Material Processor: Not available
Material Supplier: Not available
Material / Process: Not available / Not available
Tooling Supplier: Not available

This painting process uses racks with “Robber Bars” to attract paint and reduce over-spray on the backside of the plastic part during the painting process (generating squeak issues). The bars on the backside of the racks attract the paint of the electrostatic paint line and help to prevent over-spray, reducing VOCs due to less use of paint and eliminating the need for the manual masking process. This results in a cost save of $.24 per vehicle and can be translated to all electrostatic paint lines for plastic components.

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D Pillar
2018 Ford Motor Company
Ford Expedition

System Supplier: Windsor Mold Group
Material Processor: AUTOPLAS
Material Supplier: SABIC
Material / Process: LEXAN SLX 2271T PC Copolymer / injection molding
Tooling Supplier: Windsor Mold Group

This is an Industry-first use of a polycarbonate copolymer material on a D Pillar. Improved impact performance vs. PMMA was achieved and it allowed for rivet attachment to the vehicle without failure during environmental testing. The material demonstrated good UV, heat, and gloss performance. The material change also made it possible to achieve a high gloss piano black mold-in-color to OEM standards.
**Energy Absorbing Collapsible Glove Box Bin**  
**2018 Ford Motor Company**  
**Ford Expedition**

- **System Supplier:** Detroit Manufacturing Systems  
- **Material Processor:** Detroit Manufacturing Systems  
- **Material Supplier:** Advanced Composites  
- **Material / Process:** Basell - SG702 PP / injection molding  
- **Tooling Supplier:** Lamko Tool & Mold

This bin, that holds and stores the owner’s manual, collapses during impact to prevent severe femur loads while providing a beautiful flocked appearance. The new design provides a 400 gram weight savings while lowering femur loads from unacceptable to 5-star compliant. The support structure is injection molded with a compressed PET internal shell. This 100% recyclable, patent pending, concept can be used on any vehicle line to address high femur load issues and assist in achieving a 5-star crash rating.

**All Plastic Hood Leveler**  
**2018 Ford Motor Company**  
**Lincoln Navigator**

- **System Supplier:** MacLean-Fogg, Engineered Plastic Components, Inc  
- **Material Processor:** MacLean-Fogg, Engineered Plastic Components, Inc  
- **Material Supplier:** DuPont Automotive, ExxonMobil  
- **Material / Process:** Zytel 70G33 PA66, Delrin 100 POM, Santoprene SA60 TPE / injection molding & over-molding  
- **Tooling Supplier:** Elite Tool & Die

This industry first all plastic hood leveler helps to manage pedestrian hood/ head impact to reduce head trauma. It is easily customizable for various OEM hood load requirements and platform PedPro system needs. It features a light weight design, OEM snap-in quick assembly, preset and adjustable height, and is recyclable. A 50% weight savings and a 35% cost savings is estimated compared to current steel/plastic/rubber hood levelers. The snap-in base is Acetal for a strong snap feature and no squeak against the Nylon post. The threaded post is Nylon for strength and low moisture dimensional influence. The over-molded bumper is TPE for no squeak on the inner hood and additional energy management. The interaction of the three chosen polymers allow for required use of their individual properties and also the collaborative energy management response as they work together to help reduce head impact trauma from beneath the hood inner upon a low speed pedestrian contact.

**Gen-3 4-Way Head Restraint**  
**2018 Ford Motor Company**  
**Ford F150**

- **System Supplier:** Windsor Machine and Stamping  
- **Material Processor:** Windsor Machine and Stamping  
- **Material Supplier:** Ravago  
- **Material / Process:** Hylon N1000STHL PA / injection molding  
- **Tooling Supplier:** Integrity Tool & Mold

This low cost, low mass, head restraint provides exceptional rigidity for whiplash protection. Its flexible design allows the front surface of the head restraint to be translated closer to or further from the occupant by 60 mm without incurred costs (allowing for the precise balancing of comfort and safety). Using plastic, in place of steel, as the primary load bearing component is new to front row head restraints. The part design eliminates manufacturing complexity making use of intelligent geometries so that readily available materials could be used. A $10.73 Million savings ($2.80/vehicle) is projected by the end of MY2020.

**12 Volt Battery Impact Shield**  
**2018 General Motors Company**  
**Buick Enclave**

- **System Supplier:** CSP Teijin  
- **Material Processor:** CSP Teijin  
- **Material Supplier:** Quadrant Plastic Composites  
- **Material / Process:** GMTex X103F61-4/1-0/90° PP / compression molding  
- **Tooling Supplier:** Laval Tool and Mould

This low cost, simple crash barrier protection shield boasts rapid development and implementation with innovative materials and molding. Six parts were molded together as one mold, requiring calculating the materials reaction when secondary waterjet cuts out each piece. Three composite material constructions were tested (polypropylene with 40%, 50% then 60% glass) while tooling and 12 sets of prototype parts were developed over a 6 week period. A test vehicle was crashed, with production intent parts, passing all test criteria the following week. Production tooling and fixtures were also completed during that time (week 7). Full production was initiated in week 12. A 75% mass and 60% cost saving vs traditional high strength steel stamping with metal fabrication was achieved.
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The SPE® Automotive and Composites Divisions, in conjunction with The SPE Foundation®, have formed an endowed scholarship to honor the memory of Dr. Jackie Rehkopf and are still accepting donations. The groups hope to raise funds for a sufficiently large endowment to allow annual scholarships to be given to deserving undergraduate or graduate students studying engineering or science and with plans to work in the field of transportation composites.

Rehkopf spent her career doing research in the field of automotive plastics and composites. She was a long-time SPE ACCE committee member, session organizer, and two-times technical program co-chair. She also served on the SPE Automotive Division board as a director from 2005 through 2014, plus was intersociety chair for 2 years and treasurer for 2 years. She was active from the mid-1990s until 2014 with SAE International®, helping organize a large plastics session for over a decade for SAE Congress. Additionally, she wrote a book in 2011 entitled Automotive Carbon Fiber Composites: From Evolution to Implementation that was published by SAE. She was awarded an SAE Outstanding Technical Contribution Award for her work in co-developing and sponsoring the SAE Standard J2749 High Strain Rate Tensile Testing of Polymers. She authored many publications and presented at numerous technical conferences during her 20 year career.

In both academia and industry, Rehkopf’s research interests were in mechanics of materials. After earning both B.S. and Ph.D. degrees in Civil Engineering from the University of Waterloo in Canada, she moved to the Detroit area and began work in 1994 as a materials engineer for Ford Motor Company. After 4 years, she became a technical specialist at Ford in the company’s Research Lab Safety Department (from 1998-2003) and later in the Materials Engineering Department (from 2003-2006). She left the automaker in 2006 to join Exponent as a senior engineer and consultant in the areas of mechanics of materials, structural mechanics and dynamics, experimental testing, and failure analysis. Rehkopf’s expertise was in high-strain-rate behavior of both metallic and polymeric materials, and fatigue and creep of reinforced and non-reinforced plastics. In 2010, she joined the R&D department of Plasan Carbon Composites as a senior researcher working on carbon fiber-reinforced composites. During her first 2 years at Plasan, she split her time between the company’s Customer Development Center in Michigan and offices at Oak Ridge National Laboratory where she was principal investigator for a 3-year U.S. Department of Energy (DOE)-sponsored project that Plasan participated in on predictive modeling of carbon fiber composites in automotive crash. In 2013, Rehkopf became director of research at Plasan with a focus on developing new materials systems to facilitate the use of carbon fiber composites in mainstream automotive applications. She lost a year-long battle to cancer in 2014.
The Hall of Fame Award is given annually for an application that has been in continuous use for 16 years or more, and has made a significant and lasting contribution to the application of plastics in automobiles.

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<thead>
<tr>
<th>Year Recognized</th>
<th>OEM</th>
<th>Application</th>
<th>Material</th>
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<tbody>
<tr>
<td>2016</td>
<td>Ford Motor Company</td>
<td>Polycarbonate Instrument Panel</td>
<td>PC / PC blends</td>
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<tr>
<td>2015</td>
<td>General Motors Company</td>
<td>GMT Composite Bumper</td>
<td>PP/Glass GMT</td>
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<td>Blow-Molded CVJ Half-Shaft Drive-Axle Boot</td>
<td>TPE</td>
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<td>Ford Motor Company</td>
<td>Integrated Front-End Module System</td>
<td>SMC</td>
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<tr>
<td>2012</td>
<td>General Motors Company</td>
<td>First Publicly Accessible Airbag System</td>
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<tr>
<td>2011</td>
<td>General Motors Company</td>
<td>Integrated Door Hardware Module</td>
<td>PC/PBT</td>
</tr>
<tr>
<td>2010</td>
<td>General Motors Company</td>
<td>Front &amp; Rear TPO Bumper Fasclas</td>
<td>TPO</td>
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<tr>
<td>2009</td>
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<td>Thermoplastic Vertical Body Panel</td>
<td>MPPE/PA</td>
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<td>Rear Seat Cushion</td>
<td>PUR Foam</td>
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<td>Radiator End Tank</td>
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<td>General Motors Corp.</td>
<td>Thermoplastic Front Grille</td>
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<td>Dual-Density Energy Absorbing Bumper System</td>
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<td>Front-Fender Wheel Liner</td>
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<th>OEM</th>
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<td>Ford Motor Company</td>
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<td>All-Olefin Liftgate</td>
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<td>All-Olefin, Soft Skin, Stitched Full IP System</td>
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<td>1971</td>
<td>Ford Motor Company</td>
<td>Transmission Reactor</td>
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