49TH-ANNUAL

AUTOMOTIVE INNOVATION AWARDS COMPETITION & GALA

HONORING THE BEST IN AUTOMOTIVE PLASTICS

PLASTICS –> Advancing Mobility

November 6, 2019

SOCIETY OF PLASTICS ENGINEERS
AUTOMOTIVE DIVISION

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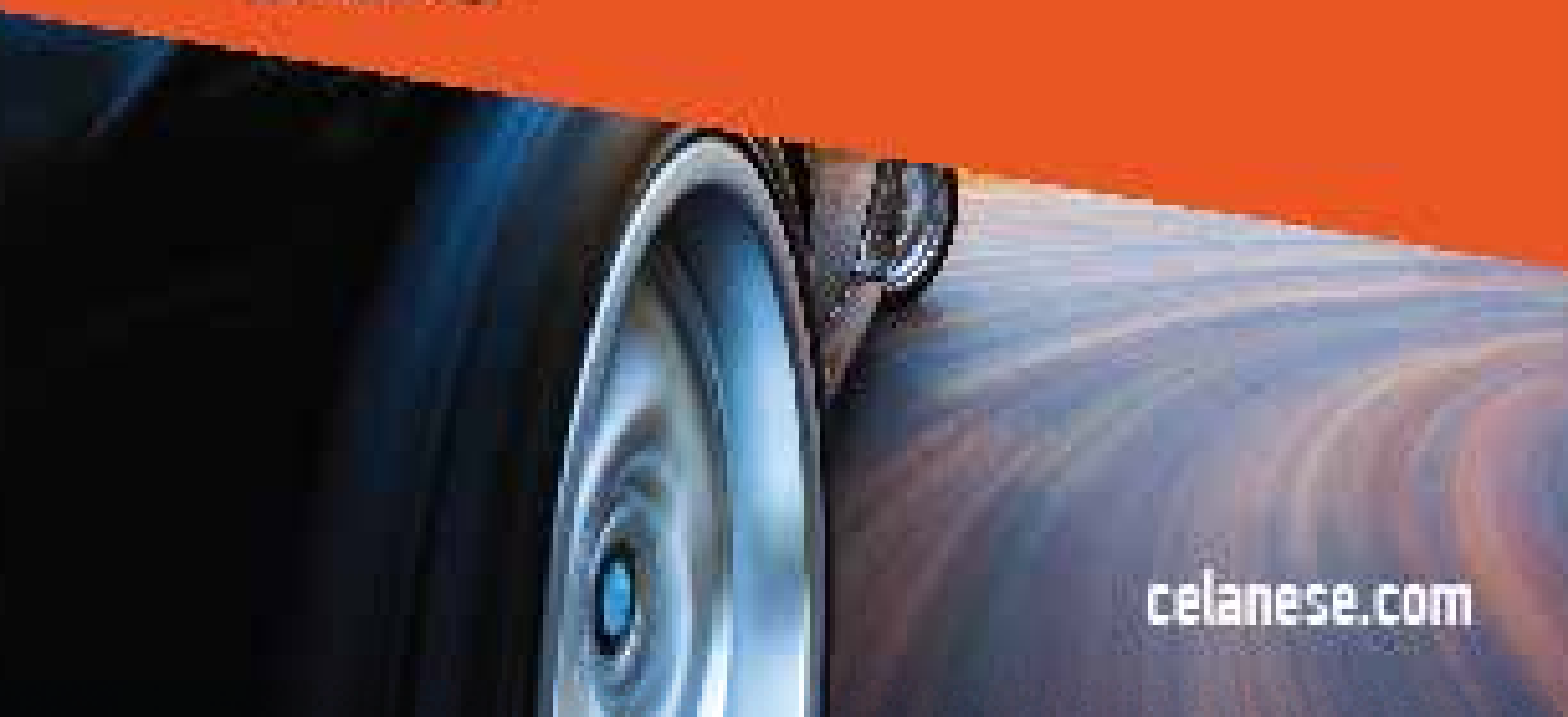

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WELCOME TO THE

November 6, 2019

Welcome to the 49th-annual SPE® Automotive Innovation Awards Gala, sponsored by the Automotive Division of the Society of Plastics Engineers. 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 market. 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, "Plastics –> Advancing Mobility," refers to the rapidly evolving landscape we are all witnessing in automotive design, manufacturing, and usage and the evolution achieved through innovations in plastics. The innovations of today will pave the way for the needs of tomorrow. Those needs include delivering comfort and capability to the end customer; meeting societal and environmental needs for all of us through varying degrees of electrification, powertrain efficiency, and sustainable material use; and delivering products that provide value in the market while also delivering sustainable business models. 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. Many of these new technologies will be presented tonight.

The competition this year, as always, was intense, with almost 80 nominations received in 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 & Limited-Edition/Specialty Vehicles
- Additive Manufacturing
- Body Exterior
- Body Interior
- Chassis/Hardware
- Environmental
- Materials
- Powertrain, and
- Process, Assembly & Enabling Technologies

We will also recognize the latest entry into our SPE Automotive Division Hall of Fame and our newest recipient of the Lifetime Achievement Award, an honor that recognizes the technical achievements of individuals whose work — in research, design, and/or engineering

AUTOMOTIVE
INNOVATION AWARDS COMPETITION & GALA
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— has led to significant integration of polymeric materials on passenger vehicles. Periodically, we also select a recipient for our Vehicle Engineering Team Award. This prize recognizes the contributions of an entire vehicle engineering team based on both the total plastics/composites content of the platform as well as the innovation of individual applications, as well as how well received the vehicle has been by both consumers and media.

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 2019 SPE Automotive Innovation Awards Gala. Thank you for joining us and we hope you enjoy the event.

Sincerely,

Jeffrey Helms

Innovation Awards Chair 2010-2019
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, Innovation Awards Chair

Teri Chouinard, Intuit Group

7:00-9:00 PM GALA PROGRAM

Aftermarket & Limited Edition/Specialty Vehicles
Martin Popella, Lehmann & Voss & Co.

Additive Manufacturing **Rose Petrella,** Ford Motor Co.

Body Exterior **Tom Pickett,** General Motors Co.

Body Interior **Yvonne Merritt,** Ford Motor Co.

Lifetime Achievement **Jeffrey Helms,** Celanese

Chassis/Hardware **Suzanne Cole,** Miller Cole LLC

Environmental **Crystal VanHouten,** Grupo Antolin

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

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

Process, Assembly & Enabling Technologies
Steven VanLoozen, Celanese

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

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

Grand Award **Jeffrey Helms,** Celanese

9:00-11:00 PM AFTERGLOW RECEPTION

Everyone Invited to Attend

Special thanks to our student usher organizers, Teri Chouinard & Crystal VanHouten

Design: JPI Creative Group **Signage:** That Color **Printing:** PrintComm
A/V Support: Concept Productions **Flowers:** Dynamic Flowers of Royal Oak

BLUE RIBBON JUDGES

Jay Raisoni, Inteva Products (retired)

Lindsay Brooke, Automotive Engineering/ Autonomous Vehicle Engineering magazines

Rose Ryntz, IAC/Ford Moto Co. (retired)

Drew Winter, WardsAuto.com

Audrey LaForest, Plastics News

Chris Theodore, Theodore & Associates LLC

Peggy Malnati, Composites World/ Plastics Engineering magazines

Roy Sjoberg, Automotive Engineering International

Mike Whitens, Ford Motor Co. (retired)

Dale Brosius, IACMI

Larry Drzal, Michigan State University

Lilli Sherman, Plastics Technology magazine

Natalia Ortega, Plastics Technology Mexico

Marc Benevento, Industrial Market Insight

Chris Smith, AMI magazines

Jeff Sloan, Composites World

Brendan Dooley, IHS Markit

Joe Pryweller, Plastics News

David Mattis, General Motors (retired)

Dave Reed, David B Reed Consulting LLC

Al Murray, SPE Emeritus

Bill Windscheif, SPE Detroit Section

Conrad Zumhagen, The Zumhagen Co. LLC

Gary Kogowski, Ravago Holdings Americas

John Fillion, Chrysler (retired)

Nippani Rao, Rao Associates,

Norm Kakarala, SPE Automotive Division

Subi Dinda, Chrysler (retired), Oakland University

Tom Moore, Chrysler (retired)

Tom Russell, Allied Composite Technologies LLC

Fred Deans, Allied Composite Technologies LLC

Bob Eller, Robert Eller & Associates

Suresh Shah, Delphi Corp. (retired)

Suzanne Cole, Miller Cole LLC

Jeff Helms, Celanese

COMMON ABBREVIATIONS

PLASTICS TERMS

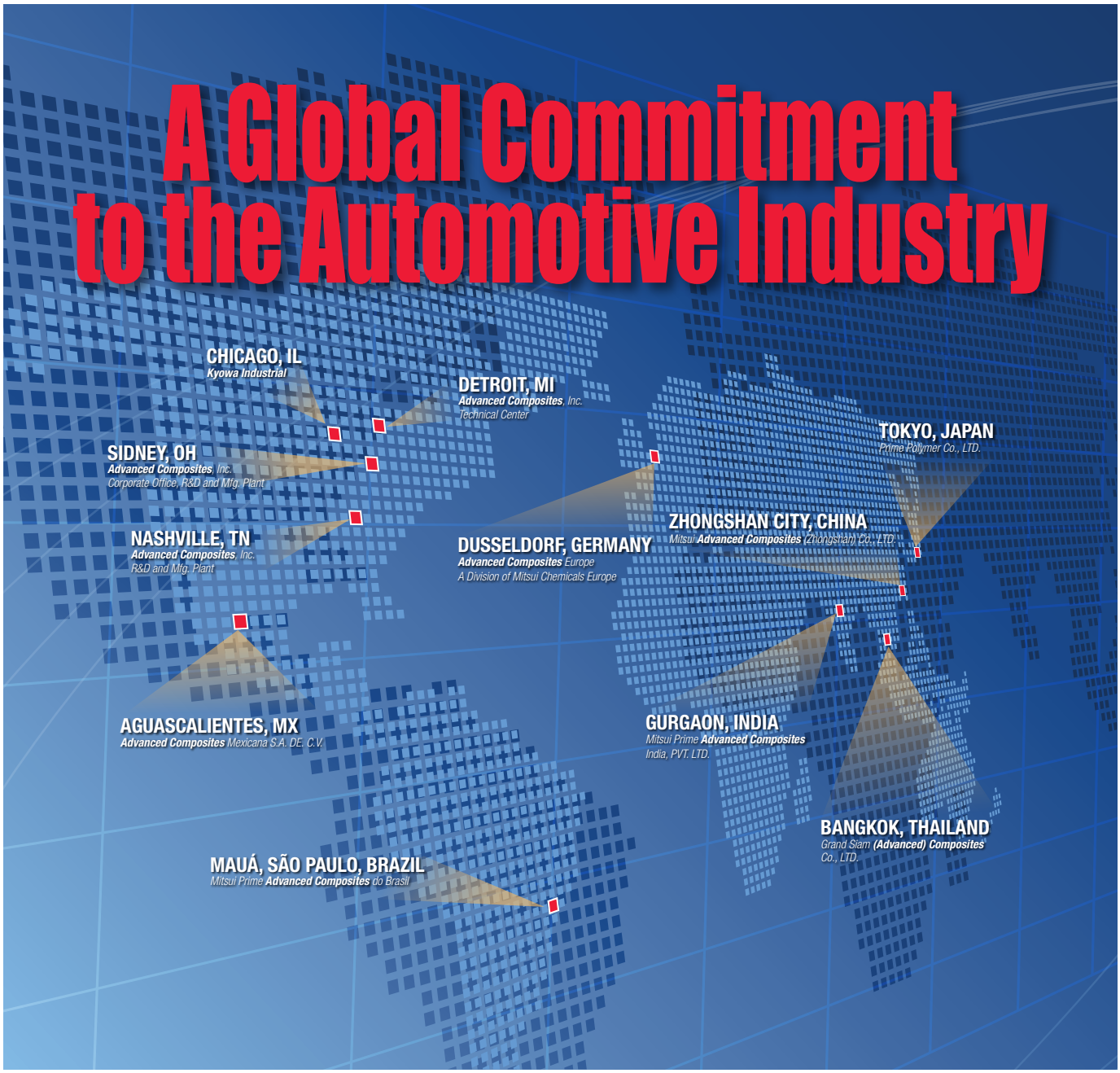
1K, 2K	1- or 2-component resin system
ABS	acrylonitrile butadiene styrene
ACM	alkyl acrylate copolymer
ASA	acrylic-styrene-acrylonitrile
CF	carbon fiber
CFRP	carbon fiber-reinforced plastic
CLTE or CTE	coefficient of (linear) thermal expansion
CUT	continuous-use temperature
D-LFT	direct-(ILC) long-fiber thermoplastic
EPP	expanded polypropylene foam
EVA	ethylene vinyl acetate
GF	glass fiber (reinforced)
GMT	glass-mat thermoplastic
GR	glass (fiber) reinforced
HDT	heat-deflection temperature
ILC	inline compounded
ITR	isophthalate terephthalate resorcinol
LCM	liquid composite molding
LCP	liquid crystal polymer
LFT	long-fiber thermoplastic
MFI	melt flow index
MFR	melt flow rate
MIC	molded-in-color
MPPE	modified-polyphenylene ether (also called MPPO, modified-polyphenylene oxide)
OOA	out-of-autoclave (process)
PA	polyamide (also called nylon)
PC	polycarbonate
PC/ABS	polycarbonate/acrylonitrile butadiene styrene
PC/ASA	polycarbonate/acrylic-styrene-acrylonitrile
PC/PBT	polycarbonate/polybutylene terephthalate
PCR	post-consumer recyclate
PE	polyethylene
PEI	polyetherimide
PET	polyethylene terephthalate
PIR	post-industrial recyclate
PMMA	polymethyl methacrylate (also called acrylic)
POM	polyoxymethylene (also called acetal)
PP	polypropylene
PPA	polyphthalamide
PPS	polyphenylene sulfide
PTFE	polytetrafluoroethylene
PUR	polyurethane
PVC	polyvinyl chloride (also called vinyl)
PVB	polyvinyl butyral
PVDF	polyvinylidene fluoride or polyvinylidene difluoride
SMA	styrene maleic anhydride
SMC	sheet-molding compound
TIO_2	titanium dioxide
TPC-ET	thermoplastic copolyester elastomer
TPE	thermoplastic elastomer
TPO	thermoplastic polyolefin
TPV	thermoplastic vulcanizate
UD	unidirectional

AUTOMOTIVE TERMS

A/C	air conditioning
AGS	active grille shutter
BEV	battery-electric vehicle
BIW	body in white
BSR	buzz/squeak/rattle
CAD	computer-aided design
CAE	computer-aided engineering
CLTE	coefficient of linear thermal expansion
CNC	computer-numerical control
CUV	cross-over (sport-) utility vehicle
CVJ	constant velocity joint
EA / EAs	energy absorber(s)
EGR	exhaust-gas recirculation
EMI / RFI	electromagnetic / radio-frequency interference
EPA	U.S. Environmental Protection Agency
FEM	front-end module
EU	European Union
FIP	foam-in-place
FMVSS	U.S. Federal Motor Vehicle Safety Standard
GOR	grille-opening reinforcement
HDT	heat-deflection temperature
HEV	hybrid-electric vehicle
HIC	head-injury criterion
HID	high-intensity discharge
ICE	internal combustion engine
IIHS	Insurance Institute for Highway Safety
IP	instrument panel
LED	light-emitting diode
Li-Ion	lithium-ion
MPV	multi-purpose vehicle
NVH	noise/vibration/harshness
OEM	original-equipment manufacturer
PCR	post-consumer recyclate
ped-pro	pedestrian protection (requirement)
PHEV	plug-in hybrid-electric vehicle
PIR	post-industrial recyclate
SUV	sport-utility vehicle
TPC-ET	thermoplastic copolyester elastomert
VOCs	volatile organic compounds

OTHER TERMS

2D	two-dimensional
3D	three-dimensional
cm	centimeter
CO_2	carbon dioxide
ft	foot
g	gram
in	inch
IR	infrared
kg	kilograms
lb	pound
KMPH	kilometers/hour
km/h	kilometers/hour
m	meter(s)
mm	millimeter
MM	million(s)
MPG	miles/gallon
MPH	miles/hour
N	Newtons
sec	second
SG	specific gravity
USD	U.S. dollars



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AFTERMARKET & LIMITED EDITION/ SPECIALTY VEHICLES

Full-Length Side Storage Box
2020MY General Motors Co.
GMC Sierra/Chevrolet Silverado pickups

System Supplier:	Gemini Group-Regency Plastics, Inc.
Material Processor:	Hutchinson, Eberhard Mfg. Co., Gemini Plastics Inc., Sierra Plastics Inc., GPM Profile Extrusion, Regency Plastics, Inc.
Material Supplier:	Washington Penn Plastics Co., Inc.
Resin:	PPC1GF15-UV YZ9A 15% GR-PP
Tooling Supplier:	Midwest Mold Builders, Inc.

These full-length (77-in./196-cm) side storage boxes attach via the D-ring tie downs and sit on the wheel wells of a full-size pickup, eliminating customer-visible fasteners and brackets as well the need to drill new holes for attachments. The MIC, grained blow-molded boxes and lids are 25-30% lighter than comparable steel or aluminum boxes and easy to install/ remove. Lockable lids open into the bed, facilitating access to contents while keeping smaller items out of the main bed and securing valuable items. Injection molded latch cover, latch bezel, and handle and extruded weather seals complete the units.

Flow-Through Letter Grille
2019MY General Motors Co.
Chevrolet Colorado pickup

System Supplier:	SRG Global
Material Processor:	SRG Global
Material Supplier:	Lotte Advanced Materials Co., Ltd.
Resin:	Starex MP-0160R ABS
Tooling Supplier:	Integrity Tool and Mold Inc.

This visually-distinctive front grille preserves the "Chevrolet look" while reducing part complexity and allowing for higher airflow to accommodate diesel or gasoline engine requirements. An injection molded ABS outer frame in painted, high-gloss black snap-fits together with an injection molded low-gloss, MIC anthracite grey ASA bezel. Versus the standard grille it replaced, mass was reduced 14% and direct costs 7.5%, while significant indirect tooling savings also were realized, all while keeping the aftermarket price point affordable.

Heavy-Duty Tailgate Gap Flap
2020MY General Motors Co.
Chevrolet Silverado & GMC Sierra HD pickups

System Supplier:	Ground Effects Ltd.
Material Processor:	Vintech Industries Inc.
Material Supplier:	ExxonMobil Corp., LyondellBasell Industries N.V., Teknor Apex Co.
Resin:	Santoprene TPV, Profax 7823 HHC PP, Sarlink 5750 DB TPV
Tooling Supplier:	Vintech Industries Inc.

This pickup end-gate gap spacer helps keep debris out of the space between the end of the pickup bed and the tailgate thanks to a tri-durometer, multi-material extrusion with injection molded end caps and a slip coating that prevents premature wear. The fully recyclable spacer is easily installed with supplied double-sided fastening tape. Its living hinge allows the part to stay in place when the tailgate is closed as well as open, it won't pinch the wire harness, and it helps reduce pinch hazards when owners try to manually clear debris.

Illuminated Emblem Light Guide
2020MY General Motors Co.
GMC Sierra pickup & Yukon SUV

System Supplier:	Windsor Mold Group
Material Processor:	Global Lighting Technologies Inc.
Material Supplier:	Idemitsu Kosan Co., Ltd.
Resin:	Tarflon LC1500 PC
Tooling Supplier:	Global Lighting Technologies Inc.

Both size and shape of this emblem made it difficult to use traditional radial design with a single LED on the light guide to ensure consistent light output along the entire path. Placing an LED behind each letter would have significantly increased costs and complexity and impacted mating components. By laser etching the perimeter of the light guide tool, a high degree of control over light intensity was achieved, lowering costs 20%. Highest etch density is used at the extremes to maximize light output, while lightest etch density is required near the light source.

AFTERMARKET & LIMITED EDITION / SPECIALTY VEHICLES

SPE AUTOMOTIVE

Multiple Additively Manufactured Components
2020MY Jaguar Land Rover Ltd.
Jaguar XE SV Project 8 supercar

System Supplier:	HP Inc.
Material Processor:	Jaguar Land Rover Ltd.
Material Supplier:	HP Inc., DyeMansion GmbH
Resin:	HP high-reusability PA 12
Tooling Supplier:	N/A

Additive manufacturing proved the most efficient and cost-effective method for producing 19 parts on this high-performance sedan whose total build volume will be limited to 300 cars. Both development and production parts were produced on the same printer platform, which eliminated significant tooling investment (est. at $123,000 USD), as well as storage and maintenance costs. All 19 parts print at one time in a kit, and multiple kits can be produced at the same time. Additionally, parts offer better bonding adhesion than conventionally produced parts and passed paint adhesion tests.

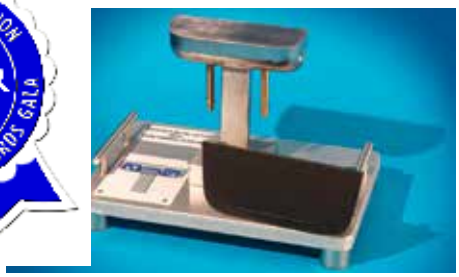
Squab Release Handle
1998MY Jaguar Land Rover Ltd.
Discovery 2 SUV

System Supplier:	HP Inc.
Material Processor:	Jaguar Land Rover Ltd.
Material Supplier:	HP Inc., DyeMansion GmbH
Resin:	HP high-reusability PA 12
Tooling Supplier:	N/A

The supplier of these parts recently went out of business. With only 50 replacement handles needed per year, and the vehicle out of production for 15 years, spending $37,000 USD to cut a new tool couldn't be justified. Additive manufacturing provided the opportunity to redesign handles with a more aggressive rib pattern that increased strength but that, in traditional tools, would have created undercuts (in a location where lifters would have been impossible to position) and stress risers. Final parts passed all OEM requirements, are fully recyclable, and extend the use-life of older vehicles.

ADDITIVE MANUFACTURING

Sunglass Bin
2020MY Ford Motor Co.
Ford Explorer SUV



System Supplier:	Methode Electronics, Inc.
Material Processor:	Methode Electronics, Inc.
Material Supplier:	Celanese Corp.
Resin:	Celstran PP-GF20-02 LFT-PP
Tooling Supplier:	RGM Tooling Consultants, Inc.

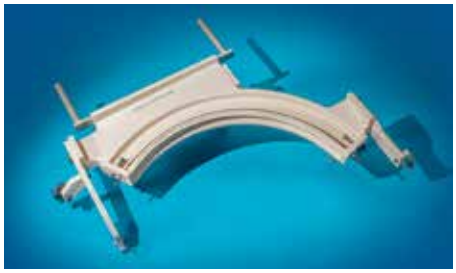
Additive manufacturing was used to produce a single tooling insert (lifter) that replaced 2 conventionally machined lifters to mold an injection molded sunglass stowage bin. That enabled design changes to produce a deeper pocket with a heavier undercut that still could be molded without hotspots, warpage, or demolding issues and without needing to switch to a more costly resin. The new deeper bin design also better meets customer requirements while reducing cycle time, molding scrap, tooling maintenance, and improving dimensional stability in the final part.

Hinge Pillar Minomi Checking Fixture
2020MY General Motors Co.
Buick Excelle compact car

System Supplier:	Kuka AG
Material Processor:	General Motors Co.
Material Supplier:	Stratasys, Ltd.
Resin:	ASA
Tooling Supplier:	Kuka AG

By changing a lean-manufacturing conveyor pallet from metal to ASA parts produced via 3D printing, pallet weight was lowered 72%, direct costs were reduced 66%, and lead times were shortened from 6-8 weeks to 4 days, making design changes faster and easier. Additionally, 1 of 2 operators usually required to lift the old pallets was reassigned, ergonomics for the remaining operator were improved, offline checks can now be conducted faster, there is now less wear and tear on equipment, and no coolant or grease is required.

Rear Wheelhouse Hemming Tool
2020MY General Motors Co.
Chevrolet Equinox CUV



System Supplier:	General Motors Tech Center – PPO North
Material Processor:	General Motors Co.
Material Supplier:	Stratasys, Ltd.
Resin:	ABS-M30
Tooling Supplier:	General Motors Tech Center – PPO North

A rear wheelhouse hemming tool that is used to join fender inner and outer panels was 3D printed in ABS. Versus incumbent machined aluminum, the ABS tool weighed 50 and 70% less (depending on vehicle size), costs were reduced 75%, lead times were shortened from 10-13 weeks to 2 weeks, making if much faster to order replacements, labor costs were lowered, and design changes were easier to make.

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2019 NOMINEE

ADDITIVE MANUFACTURING

Lug Nut Starter
2019MY General Motors Co.
Chevrolet Silverado pickup

System Supplier:	Stratasys, Ltd.
Material Processor:	Eckhart
Material Supplier:	Stratasys, Ltd.
Resin:	PA 12
Tooling Supplier:	Eckhart

This patent-pending lug-nut starter tool was produced via additive manufacturing. Its unique design eliminates the need for a lug wrench or Jemms head tool, battery drive, and charger. User ergonomics are improved and all lug nuts can be started at once on a given wheel rather than starting them individually. Since torque output is reduced, there is far less chance of cross-threading nuts. Additionally, tooling cost is reduced $2,000-$3,000 USD/tool, no additional equipment is needed, and the design can be adapted to any circular bolt pattern.

Instrument Panel Delete Plug
2019MY Ford Motor Co.
Ford F-150 Raptor pickup (China market)

System Supplier:	Detroit Manufacturing Systems LLC
Material Processor:	Ford Motor Co.
Material Supplier:	Carbon, Inc.
Resin:	EPX82 2K epoxy
Tooling Supplier:	N/A

This 3D printed production part with Class A appearance passed all relevant requirements, including UV exposure. It expedited design, testing, and production, eliminated $70,000 USD in tooling costs, and saved 3 months' time. The aesthetically pleasing delete plug with logo is preferred over a non-functional button.

BODY EXTERIOR

TPO Spoiler
2020MY Ford Motor Co.
Ford Escape CUV & Lincoln Corsair SUV

System Supplier:	Magna Exteriors
Material Processor:	Magna Exteriors - Nascote
Material Supplier:	LyondellBassell Industries N.V.
Resin:	Hifax TYC1235X filled TPO
Tooling Supplier:	Concours Mold

By switching from PC/ABS to body-panel-grade TPO for an injection molded, ultrasonically welded spoiler assembly, mass was lowered 7-10%, wallstock was thinner, a better CLTE match with liftgate outer panels was achieved, which improved dimensionality and fit & finish, and cost was reduced $2 USD/assembly. The material can be painted on most paint lines (high or low bake), achieves a quality appearance, and met OEM durability and thermal/solar load requirements.

Structural Reinforcement for Liftgates
2020MY Toyota Motor Corp.
Toyota Supra sports car

System Supplier:	Magna International Inc.
Material Processor:	Magna International Inc.
Material Supplier:	BASF Polyurethanes GmbH, Johns Manville
Resin:	Elastolit D 8790-101 PUR cores, StarRov PR440 2400 090 fiberglass, Elastolit R8819/104/LT PUR skins
Tooling Supplier:	Modelárna Liaz spol. s.r.o.

A lightweight, high-performance integral composite spaceframe replaced steel in the liftgate of a performance sports car. Mass was reduced 10% while boosting stiffness/weight ratios, CLTE was lowered, dimensional stability was improved, and a continuous load path between hinges and latches was provided. Produced using continuous glass fibers filament wound around PUR foam cores and then impregnated with PUR resin, the frame can be designed with variable diameter, shape, and wall thicknesses for difficult packaging situations and load cases.

Composite Pickup Box
2020MY General Motors Co.
GMC Sierra LD FST pickup

System Supplier:	Continental Structural Plastics
Material Processor:	Continental Structural Plastics
Material Supplier:	Teijin Ltd.
Resin:	Sereebo A235Y carbon fiber-reinforced PA 6 sheet
Tooling Supplier:	Paragon D&E, Model Die & Mold, Inc., Altron Automation, Legacy Industries

This is industry's first pickup box in thermoplastic composite and carbon composite. It saved 62 lb/28 kg, provided best-in-class impact resistance/durability, the unpainted UV-stable material eliminated need for a bedliner (saving another 40 lb/18 kg), and numerous customer features were molded in, including functional compartment dividers and motorcycle tire pockets. The ability to achieve a deeper draw during molding increased cargo capacity. Significant technical challenges were overcome due to use of novel materials, processes, coatings, and joining methods. The box is fully recyclable and some scrap is reused on the vehicle.

Active Air Deflector
2020MY FCA NA LLC
Ram pickup

System Supplier:	Magna Exteriors
Material Processor:	Prism Plastics, Inc., US Farathane Corp.
Material Supplier:	BASF Corp., DSM Engineering Plastics, Ascend Performance Materials, RTP Co.
Resin:	Ultramid B3WG7 BK 35% GR-PA 6, Akulon K224-HG6 30% GR-PA 6, Vydyne R533H BK02 33% GR-PA 6/6, KTPE 85A, Nylabond 6091-85A black TPE
Tooling Supplier:	Prism Plastics, Inc., Quest Industries, Inc., Precision Die & Machine Co.

This frame-mounted active air deflector is located forward of the vehicle, below the bumper, and activates/stows at set speeds to reduce drag, improve aerodynamics, and boost fuel economy. It would take a vehicle mass reduction of 100 lb/45 kg to achieve the same 0.7 mpg fuel-efficiency improvement. The system is designed to withstand high-energy impacts thanks to a unique actuator containing a mechanical clutch and a 2-shot injection molded blade.

BODY EXTERIOR

eApplique
2020MY Ford Motor Co.
Ford Explorer & Lincoln Aviator SUVs

System Supplier:	Magna Exteriors
Material Processor:	Co-Ex-Tec Div. of Magna International
Material Supplier:	Evonik Industries AG, Ineos AG, AsahiKasei Plastics NA, Kraiburg TPE
Resin:	WSS-M4D776-B5 PMMA, WSS-M4D690-B1 ABS, 20% GR-PP, SuperSoft TFOSTOL0999 TPE
Tooling Supplier:	Windsor Mold Inc., Redoe Group

This multi-material, co-molded keyless-entry applique uses a flexible printed-circuit board and unique electronics attachment methods to better match the crown and sweep of the pillar's Class A surface. The unit features an intelligent, touch-sensitive plastic control panel/keypad with improved rain sensor for fewer false inputs, Bluetooth authentication for greater security, and illuminated lock switch and lock status indicators. It provides uniform airgap and improved sealing, wire attachment, and stress relief vs. earlier systems while reducing cost, weight, and warranty issues. The design already has received 3 US patents.

Front End Module with Structural Bolster with Integrated AGS 2020MY Ford Motor Co.
Ford Explorer & Lincoln Aviator SUVs

System Supplier:	Flex-N-Gate Corp.
Material Processor:	Flex-N-Gate Corp.
Material Supplier:	Celanese Corp.
Resin:	Celstran PPGF40-20 AD3004 black LFT-PP
Tooling Supplier:	Integrity Tool & Mold

The largest known and most fully integrated structural bolster/front-end module carrier to date, this system incorporates upper and lower active grille shutter housing structures, a direct-mounted crash sensor, an IIHS Small Offset structure in the impact beam, a lower cooling pack support structure, and latch reinforcement and mounting integration. The injection molded design with overmolded steel inserts eliminated a large metal reinforcement, reducing mass 10% and cost 20% vs. the prior model. Thanks to significant parts integration, material and fastener usage and assembly-plant line space and labor were reduced. It supports 300 build variations across 2 platforms.

Glass Run Sealing System
2020MY Ford Motor Co.
Ford Explorer SUV

System Supplier:	Cooper Standard
Material Processor:	Cooper Standard
Material Supplier:	Cooper Standard & ExxonMobil Corp.
Resin:	Fortex TPV
Tooling Supplier:	Cooper Standard

A new class of elastomer combines the best of EPDM and TPV materials typically used in automotive weatherseals without their negatives. It is lighter, offers best-in-class compression set, weathering, and chemical resistance while maintaining high elasticity and improved NVH and scratch resistance. The non-conductive elastomer is plasticizer-free, low VOC, contains no nitrosamines, and is non-blooming and non-fogging. It also offers broad color matching and improved color/gloss finish for enhanced aesthetics and is much easier for operators to install on the assembly line.

Rear Bulkhead Window Frame
2020MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	Molded Fiber Glass Companies
Resin:	4437 polyester/vinyl ester acoustic SMC with beryllium graphite filler
Tooling Supplier:	Century Tool & Gage

Made from a custom-blended unsaturated polyester/vinyl ester resin system using beryllium graphite fillers to deaden sound on the rear bulkhead window frame, the part meets twin thermal and acoustic challenges seen when moving to a mid-engine architecture. This 2.2 SG, low-VOC, compression moldable SMC eliminates the need for secondary stampings/baffles, die-cut foam, lofted fabrics, gaskets, and other sound deadeners, reducing costs while increasing interior package space and improving body sealing and NVH.

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BODY EXTERIOR

Rear Fascia Assembly
2020MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	Molded Fiber Glass Companies
Resin:	4514 polyester/vinyl ester Class A SMC
Tooling Supplier:	Century Tool & Gage

This is the first use of a low-density (1.2 SG), Class A SMC for a rear fascia on vehicles with high production volumes. Versus TPO, the SMC's superior thermal stability enables it to be used next to hot exhaust tips. Its higher mechanical performance allows for the design of a short rear overhang and larger spacings between attachments. The SMC also does a better job of spreading loads over a larger area in low-speed rear crashes. Brackets and rear-parking assist sensors were bonded to the SMC.

Rear Surround Frame
2020MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	Molded Fiber Glass Companies
Resin:	4259 polyester/vinyl ester toughened CF/GF-SMC
Tooling Supplier:	Century Tool & Gage

A 1.2 SG toughened structural SMC with carbon/glass fiber reinforcement enabled a large rear-surround frame assembly to be compression molded for mass savings of 15% vs. previously used structural SMC and cost savings due to parts consolidation. The pigmented, low-VOC formulation survives engine-compartment heat, eliminated secondary attachments, increased interior packaging space, reduced NVH, provided better body structure and sealing performance, and improved rear-hatch visibility. The assembly is the dimensional foundation for all rear exterior/interior panels and provides the flexibility for multiple model variants from a single design.

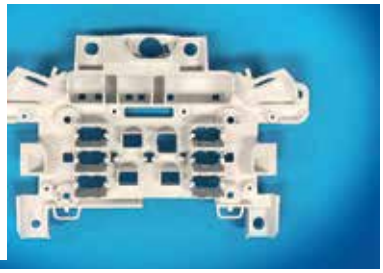
Brow Reinforcement
2019MY Ford Motor Co.
Ford Ranger pickup

System Supplier:	Flex-n-Gate Corp.
Material Processor:	Flex-n-Gate Corp.
Material Supplier:	SABIC
Resin:	Valox HT 4031 PBT/PET
Tooling Supplier:	N/A

Development of a novel thermoplastic polyester that could be molded in the same tools as the previous PA 6/6 / MPPO resin reduced material costs 30%, injection pressures 20%, reduced clamp tonnage needs, and improved dimensional stability. With higher modulus and thermal stability, mechanical performance increased and moisture absorption was decreased. The high-flow grade also permitted cycle times to be lowered.

BODY INTERIOR

Integrated Button Carrier Modular Strategy
2020MY Ford Motor Co.
Explorer/Aviator/Corsair SUVs



System Supplier:	Methode Electronics, Inc.
Material Processor:	Methode Electronics, Inc.
Material Supplier:	The Materials Group
Resin:	Opticarb 8085SE PC/ABS
Tooling Supplier:	RGM Tooling Consultants, Inc.

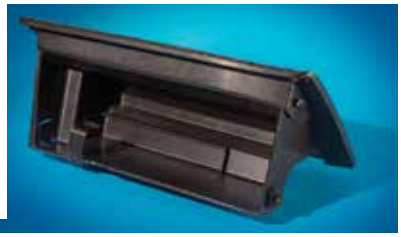
To reduce overhead console complexity, a new design was developed that integrated mechanical, lighting, electrical, and safety functions into a single modular button carrier injection molded from MIC PC/ABS. With all program variants, this reduced part count from 70 to 17/vehicle, achieved a $7 USD cost savings/vehicle and $1.42-million USD program savings for tooling and testing. No button binding issues have been seen, BSR was improved, and the headliner fit better. To date, 2 patents have been filed and one has been granted on this technology.

Multifunctional Plastic Seat Bracket
2020MY Ford Motor Co.
Ford Explorer & Lincoln Aviator SUVs

System Supplier:	Lear Corp.
Material Processor:	Engineered Plastic Components Inc.
Material Supplier:	BASF Corp.
Resin:	Ultramid 30% GR-PA 6/6
Tooling Supplier:	Technical Molding Management Systems Inc.

With the goal of reducing complexity, labor, and costs, a single, multifunctional seat bracket was designed to secure 3 different control modules, while ensuring the modules, wiring, brackets and clips, and J retainers provide secure attachment of components during a crash. The patent-pending design reduced 4 components to 1, lowered tooling investment, labor, and packaging costs, improved seat maintenance, and achieved a small weight savings (0.7 lb/0.3 kg per vehicle).

Glove-Box Latch
2020MY Ford Motor Co.
Ford Explorer SUV



System Supplier:	Detroit Manufacturing Systems LLC
Material Processor:	Piolax Corp.
Material Supplier:	BASF Corp., Trinseo, Polyplastics Co., Ltd., Ashtabula Rubber Co.
Resin:	Ultramid B3EG6 30% GR-PA 6, Pulse 2000ez PC/ABS, Ultraform M90-44 POM, ARC PN 43181 70 durometer polychloroprene
Tooling Supplier:	Lamko Tool and Mold

A patent-pending glove-box latch redesign featured 5 innovations that improved fit & finish, reduced NVH, lowered costs 30%, and allowed for automated assembly. First, both housing halves are identical, eliminating an injection molding tool. Second, a molded-in L-shape elastic element replaces the small gap normally left to ensure latch-pawl engagement, eliminating movement and noise. Third, an interlocking design replaces a snap-fit, making the latch more robust. Fourth, a double torsion spring reduces twist on latch components and facilitates automated assembly. Fifth, locators in each mold half function as the stop feature.

Tailgate Inner Structure
2018MY SAIC Motor Corp. Ltd.
SAIC Marvel X electric CUV

System Supplier:	Yanfeng Plastic Omnium Automotive Exterior Systems Co. Ltd.
Material Processor:	Yanfeng Plastic Omnium Automotive Exterior Systems Co. Ltd.
Material Supplier:	SABIC, Clariant AG
Resin:	Stamax 40YM240E LFT-PP
Tooling Supplier:	Yanfeng Plastic Omnium Automotive Exterior Systems Co. Ltd.

Through integration of a liftgate structural reinforcement/inner panel with a garnish trim, improved surface aesthetics and passenger comfort were achieved while eliminating paint. The 1-piece, low-emissions/odor MIC 40% LFT-PP part also reduced weight 20%, saved 5% in direct costs and an additional 40% in indirect costs by eliminating tooling and welding fixtures.

BODY INTERIOR

Console Armrest Hinge
2020MY Ford Motor Co.
Lincoln Aviator SUV

System Supplier:	Summit Polymers, Inc.
Material Processor:	Summit Polymers, Inc.
Material Supplier:	Toyobo U.S.A., Inc.
Resin:	Glamide TY-791HQ 60% glass/mineral PA 6
Tooling Supplier:	Commercial Tool & Die Inc.

The goals were to replace a metal hinge for a console armrest and to consolidate both hinge and armrest substrate into a single MIC part, eliminating an assembly step and paint. The challenges were meeting deflection and mechanical requirements with an aesthetically pleasing material that was highly loaded. A special formulation of 60% glass/mineral-reinforced PA 6 met all requirements, including passing an 11,000-cycle lifecycle performance test without breakage. The part also cut 2.1 lb/0.95 kg and $2 USD of cost out of each vehicle.

Web Guide
2020MY Ford Motor Co.
Ford Escape & Lincoln Corsair SUVs

System Supplier:	Innotech Precision Inc.
Material Processor:	Innotech Precision Inc.
Material Supplier:	Celanese Corp.
Resin:	Celcon UV90Z POM
Tooling Supplier:	Innotech Precision Inc.

An important safety component, the web guide keeps seatbelt travel in position and secures passengers against high forces during crashes. The earlier design, which featured 3 stamped steel brackets and 2 overmolded plastic parts, was complex, heavy, and costly. The new lean design features a single bracket overmolded with UV-stabilized, MIC POM. Not only does the part meet high (14 kN) dynamic impact requirements, and its inherent lubricity facilitates seatbelt retraction efforts, but its appearance also is improved. Additionally, mass was reduced 15% and direct costs 30%.

Seatback Suspension System
2019MY Ford Motor Co.
Lincoln Aviator SUV

System Supplier:	Leggett & Platt, Inc.
Material Processor:	Sle-Co Plastics
Material Supplier:	Advanced Composites
Resin:	ADX 5017 18% talc filled/UV stabilized/0 degree TPO, ADX 5028M 15% talc filled/-40 degree TPO
Tooling Supplier:	Sle-Co Plastics

Two grades of injection molded TPO are key to achieving iconic styling and flexible bolster comfort and support to accommodate different-size seat occupants in front row seats. The 3-piece seat back system — inner closeout, flex-arch bolster and carrier support, and comfort carrier — snap together to form a unique floating style and a comfort-optimized suspension system with improved craftsmanship and safety. The final seat assembly is over 2.2 lb/1 kg lighter and 10-13% less costly than traditional seating and has had 7 patents granted to date.

Modular Seat-Cushion Pan Nose
2019MY Ford Motor Co.
Lincoln Aviator SUV

System Supplier:	Leggett & Platt, Inc.
Material Processor:	Summit Plastic Molding, Inc.
Material Supplier:	BASF Corp.
Resin:	Ultramid B3ZG7 OSI WSS-M4D578-B1 35% GR-PA 6
Tooling Supplier:	MacLean-Fogg Co.

Injection molded, impact modified GR-PA 6 replaced steel on front-row seat-cushion pan and nose components, saving 1.1 lb/0.5 kg per vehicle and lowering direct costs 4-5%. Additionally, the new design handles front dynamic crash loads, enables floating style and comfort-optimized seat cushions, includes MIC A surfaces that improve craftsmanship, and provides more efficient modular assembly, eliminating assembly steps and saving labor. To date, 5 patents have been granted on this development.

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LIFETIME ACHIEVEMENT AWARD

FORMER FORD EXEC, MICHAEL J. WHITENS, IS 2019 SPE LIFETIME ACHIEVEMENT AWARD WINNER

Michael J. Whitens, retired global director for Ford's Vehicle and Enterprise Sciences, Research and Innovation Center, has been named SPE's Lifetime Achievement award winner for 2019. In his most recent role at Ford (2014 – 2018), Whitens led the development of technology strategy and implementation in support of emerging areas including plastics/polymers, advanced plastics processing technologies, composites and material formulations with responsibility for over 500 researchers at three Ford Motor Co. global facilities.

He has demonstrated expertise working on several advanced plastics processes including micro-cellular foaming, long-fiber thermoplastic (D-LFT) composites, natural fiber composites, carbon fiber composites, nano additive based composites, metal-plastics hybrid molding, co-injection molding, twin screw extrusion compounding, polyurethane foams and more. His work includes the development of several innovations for numerous automotive plastics applications, ranging from interiors and exteriors to under the hood and safety – including instrument panels, door panels, door modules, molded-in-color, seating, NVH foams, fuel systems components and more.

An automotive industry veteran with over 30 years of experience, Whitens has spent the majority of his career at Ford Motor Co. in various body engineering disciplines. He also spent three years as the Mustang PVT (Platform Vehicle Team) manager, bringing the second-generation Bullitt and Mach 1 to life.

He is a recognized leader in the development of innovative technologies in the automotive field, with 35 patents in many areas of component innovation, new material development, safety, body interior, exterior and vehicle execution.

"I am very grateful to be recognized with this esteemed SPE Automotive Division award for Lifetime Achievement, and especially grateful to the talented teams of people I have had the honor to work with who have made this possible," said Whitens. "This award would not be possible without the challenging work experience that I enjoyed, the innovative support from my associates at Ford and their supplier base, participation in SPE and other professional trade associations and education," added Whitens.

"Mike is known industry wide as one of the best problem solvers and innovators in the field of plastics and composites," said Dr. Alper Kiziltas, industry expert, Ford Motor Co. "He has a rare combination of expertise that is hard to find in the industry, including an understanding of the total system – an interaction between polymeric materials and chemistry, plastic processes, plastics part design, CAE, characterization and tooling," continued Kiziltas.

"Mike has a unique combination of global cross-functional leadership and refined people skills, giving him the ability to handle any business challenge," said Dr. Cynthia Flanigan, chief engineer, vehicle research & technology, Ford Motor Co. "He's a great leader who is very well-liked and respected in the industry, and most deserving of this award," added Flanigan.

MICHAEL J. WHITENS WORK EXPERIENCE:

Global Director – Vehicle & Enterprise Sciences, Ford Motor Co. (2014 – 2018)

Led development of technology strategy and implementation in support of emerging areas. Responsible for more than 500 researchers at three global facilities.

Global Director – Body Interior Engineering, Ford Motor Co. (2011 – 2014)

Responsible for quality, cost, weight, function and delivery of a more than $15 billion commodity base managing a $100 million budget. This included an all global cockpit, hard and soft trim, seats, restraints, climate and interior lighting for all Ford vehicles globally, leading a team of over 2,000 people in nine engineering centers around the globe.

Global Chief Engineer – Body Interior Engineering, Ford Motor Co. (2006 – 2011)

Responsible for quality, cost, weight, function and delivery of more than $6 billion commodity base, including all global cockpit, hard and soft trim, interior lighting and restraints for all Ford vehicles globally. Led more than 600 people in nine engineering centers around the globe.

LIFETIME ACHIEVEMENT AWARD

MICHAEL J. WHITENS

Chief Engineer – Body Engineering Exterior & Interior Small Car Cluster (Mustang, Windstar, Focus, Escape, Villager, Lincoln LS), Ford Motor Co. (2001 – 2005)
Responsible for quality, cost, weight, function and delivery of all body interior and exterior commodities, including all small car vehicle body structures, closures, exterior ornamentation/lighting, global cockpit, hard and soft trim and seats and restraints.

Mustang PVT Manager, Ford Motor Co. (1999 – 2001)
Responsible for quality, cost, weight, function and delivery of all Mustang vehicles.

Lincoln LS / Jaguar S-type Global Body Structure Platform Supervisor, Bumper/Exterior Ornamentation Mirror Supervisor, Front End & Underbody CAD Supervisor, Ford Motor Co. (1987 – 1999)
Developed common underbody structure to support first Ford global vehicle platform.

Doors & Mechanical Component Engineer, General Motors (1985 – 1987)
Developed door and deck lid mechatronics for C-H platform vehicles.

SIGNIFICANT ACCOMPLISHMENTS AND AWARDS:

- Numerous Society of Plastic Engineers (SPE) – Automotive Innovation Awards
- Numerous PACE Awards in Collaboration with Suppliers
- Automotive News Award in Collaboration with Ernst & Young
- Design for 6-Sigma National Award Recipient, Ford Motor Co.
- Awards for People Development, Ford Motor Co.
- Numerous Quality Awards, Ford Motor Co.
- Distinguished Alumni Recognition, Michigan Technological University, Electrical and Computer Engineering Academy (ECE Academy)

CONTRIBUTION TO PROFESSIONAL SOCIETIES, LEADERSHIP ROLES AND ACADEMIA:

- Served on Board of Directors of SPE Automotive Division
- A member of the Blue Ribbon Judging Committee for SPE Automotive Division Innovation Awards Competition and Gala
- Chaired, organized and contributed to several SPE technical sessions at industry conferences, including SPE TPO (Thermoplastic Engineered Polyolefins) SPE AUTO EPCON (Automotive Engineering Plastics), SPE ACCE (Automotive Composites) and SAE (Society of Automotive Engineers) conferences and events.
- SPE member since 2000
- Michigan Technological University External Advisory Board
- Our Lady of Victory Volunteer Coach

CONTRIBUTION TO INNOVATIONS AND INTELLECTUAL PROPERTIES/TECHNICAL:

- **35 IP (Intellectual Properties) – US and worldwide PATENTS** related to plastics materials processes and automotive applications
- **His patents** range from plastics process innovations, material formulations, to product innovations (interiors, safety, seating, exterior and under-the-hood) and tooling
- **Invited Keynote Speaker** at prestigious conferences and exhibitions, both nationally and internationally, such as SPE ACCE, SPE TPO, SPE Antec, SAE, and more. Invited reviewer as a subject matter expert. Invited committee member for SPE Innovation Awards Competition.
- **Several citations** in prestigious magazines, such as Plastics Engineering, Plastics Technology, Modern Plastics, Ward's AutoWorld, Injection Molding, Automotive Engineering, Automotive Interiors International, Plastics World, Plastics Design Forum, Design News and other Automotive & Transportation Interiors publications.

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PAST LIFETIME ACHIEVEMENT AWARD WINNERS

First given in 2001, the SPE Automotive ***Lifetime Achievement Award*** 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. Past winners include:

- **J.T. Battenberg III,** then chairman and chief-executive officer of Delphi Corp. (2001)
- **Bernard Robertson,** then executive vice-president of DaimlerChrysler (2002)
- **Robert Schaad,** chairman of Husky Injection Molding Systems, Ltd. (2003)
- **Tom Moore,** retired vice-president, Liberty and Technical Affairs at then DaimlerChrysler (2004)
- **Mr. Shigeki Suzuki,** general manager - Materials Division, Toyota Motor Co. (2005)
- **Barbara Sanders,** then director-Advanced Development & Engineering Processes, Delphi Corp. (2006)
- **Josh Madden,** retired executive at General Motors Corp. (GM) & Volkswagen of America (2007)
- **Frank Macher,** former CEO of Collins & Aikman Corp., Federal Mogul Corp., and ITT Automotive (2008)
- **Irv Poston,** retired head of the Plastics (Composites) Development-Technical Center, General Motors Corp. (2009)
- **Allan Murray,** Ph.D., retired technology director, Ford Motor Co. (2010)
- **David B. Reed** P.E., retired staff engineer, Product Engineering, General Motors Co. (2011)
- **Gary Lownsdale,** P.E., retired chief technology officer, Plasan Carbon Composites (2012)
- **Roy Sjöberg,** P.E., retired executive engineer-Viper Project, Chrysler Corp. (2013)
- **Dr. Norm Kakarala,** retired senior technical fellow, Inteva Products LLC (2014)
- **Fredrick Deans,** P.E., chief marketing officer, Allied Composite Technologies LLC (2015)
- **Dr. Lawrence T. Drzal,** university distinguished professor of Chemical Engineering and director-Composite Materials and Structures Center at Michigan State University College of Engineering (2016)
- **Dr. Suresh Shah,** retired senior technical fellow at Delphi Corp. (2017)
- **Dr. Rose A. Ryntz,** retired vice-president, Global Advanced Development and Material Engineering at International Automotive Components (IAC) Group (2018)

CHASSIS / HARDWARE

Rear-Differential Module Front Bracket
2020MY FCA NA LLC
Jeep Cherokee SUV

System Supplier:	Boge Rubber & Plastics
Material Processor:	Boge Rubber & Plastics
Material Supplier:	BASF Corp.
Resin:	Ultramid A3WG10CR 50% GR-PA 6/6
Tooling Supplier:	N/A

A critical diecast and machined aluminum bracket was replaced by an injection molded bracket in 50% GR-PA 6/6 in this demanding rear differential module. The composite material was not only 30% lighter and saved $1 USD/car direct costs vs. the benchmark aluminum, but its matrix provided 10x higher damping, improving NVH performance, and it fit current packaging space for this running change. The part passed all performance and durability requirements, eliminated corrosion issues, and will significantly reduce tooling costs over the life of the program.

CVJ Boot
2020MY Hyundai Motor Co.
Hyundai Sonata HEV

System Supplier:	SeoHan Group
Material Processor:	KunHwa ENG Co., Ltd.
Material Supplier:	DuPont de Nemours, Inc.
Resin:	Hytrel HTR8895 BK320 TPC-ET
Tooling Supplier:	Ossberger GmbH + Co. KG

An OEM-supplier team worked to identify factors suspected of causing wet squeaking problems on CVJ boots on quiet electric cars. A new test protocol that better simulates real driving conditions and generates data for more accurate material cards was developed, leading to design and material modifications and a new tool. A dual-wax system in the polymer, coupled with elimination of a knitline in the molded part were key to solving the problem, which eliminated $1.5-million USD/year in field claims and up to $5-million USD/year in repair costs.

Window-Regulator Plastic Fastener
2020MY Ford Motor Co.
Ford Explorer SUV / Lincoln Aviator SUV

System Supplier:	Hi-Lex Corp.
Material Processor:	Hi-Lex Corp.
Material Supplier:	Celanese Corp. & ExxonMobil Corp.
Resin:	Hostaform S9363 POM & Santoprene 101-55 TPV
Tooling Supplier:	ITW Automotive

A new and more efficient design for window-regulator retention fasteners was developed using dual-shot injection molded LFT-PP overmolded with a TPV seal. The patent-pending design, industry's first to provide quick assembly of integrated window regulators, works with hex or Torx tools for greater flexibility and reduced assembly time and effort. It eliminated the need for grease, lowered mass 1.65 lb/0.75 kg per vehicle, and reduced cost 20%. The fastener already is being used on 33-million vehicles with another 10-million expected to be added as the application spreads to other regions.

Precision Wheel-Balance System
2019MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	The 3M Co.
Material Processor:	The 3M Co.
Material Supplier:	The 3M Co.
Resin:	3M Dyneon THV fluoropolymer
Tooling Supplier:	N/A

A unique composite with high density (5.8 SG) has replaced traditional metallic wheel weights in steel, zinc, or lead. The extruded fluoropolymer contains 67% by volume post-industrial, corrosion-resistant steel alloy and can be recycled again. Supplied as a continuous tape, and with tailored magnetic properties, the weights can be precisely dispensed using a fully automated wheel-balance system in smaller increments for improved ride and less tire wear. The weights reduce assembly time up to 50%, lower costs 10%, significantly reduce and simplify inventory, and offer a broader range of colors.

CHASSIS / HARDWARE

Composite Brake Pedal
2020MY Volkswagen AG
Porsche 911 sports car / Taycan EV

System Supplier:	Boge Rubber & Plastics
Material Processor:	Boge Rubber & Plastics
Material Supplier:	Celanese Corp.
Resin:	Celstran CFR-TP 60% LFT-PA 6
Tooling Supplier:	Boge Rubber & Plastics

By selectively adding UD thermoplastic tapes to key locations of a brake pedal compression molded in fabric-reinforced GMT (organosheet) and overmolded with injection-molded short fiber compound — all in glass/PA 6 — ≈30% less organosheet was needed, failure mode was ductile, and mass was reduced 50-55% vs. the incumbent steel design. The lighter pedal improves driving haptics, the entire assembly is fully recyclable, and costs are neutral or lower than those for steel pedals that were replaced.

Underbody Tunnel Structural Closeout
2020MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	Molded Fiber Glass Companies
Resin:	Patch 767 CF/GF-vinyl ester SMC
Tooling Supplier:	Penco Products

Liquid compression molding (LCM) was used to form a structural composite reinforced with 2 layers of carbon and 3 layers of glass fiber impregnated with a low-VOC vinyl ester matrix. The resulting composite closeout provides better body structure and chassis performance and contributes 10% or more torsional stiffness to this tunnel-dominated vehicle architecture, while reducing mass 4.2 pounds/1.9 kilograms and cost vs. aluminum. Secondary attachments also were eliminated, reducing labor, tooling, and capital expenditures.

Particulate Matter Air Sensor
2020MY Ford Motor Co.
Lincoln Aviator SUV

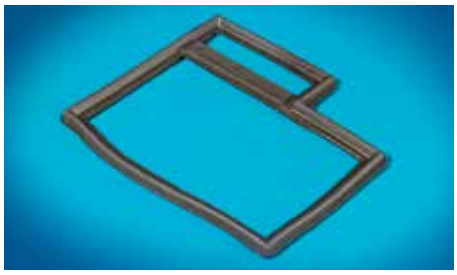
System Supplier:	Amphenol Corp.
Material Processor:	Ga Hyeon Enpla Co., Ltd.
Material Supplier:	LG Chem, Ltd.
Resin:	Lupoy PC/ASA EU5000G
Tooling Supplier:	Ga Hyeon Enpla Co., Ltd.

This highly accurate (PM 2.5/fine dust) air sensor provides the sensitivity of costly lab equipment with the compactness, durability, and cost-effectiveness required in the auto industry. Five of the maintenance-free sensor's 6 components are molded in PC/ASA, selected for its ability to mold complex geometries, hold tight tolerances, provide smooth interior surfaces, and function at temperatures between -40F/-40C and 185F/85C. Owing to its light weight, compact design, and nearly-silent operation, the sensor was able to be packaged in the overhead console.

ENVIRONMENTAL

spe AUTOMOTIVE

Biobased PUR Foam for Air Filters
2019MY Ford Motor Co.
Ford F-150 pickup



System Supplier:	Mann+Hummel Group
Material Processor:	Mann+Hummel Group
Material Supplier:	Cargill, Inc.
Resin:	BiOH soy-based polyol
Tooling Supplier:	Mann+Hummel Group

Containing the highest amount of bio-based (soy oil) polyol in the automotive industry (33%), this also is the first bio-based PUR foam used in the demanding underhood environment. The self-extinguishing foam molds identical to the full-petroleum-based foam it replaced and fared slightly better on the microbial-growth tests than the benchmark. The application is cost neutral, but offers higher sustainability.

100% PCR Carbon Canister Housing
2019MY Ford Motor Co.
Ford Mustang sports car

SPE Automotive Division AWARD WINNER Innovation Awards Gala

System Supplier:	Delphi Technologies PLC
Material Processor:	MGS Mfg. Group
Material Supplier:	Wellman Advanced Materials
Resin:	Ecolene PP8004-BK1 20% GR-PP
Tooling Supplier:	MGS Mfg. Group

The PP backing from PCR carpeting is given another use life by being recycled back into the injection molded carbon canister housing for passenger cars. This is the first 100% PCR PP-based carbon cannister. By replacing virgin PP, the recycled resin reduces cost 25% with no sacrifice to processing or molded-part performance, but increases sustainability. It is currently being rolled out on more than 20 Ford programs globally.

Rice Hull-Filled PP
2019MY Ford Motor Co.
Ford Edge SUV

SPE Automotive Division FINALIST Innovation Awards Gala

System Supplier:	ARaymond
Material Processor:	ARaymond
Material Supplier:	RheTech A HEXPOL Co.
Resin:	RH10P325-0110% rice hull-filled PP
Tooling Supplier:	ARaymond

One of 8 types of renewable materials in Ford vehicles, rice hulls are used as reinforcement for injection molded PP wiring channels, replacing 20% talc-filled PP without loss of properties. The high silica content of rice hulls provides high resistance to mildew and fungal growth, and offers better flame retardance and lower moisture absorption than cellulose-reinforced plastics. Versus outgoing talc-filled PP, the application also is 10% lighter and 10% less costly, yet meets all OEM specs. It also offers an additional revenue stream to farmers.

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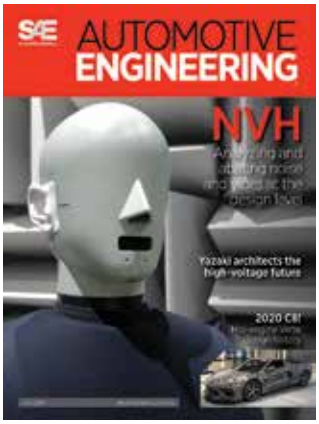


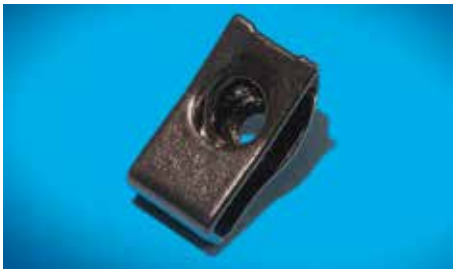
MATERIALS

LED Front Fog Lamp
2020MY Ford Motor Co.
Ford F-150 pickup

System Supplier:	Flex-N-Gate Corp.
Material Processor:	Ventra Plastics
Material Supplier:	Covestro LLC
Resin:	Makrolon TC8030 thermally-conductive PC
Tooling Supplier:	Krieger Craftsmen Inc.

A thermally and electrically conductive PC housing reduced weight and complexity and improved light output on this front fog-lamp assembly. Replacing die cast aluminum, the injection molded part reduces weight 46%, component count 12%, and direct costs 20% vs. the incumbent design. The material's high thermal conductivity manages heat well, its high modulus handles structural loads, its low CLTE provides dimensional stability, its electrical conductivity dissipates static charge, and its low EMI shielding helps with electronic integration. The material is fully recyclable and supports high production rates.

Galvanic-Corrosion Coating
2020MY General Motors Co.
GMC Sierra & Chevrolet Silverado pickups



System Supplier:	Nylok LLC
Material Processor:	Nylok LLC
Material Supplier:	Nylok LLC
Resin:	NyShield epoxy
Tooling Supplier:	N/A

A special epoxy powder coating has been developed to coat fasteners, clips, and other small connectors in a high-speed process. The coated components eliminate the need for costly and exotic galvanic corrosion mitigation strategies when mixed-material components are connected, helping reduce overall vehicle mass. Compared with competitive PA 11 coatings, the epoxy coating provides uniform flow across irregular surfaces, very-good chemical and corrosion resistance, and has low creep under compressive forces – even at elevated temperatures – which otherwise can lead to joint loosening. It also provides an electrical barrier.

High-Gloss Black MIC Wiper-Motor Cover
2020MY General Motors Co.
Chevrolet Suburban SUV

System Supplier:	ABC Inoac Exterior Systems
Material Processor:	ABC Technologies
Material Supplier:	Lotte Advanced Materials Co., Ltd.
Resin:	Starex WX-9950UV ASA/PMMA
Tooling Supplier:	Delta Mold, Inc.

A novel ASA/PMMA blend overcame challenges on a MIC high-gloss black wiper motor cover that the individual resins could not. While ASA provides good impact, ductility, and weatherability (in low gloss), it scratches easily and has retention issues in high gloss. And PMMA offers high gloss and brilliant color, scratch resistance, and good weatherability in high gloss, but suffers from poor impact strength and ductility. The new blend offers both color and gloss retention, scratch resistance, weatherability (regardless of gloss level), plus impact strength and ductility. Fully recyclable, it eliminates paint and saves $4 USD/vehicle.

Steering-Wheel Bezel
2020MY Ford Motor Co.
Ford F-250 & F-350 pickups

System Supplier:	ZF Friedrichshafen AG
Material Processor:	Eclipse Mold
Material Supplier:	Celanese Corp.
Resin:	Celanyl NKX-101 PA 6
Tooling Supplier:	Eclipse Mold, Inc.

A multipronged approach eliminated paint on a PA 6 steering-wheel bezel. First, a special pigment package, which achieved the desired color, flop, pop, and depth of color to match the benchmark painted metallic grey, was developed. Second, a knitline issue was resolved by thinning out 3 areas of the part that are hidden under the steering-wheel cover in the final assembly and adding overflows. The MIC PA 6 met all performance and aesthetic requirements while eliminating the cost and environmental impact of paint and reducing warranty issues in this high-touch area.

MATERIALS

Door-Trim Panels
2020MY Ford Motor Co.
Ford Police Interceptor SUV

System Supplier:	Yanfeng Automotive Interiors
Material Processor:	Yanfeng Automotive Interiors
Material Supplier:	Advanced Composites
Resin:	ADX-5393 talc-filled TPO
Tooling Supplier:	ToolPlas Systems Inc.

For this police vehicle, front and rear door-panel inners were reformulated with lighter weight, lower cost talc-filled TPO. By cutting filler levels from 20 to 10%, mass was reduced 7.3% and cost $0.18/vehicle without any compromise to durability. Density dropped, melt flow index increased, and tensile strength at yield also went up. Instrumented impact stayed the same and, while there was a small drop in flexural modulus, the door panels met all OEM requirements.

Instrument Carrier
2020MY BMW AG
BMW 3 Series

System Supplier:	Dräxlmaier Automotive
Material Processor:	Dräxlmaier Automotive
Material Supplier:	Trinseo
Resin:	Enlite LGF2601 LFT-ABS
Tooling Supplier:	N/A

Replacing die cast magnesium with a new injection molded LFT-ABS composite reduced mass 28% and simplified production processes for this instrument panel carrier while offering comparable resonant frequency. At 185F/85C, the new material offers similar stiffness/density ratios vs. LFT-PP and higher stiffness at lower density than LFT-PA. Additionally, warpage is lower than comparably gated LFT-PP materials in test plaques. The material is said to be low VOC, low odor, and offer high dimensional stability.

Low-CLTE PC/ABS Roof Rail
2020MY Toyota Motor Corp.
Toyota RAV4 CUV

System Supplier:	JAC Products
Material Processor:	Plastic Mold Technology
Material Supplier:	Trinseo
Resin:	Pulse XT7215 PC/ABS
Tooling Supplier:	Plastic Mold Technology

An unnamed mineral fiber and a reformulated resin system helped achieve a low CLTE and higher dimensional stability on a roof rail injection molded in PC/ABS. The fiber's specific aspect ratio was key to improving flow on such a long part. The resulting high gloss, lower density, thermally stable and paintable polymer system is an alternative to mineral-filled PC/PET and PC/SAN at lower cost.

Front End Module
2018MY Volkswagen AG
Volkswagen Atlas SUV

System Supplier:	Arkal Automotive
Material Processor:	Arkal Automotive
Material Supplier:	Lanxess Corp.
Resin:	Tepex 104RG600 PP/organosheet
Tooling Supplier:	M.C.S. Morandi S.r.l.

Strategically placed strips of continuous glass-fabric-reinforced GMT (organosheet) with a PP matrix eliminated the need for several heavy stamped steel brackets on the sides of this front-end module. A hybrid injection/compression process was used to produce the part, which features 2 metal stampings on the core side and 3 preheated strips of organosheet on the cavity side that are backfilled with 30% LFT-PP. No additional secondary operations are required. The substitution lowered mass ≈0.82 lb/0.37 kg, reduced cost 15%, while still meeting front crash requirements and engine hood-latch load constraints.

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MATERIALS

Glass Wool-Reinforced Composites for Improved Scratch Resistance 2017MY Hyundai Motor Co. Hyundai Elantra sedan

System Supplier:	Seoyon E-Wha
Material Processor:	Seoyon E-Wha
Material Supplier:	Daehacom Co. Ltd.
Resin:	SW920 SA glass wool-reinforced PP
Tooling Supplier:	Seoyon E-Wha

To improve both long-term scratch resistance and dimensional stability in injection molded PP interior trim panels, glass wool (crushed glass + sand produced from reclaimed/PIR building insulation) was used to replace talc, whiskers, and fiberglass. Because glass wool boosts mechanical properties vs. talc, filler content was reduced 5%, leading to lighter, less costly parts. Since it helps maintain surface finish longer, it should lower warranty claims. A unique process was developed to incorporate glass wool into the resin compound. Glass wool is difficult to dispose of, so this application gives it another use life.

SMC/LMC Rear Trunk Components 2020MY General Motors Co. Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	Molded Fiber Glass Companies
Resin:	LCM Float 758 polyester/vinyl ester SMC
Tooling Supplier:	Century Tool & Gage

A lower density (0.9 SG), structural composite, which literally floats on water, was developed to replace standard low-density SMC (1.25 SG), injection molded composite, and multipiece metallic structures for the vehicle's rear and front trunks. Compared with metals, the new LCM material reduces mass approximately 10 lb/4.5 kg and direct costs while offering the flexibility of two storage trunks, lower NVH, and higher parts-consolidation opportunities. The material/process combination, with a low-VOC unsaturated polyester/vinyl ester matrix, also made it possible to successfully mold both front and rear trunks with tall walls and deep-draw sides.

Instrument-Panel Bracket 2020MY Ford Motor Co. Lincoln Corsair SUV

System Supplier:	Summit Polymers, Inc.
Material Processor:	Summit Polymers, Inc.
Material Supplier:	Toyobo U.S.A., Inc.
Resin:	Glamide JF-30G 70% GR-PAMXD6 aliphatic PA
Tooling Supplier:	Commercial Tool & Die, Inc.

The design team wished to create an A/C and heat controller that cantilevered off the IP, adding a sleek, minimalist look to the cockpit. However, it also was highly desirable to replace metal and lower weight and cost. Eventually, a 70% GR-aliphatic PA provided the strength to resist downward loads on the controller. The high-strength, low-warpage injection molded grade eliminated metal brackets while providing better design flexibility for fastening. It also reduced weight 12% vs. aluminum and 72% vs. steel while lowering costs 18% and improving NVH and wear issues.

Multifunctional Control Valve 2019MY FCA NA LLC Dodge Ram 3500 pickup

System Supplier:	Continental AG
Material Processor:	Stant Corp.
Material Supplier:	Polyplastics Co., Ltd.
Resin:	Duracon H140ARCF2001 POM
Tooling Supplier:	Poly-Nova Technologies, Corp.

A new POM with improved acid tolerance (pH ≈1) and superior stress-crack resistance replaced standard POM on injection molded fuel flanges for multifunctional control valve assemblies. Through a combination of additives and tighter crystalline structure, the specialized polymer provides 30x higher acid resistance than standard POM, it flows more easily to produce parts with less stress, shrink is similar so tool changes were unnecessary, and it offers comparable mechanical properties. Although higher cost than standard POM, it avoided the need to upgrade to a much more costly resin and lowers warranty claims.

AUTOMOTIVE

HALL OF FAME

FIRST PLASTIC-METAL HYBRID FRONT END STRUCTURE NAMED 2019 SPE® AUTOMOTIVE INNOVATION AWARDS "HALL OF FAME" WINNER

The first Plastic-Metal Hybrid (PMH) front end structure, used on the 1999 C170 Ford Focus GOR from Ford Motor Co., has been named the 2019 Hall of Fame winner. The plastic-metal front end structure, made with Durethan BKV30H2.0 (30% glass filled PA6/heat stabilized) resin from LANXESS (formerly Bayer from 1999-2004) with a steel insert enabled a 40% weight reduction, 30% cost reduction, high function integration with reduced process steps, higher accuracy and quality, and higher load capacity compared to a 100% steel structure. 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 broadly adopted in the automotive industry. This application certainly qualifies as there have been more than 70 applications and 70 million manufactured parts to date worldwide.

The companies involved in developing the first PMH front end application include: OEM – Ford Motor Co.; System Supplier – Visteon; Molder/Processor – Visteon; Toolmaker – Misslbeck; and Material Supplier: – LANXESS. Boris Koch is the inventor and designer of the PMH innovation with Bayer/ LANXESS and Dr. Hubert Goldbach is the inventor and designer for the PMH innovation with Bayer.

The LANXESS PMH technology combined the great design freedom, good flexibility and low density of glass filled PA 6 with the high strength, stiffness and low thermal expansion of metal. This thermoplastic and metal integration enabled a part with higher load capacity compared to sheet metal profiles, higher torsional stiffness compared to open sheet metal profiles, higher precision in production and use, and higher integration of functional elements.

Key design features include an injection molded rib structure, in the thin wall metal sheet profile, with form closure grips, lay-on surfaces, overmolded edges and supporting ribs on the outside of the profile (providing a mechanical adhesion) resulting in improved part strength and support.

HALL OF FAME

Other key design features, enabling a mechanical connection of the thermoplastic and metal structures, include: conical piercing in the sheet metal creating ports for the thermoplastic ribs to be secured; fixing area at sheet metal flange for the thermoplastic ribs to snap in place; and the thermoplastic rib structure providing additional strength and support inside the metal profile.

The LANXESS PMH front end structure technology permitted the integration of features (piercings in the metal for connecting 21 different parts to the structure) in a single operation greatly improving production efficiency, cost effectiveness, and part performance.

The 2019 SPE Automotive Division Hall of Fame committee was chaired by **Nippani Rao,** Chrysler LLC, retired and co-chaired by **Dave Reed,** General Motors Corp., retired and **Fred Deans,** Allied Composite Technologies, LLC. Committee members include:

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PROCESS, ASSEMBLY & ENABLING TECHNOLOGIES

Rear Bumper
2020MY General Motors Co.
evrolet Corvette sports car

System Supplier:	Shape Corp.
Material Processor:	Shape Corp.
Material Supplier:	SGL Carbon SE, VectorPly Corp., Scott Bader Co. Ltd.
Resin:	Crestapol 1250 PUR-acrylate reinforced with CF
Tooling Supplier:	Thomas GmbH + Co. Technik + Innovation KG

The auto industry's first pultruded curved bumper beam uses the unique radius-pultrusion process and equipment to achieve a hollow beam with central web in carbon fiber fabric-reinforced polyurethane/acrylate resin. The curved geometry was desired to better match rear styling and vehicle package space. The beam features an integral tow hook mounting and is assembled to the body-in-white (BIW), requiring excellent mechanicals at elevated temperature. The beam meets low-speed crash requirements while cutting mass by 4.9 lb/2.2 kg vs. a metal-inert gas (MIG) welded aluminum extrusion. 3D printing was used to produce mandrels to maintain the hollow interior.

Textured Surface w/Film on Console & Door
2021MY Ford Motor Co.
Lincoln Corsair SUV

System Supplier:	International Automotive Components (IAC) Group
Material Processor:	Summit Polymers, Inc.
Material Supplier:	SABIC, AkzoNobel, Wavelock Advanced Technology Co., Ltd.
Resin:	XCY620S WRS-M40585-C2 PC/ABS
Tooling Supplier:	Commercial Tool Group

Engineering was challenged to create a 1-piece console top finish panel featuring both high-gloss black and low gloss with texture, plus chrome accent rings without painting or plating. Two conventional thermoformable films — one in high gloss and one chrome — were back injection molded in a tool with selective texturing and de-gloss surfaces. The technique improves fit & finish, increases B-side package space, reduces tooling and mass, and eliminates paint and plating while creating a final assembly with multiple film appliques, different textures, colors, gloss, and patterns that even can be selectively backlit.

Hybrid Bobbin for Traction Motor
2020MY Hyundai Motor Co.
Hyundai Sonata HEV

System Supplier:	Hyundai MOBIS
Material Processor:	Woosung High-Tech Co., Ltd.
Material Supplier:	DuPont (Korea) Inc.
Resin:	Zytel HTN 51G35EF BK083 35% GR-PPA and Nomex meta-aramid core
Tooling Supplier:	Woosung High-Tech Co., Ltd.

Insert molding was used to combine bobbin and stator core for an HEV traction motor replacing a multipiece assembly requiring post-mold hand-assembly. The one-step/one-piece assembly replies on an FR meta-aramid core and high-temperature PPA resin. Motor efficiency and durability were improved thanks to improvements to coil space and heat transfer, while reducing mass 25%, wall thickness 50%, as well as lowering direct costs 30% and indirect costs an additional 10%. Three patents have been filed on the innovation.

Artificial-Intelligence Assembly
2018MY Ford Motor Co.
Ford Ranger pickup

System Supplier:	Grupo Antolin
Material Processor:	Grupo Antolin
Material Supplier:	Multiple
Resin:	Multiple
Tooling Supplier:	N/A

As headliner producers face increasingly tight vehicle packaging restrictions, the challenge to maintain tight tolerances increases. To meet these requirements, an innovative assembly cell equipped with single-coordinate referencing and artificial intelligence and deep-learning visual inspection was used for positional inspection, validating, and troubleshooting process variation to predict failures, and determining future preventative-maintenance actions. The result was increased dimensional accuracy, reduced costs, increased efficiency, and the ability to take preemptive field actions. Inspection times were reduced and rework costs were lowered an estimated $50,000-$150,000 USD/month.

PROCESS, ASSEMBLY & ENABLING TECHNOLOGIES

Rear Service Doors
2020MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	The Dow Chemical Co.
Resin:	Silastic Mar-86 thixotropic elastomeric silicone foam
Tooling Supplier:	Century Tool & Gage

A one-part silicone thixotropic elastomeric foam was key to creating durable seals on rear service doors, permitting customer access to trunk space and the air-filter system. The high-temperature elastomer can handle engine-bay temperatures in excess of 392F/200C. Most other die-cut foams and gaskets would melt or break down under such temperatures. Additionally, the elastomer provides excellent durability and compression-set resistance to withstand repeated open/close cycles during normal use. After dispensing, the applied gasket material is heat treated (167F/75C for 10 min) to expand the foam, eliminating the cost and waste of die cutting foam/gaskets.

Direct Back Foaming
2020MY Ford Motor Co.
Ford Kuga Vignale CUV

System Supplier:	Yangfeng Automotive Systems
Material Processor:	Yanfeng Automotive Interior Systems
Material Supplier:	Mondi Group, Benecke-Kaliko AG, BASF Corp., Celanese Corp., Jowat SE
Resin:	PP foil, PUR coverstock, Biogen 3 foam, 30% LFT-PP, & PUR adhesive
Tooling Supplier:	AKE Knebel GmbH & Co. KG

With an estimated $24-million USD lifetime program savings, direct back foaming eliminates 83 minutes of time and 11 of the typical 16 process steps needed to produce a foamed and skinned IP pad. Interestingly, the same process can be used for base-model and higher-trim levels (including faux and real leather), eliminating multiple tools. It also eliminates PVC and reduces mass 3.3 lb/1.5 kg, while improving cabin NVH and creating a Class A surface.

Laser Technology for Decorative Panels
2020MY Ford Motor Co.
Lincoln Aviator SUV

System Supplier:	Summit Polymers, Inc.
Material Processor:	Summit Polymers, Inc., Spectrum Industries, Inc.
Material Supplier:	SABIC, Techno – UMG America, Covestro AG
Resin:	Lexan 121R PC, Cycolac MG37EPX ABS, Cycoloy XCY620S PC/ABS, Hushlloy HS210, Texin 288 LW TPU
Tooling Supplier:	N/A

Lasers were key for part cutting and pattern etching on the tambour door and top finish panel of this center console. This creates a continuous, holographic pattern on a discontinuous surface, giving the appearance of a single-piece door. Additionally, the dynamic pattern changes with viewing angle, hides smudges in high-touch areas, and is 30-50% less costly than films. Top finish panel are injection molded, then painted and laser etched, while tambour doors are injection molded, laser cut apart, painted, and then laser etched. The result is better fit and finish and a unique look.

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Lightweight Vehicle Brackets 2020MY Daimler AG Mercedes-Benz GLS-Class SUV

System Supplier:	Pöppelmann GmbH & Co. KG
Material Processor:	Pöppelmann GmbH & Co. KG
Material Supplier:	SABIC
Resin:	SABIC G3230AE 30% GR PP
Tooling Supplier:	N/A

Microcellular foaming of emissions-optimized, heat-stabilized injection molded 30% GR-PP was used to produce 15 different brackets for various areas of the vehicle. The foamed brackets are 10% lighter and 10% less costly than solid brackets in the same material. Because the polymer is heat stabilized, brackets can be used in hotter areas of the car and because it is low-VOC, brackets also are appropriate for vehicle interiors.

High Gloss Black TPO 2020MY Ford Motor Co. Lincoln Aviator SUV

System Supplier:	Tribar Manufacturing LLC
Material Processor:	Tribar Manufacturing LLC
Material Supplier:	LyondellBasell Industries N.V.
Resin:	Indure X76 K9WA LC black TPO
Tooling Supplier:	Superior Design & Engineering, Inc.

This unique front grille features a 2-tone finish with both high gloss/piano black and bright chrome sections. What was most unusual is that this look was achieved via 2-shot MIC TPO, which eliminated the need for more costly engineering thermoplastics and for painting, filming, and chroming. The result is a premium look achieved at lower weight and cost using an easier processing material that is equally adept at handling part complexity. Piece price dropped $25-$30 USD/part. Additional program savings of $30K-$50K accrued from eliminating paint racks and another $300K from eliminating paint.

2020MY CORVETTE STINGRAY SPORTS CAR WINS SPE'S VEHICLE ENGINEERING TEAM AWARD

The composites-intensive 2020 model year (MY) *Chevrolet Corvette Stingray* sports car from General Motors Co. was selected by a panel of industry experts as the winner of this year's SPE Vehicle Engineering Team Award (VETA). The VETA award was created in 2004 to recognize the technical achievements of entire teams — comprised of automotive designers and engineers, tier integrators, materials suppliers, toolmakers, and others — whose work in research, design, engineering, and/or manufacturing has led to significant integration of polymeric materials on a notable vehicle.

For 67 years, the iconic Corvette has been a composites-intensive sports car. Therefore, it is not surprising that the eighth-generation Corvette features a host of innovative new composites technologies, many of which were nominated in other categories of SPE's 49th Automotive Innovation Awards Competition. Some of the notable applications on the vehicle include:

BODY EXTERIOR NOMINATIONS

Rear Bulkhead Window Frame

Rear Fascia Assembly

Rear Surround Frame

CHASSIS & HARDWARE NOMINATIONS

Precision Wheel-Balance System

Underbody Tunnel Structural Closeout

MATERIALS NOMINATION

SMC/LMC Front & Rear Trunk Components

POWERTRAIN NOMINATION

Rear Induction Duct

PROCESS, ASSEMBLY & ENABLING TECHNOLOGY NOMINATIONS

Rear Bumper

Rear Service Doors

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— Tadge Juechter,
Chevrolet Corvette executive chief engineer

Previous winners of the award, which is given from time to time, include:

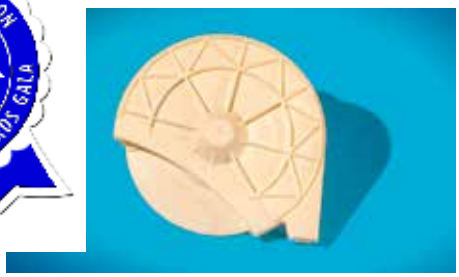
- **2004 MY *Porsche Carrera GT* supercar**
- **2009 MY *Ford Flex* CUV**
- **2010 MY *Ford Taurus* sedan**
- **2011 MY *Ford Explorer* SUV**
- **2011 MY *Chrysler 200* & *Dodge Avenger* sedans**
- **2013 MY *SRT Viper* supercar**

Photos courtesy of General Motors Co.

spe AUTOMOTIVE

POWERTRAIN

Transmission Gear Shroud
2017MY Ford Motor Co.
Ford F-150 pickup



System Supplier:	Stackpole International
Material Processor:	MacLean-Fogg Co., Engineered Plastic Components Inc.
Material Supplier:	DuPont de Nemours, Inc.
Resin:	Hytrel 8238 TPC-ET
Tooling Supplier:	Gibson Automation

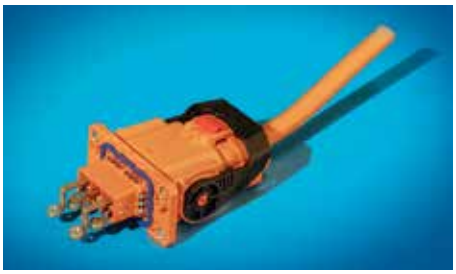
A new transmission gear shroud cover and base protect the drive gear so it rotates freely without needing to push through transmission fluid, lowering effort, improving pump efficiency, and increasing vehicle MPG and the effective life of the transmission fluid. Injection molded TPC-ET replaced earlier steel covers with rubber seals that were heavier, more complex and costly, and suffered from more variation. Very aggressive snap fits permanently join cover to base once the assembly is completed. The same material molded very thin provides a ductile seal. Costs were reduced 22%, weight lowered 65%, and NVH was improved.

In-Wheel Motor Thermally Conductive Insulation
2020MY IBM & Local Motors
Pujil autonomous bus

System Supplier:	Protean Electric
Material Processor:	Puju Plastics Technology
Material Supplier:	Celanese Corp.
Resin:	Coolpoly D5120 PPS
Tooling Supplier:	Puju Plastics Technology

A thermally conductive but electrically insulative PPS provided improved performance and reliability to encapsulate stators used on in-wheel motors for an autonomous electric bus. The polymer, which is injection overmolded to form a single-piece design, was selected for its high mechanical strength and CUT, tight tolerances, and good adhesion to steel. It replaced a multipiece bonded design, increasing torque capabilities of the motors, lowering mass 10% and direct costs 12%, reducing part count from 4 to 1 per stator, and improving water ingress.

High-Voltage Connectors
2020MY Volkswagen AG
Volkswagen Passat PHEV



System Supplier:	Aptiv PLC
Material Processor:	Aptiv PLC
Material Supplier:	Ascend Performance Materials
Resin:	Vydyne R535J 35% GR-PA 6/6
Tooling Supplier:	Suzhou Jiahong

The desire to create a safe, reliable connection with a high-voltage EV connector brought together German specifications, Chinese design, and U.S. materials. The new design features a two-step, finger-proof and touch-safe connect/disconnect feature that assures proper attachment via molded-in ribs and slots. Connectors are hermetically sealed for reliable performance under harsh operating conditions. The injection molded, heat-stabilized 35% GR PA 6/6 resin offers high EMI shielding to minimize interference, best-in-class comparative tracking index, excellent stiffness/strength yet with sufficient ductility to survive 3.3-ft/1-meter drop tests without fracture.

Air Intake Assembly
2017MY Ford Motor Co.
Ford F-150 pickup

System Supplier:	Mann+Hummel USA
Material Processor:	Mann+Hummel USA
Material Supplier:	Washington Penn Plastic Co., Inc.
Resin:	PPH1TF2 blow molded PP
Tooling Supplier:	Product and Tooling Technologies, Inc.

NVH was reduced on a twin-turbo engine's clean-side air-intake duct thanks to development of an innovative method for inserting the acoustic silencer. The silencer cage plus foam was first inserted into the body of the duct's blow molded bellows, then injection overmolded to create a robust seal that is low cost, low scrap, and lower in weight, while also eliminating the need for a resonator housing. The design reduces mass 2.7-4.2%, costs 8.3%, and component count. All openings are produced burr-free, reducing risk of turbo damage.

POWERTRAIN

Engine Badge
2019MY Ford Motor Co.
Ford F-150 Raptor pickup

System Supplier:	Eagle Industries
Material Processor:	Tribar Manufacturing LLC
Material Supplier:	Celanese Corp.
Resin:	Celanyl NKX-101 PA 6
Tooling Supplier:	N/A

The first completely molded-in-color engine badge assembly replaced a previously unrecyclable and costly assembly combining painted and plated plastic and metal produced in 3 separate processes. In the new design, a single base resin (PA 6) was used to produce the entire badge. Three separate MIC pigment packages matched the benchmark part without color deviation. Unique metallic silver and color-stable red pigment packages replaced chrome-plated and painted PC/ABS, while a bronze pigment package replaced brushed aluminum. The final assembly reduces cost, environmental burden, and is slightly lighter.

Fuel-Vapor Pump Assembly
2019MY General Motors Co.
Cadillac XT4 CUV

System Supplier:	Pierburg GmbH
Material Processor:	Swoboda Inc.
Material Supplier:	BASF Corp.
Resin:	Ultramid A3WG6 LS/A3EG6 PA 6/6 and LT/B3WG6 PA 6
Tooling Supplier:	Swoboda Inc.

The first all-plastic fuel vapor-pump reduces VOCs and improves evaporative emissions control (EVAP) system efficiency while protecting against thermal shocks and holding rotors in place at high rotational speeds in a corrosive environment. Tough injection molded PA 6 and 6/6 provide parts consolidation and hold dimensional tolerances on key parts to 0.002 in./0.05 mm. An integrated pressure sensor offers real-time performance feedback. Overmolding and laser welding eliminate separate seals and fasteners, creating a leak-proof seal. Multiple tooling and process innovations were required to produce the complex assembly.

Rear Induction Duct
2020MY General Motors Co.
Chevrolet Corvette sports car

System Supplier:	Molded Fiber Glass Companies
Material Processor:	Molded Fiber Glass Companies
Material Supplier:	Molded Fiber Glass Companies
Resin:	Float 4281 polyester/vinyl ester SMC
Tooling Supplier:	Century Tool & Gage

Made from a special toughened, low-density SMC (SG 0.95), which was developed to reduce noise as well as mass without needing resonators on rear induction ducts, these parts are the first to be fully integral to the body frame. The low-VOC, low-styrene polyester/vinyl ester SMC formulation reduces emissions while providing required mechanicals at approximate 5.2 lb/2.4 kg mass savings plus delivered cost savings vs. alternative technologies. A unique duct design is required to funnel air from the rear air intake vents into the mid-mounted engine.

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POWERTRAIN

Plastic Coolant Tubes
2019MY Volkswagen AG
Audi A8 sedan

System Supplier:	Teklas
Material Processor:	PASS GmbH & Co. KG, ContiTech AG, Tristone Flowtech
Material Supplier:	Solvay Specialty Polymers
Resin:	Ryton XE 3500 and 5430 PPS
Tooling Supplier:	AFT Automotive GmbH, MKS-Kunststoffspritzguss GmbH

Three grades of PPS with graduated flexural modulus values were used to develop unique powertrain fluid delivery tubes that provide mechanical retention values for 3,000 hr in coolant fluid at 275F/135C and at underhood operating temperatures of 338F/170C. The new design, which combines extruded tubes and injection molded connectors, simplifies the very complex, multi-step, multi-material incumbent assemblies of metal, plastics, elastomers, and fittings. The final assembly halved weight and reduced costs 20%, and eliminated secondary operations necessary with metal designs, yet met all performance requirements.

Traction-Motor Connection Ring
2017MY General Motors Co.
Chevrolet Bolt BEV

System Supplier:	VC Company
Material Processor:	Ecorea Industrial Co., Ltd.
Material Supplier:	DuPont de Nemours, Inc.
Resin:	Zytel HTN 51G35EF BK083 25% GR-PPA
Tooling Supplier:	Ecorea Industrial Co., Ltd.

An integrated connection ring for EV traction motors provides electrical connections from stator windings, integrates and insulates stator leads, and provides ease of assembly for component connections. The novel multi-lead integrated connection design can be used with rigid or flexible leads, which are individually insulated and assembled. By reducing packaging space while maintaining electrical isolation to prevent discharge breakthrough, it contributed to optimized motor design. PPA was selected for its high temperature, high dielectric strength, 600-V comparative tracking index, and volume resistivity at operating temperatures, helping reduce mass and create more reliable motor connections.

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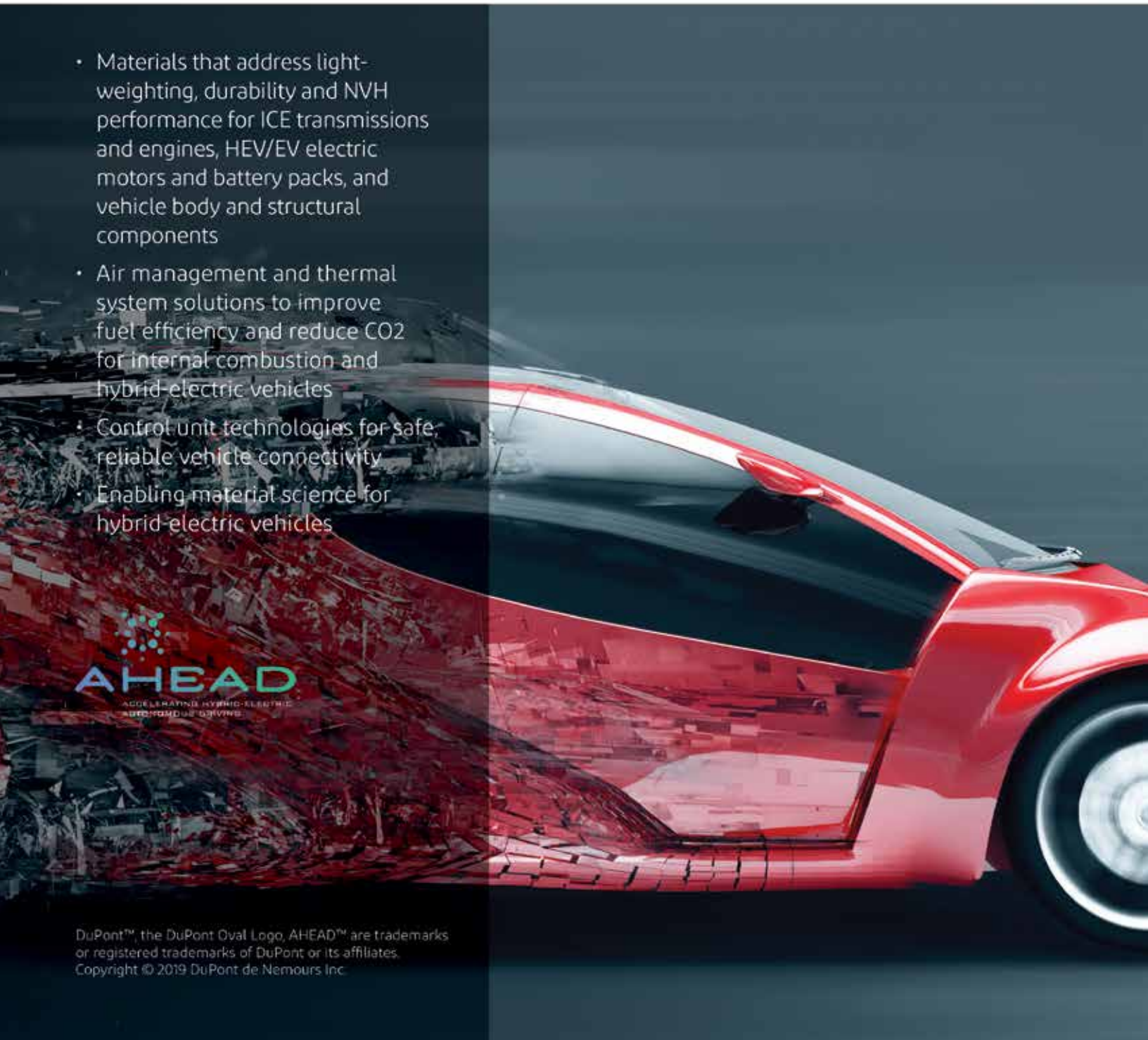

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HALL OF FAME BY YEAR

The Hall of Fame Award is given annually for an application that has been in continuous use for 15 years or more, and has made a signficant and lasting contribution to the application of plastics in automobiles.

YEAR RECOGNIZED	OEM	APPLICATION	MATERIAL
2018	Honda Motor Co.	Injection Molded Thermoplastic Energy Absorber	PC/PBT
2017	General Motors Co.	Thermoplastics Polyolefin Skin Instrument Panel	TPO
2016	Ford Motor Co.	Polycarbonate Instrument Panel	PC /PC blends
2015	General Motors Co.	GMT Composite Bumper	PP/Glass GMT
2014	General Motors Co.	Blow-Molded CVJ Half-Shaft Drive-Axle Boot	TPE
2013	Ford Motor Co.	Integrated Front-End Module System	SMC
2012	General Motors Co.	First Publicly Accessible Airbag System	multiple
2011	General Motors Co.	Integrated Door Hardware Module	PC/PBT
2010	General Motors Co.	Front & Rear TPO Bumper Fascias	TPO
2009	General Motors Co.	Thermoplastic Vertical Body Panel	MPPE/PA
2008	Chrysler LLC	Rear Seat Cushion	PUR Foam
2007	Ford Motor Co.	Radiator End Tank	PA 6/6
2006	General Motors Corp.	Thermoplastic Front Grille	ABS
2005	Porsche AG	Thermoplastic Intake Manifold	PA
2004	Ford Motor Co.	Box Beam Bumper	PC/PBT
2003	General Motors Corp.	Dual-Density Energy Absorbing Bumper System	PP
2002	General Motors Corp.	Mini-Wedge Latch and Door-Lock Actuator	PA
2002	General Motors Corp.	Wiper-System Transmission Housing	PA
2001	General Motors Corp.	Instrument-Panel Retainer	SMA
2000	Volkswagon AG	Fuel Tank	HDPE
1999	Ford Motor Co.	Hydraulic Clutch Actuator	PA
1998	Peugeot Citroën Group	Fan Shroud	PA
1997	Ford Motor Co.	Transmission Seal	PPS
1996	General Motors Corp.	Front Fenders	RIM-PUR
1995	General Motors Corp.	Guide-Flex Energy Absorbers	EVA
1994	Ford Motor Co.	Headlamp Assembly	PC
1993	General Motors Corp.	Front/Rear Bumper Covers	RIM-PUR
1992	General Motors Corp.	Composite Exterior Body Panels	SMC
1991	General Motors Corp.	Tilt Steering-Wheel Centering Sphere	Acetal
1990	General Motors Corp.	Transverse Leaf Spring	Epoxy
1989	American Motors Corp.	Battery Case	PP
1988	Ford Motor Co.	Windshield Interlayer	PVB
1987	General Motors Corp.	Grill-Opening Panel	SMC
1986	Chrysler Corp.	Heater Housing	PP
1985	Chrysler Corp.	Disc-Brake Piston	Phenolic
1984	General Motors Corp.	Front-Fender Wheel Liner	PP
1983	General Motors Corp.	Emissions Control Canister	PA

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GRAND AWARD BY YEAR

YEAR	OEM	APPLICATION	MATERIAL
2018	Ford Motor Co.	Vacuum Generation System for Brake Assist	multiple
2017	Ford Motor Co.	Structural Active Grill Shutter (AGS) with Integrated Loose Layer Construction	PP GF
2016	Ford Motor Co.	Composite Suspensions for Upper and Lower Seat Backs	PA/TPO
2015	General Motors Co.	Ultralight Class A Body Panels	SMC
2014	Ford Motor Co.	Active Glove Box	TPO
2013	Nissan Motor Co.	All-Olefinic Liftgate	TPO/PP
2012	General Motors Co.	All-Olefin, Soft Skin, Stitched Full IP System	TPO
2011	Ford Motor Co.	Microcellular-Foam Instrument Panel	PP
2010	Ford Motor Co.	Diesel-Exhaust Fluid (DEF) System	multiple
2009	General Motors Co.	Shielded Plastic Case Radio	PC/ABS
2008	BMW AG	Twin-Sheet Blow-Molded Fuel System	HDPE
2007	General Motors Corp.	Backlighting with Color-Converting Plastic	PC
2006	DaimlerChrysler	Blow-Molded Front- & Rear-Bumper System	TPO
2005	Honda Motor Co.	Composite In-Bed Trunk	SMC
2004	Ford Motor Co.	Door Trim with Integrated Acoustic Chamber and Subwoofer	PP
2003	DaimlerChrysler	Roof Module	PC Copolymer
2002	DaimlerChrysler	Extruded Polymer Film Fascia	Multi-Layer Ionomer
2001	General Motors Corp.	Nanocomposite TPO	Nanocomposite TPO
2000	Ford Motor Co.	Controlled Energy Management Bumper Isolator	HDPE
1999	DaimlerChrysler	Fan Shroud and Reservoir Assembly	PP
1998	Mitsubishi Motors	"I" Section Bumper Beam	PP-GMT
1997	Ford Motor Co.	"Carpet to Car Parts"	PA
1996	General Motors Corp.	Structural Battery Tray	PP-GMT
1995	Ford Motor Co.	Integrated Front-End System	SMC
1994	General Motors Corp.	Thermoplastic Air-Intake Manifold	PA Copolymer
1993	Ford Motor Co.	Front-Suspension Stabilizer Link	POM
1992	Chrysler Corp.	Instrument-Panel System	PP-GMT, MPPE, PP & PU Foam
1991	Chrysler Corp.	Integrated Child's Seat and Top Impact Pad	PP-GMT, Expanded MPPE
1990	General Motors Corp.	Exterior Door Panel	PC/ABS
1989	Chrysler Corp.	Composite Wheel	SMC/XMC
1988	General Motors Corp.	Front Fender	MPPE/PA
1987	General Motors Corp.	Quarter-Panel Assembly – Sportside	SMC
1986	General Motors Corp.	Quarter Window	PMMA
1985	General Motors Corp.	Windshield with Anti-Lacerative Layer	Polyvinyl Butyral/PE Film
1984	Ford Motor Co.	Drive Shaft	Vinylester/Graphite/Glass
1983	General Motors Corp.	Exterior Body Panels	SMC, RIM, RRIM, & TPO
1982	General Motors Corp.	Tailgate Assembly	SMC
1981	Ford Motor Co.	Radiator-Core End Caps	PA
1980	General Motors Corp.	Rear-Axle Leaf Spring	Epoxy
1979	Ford Motor Co.	Grille-Opening Panel Assembly	SMC
1978	General Motors Corp.	Bucket-Seat Frame	SMC
1977	Ford Motor Co.	Instrument Panel	
1976	Ford Motor Co.	Fender Aprons	PP
1975	American Motors Corp.	One-Piece Jeep Top	PC
1974	General Motors Corp.	Fascia and Rear Bumper Cover	RIM-PUR
1973	Ford Motor Co.	Block-Heater Motor Housing	
1972	General Motors Corp.	Radiator Fan-Shroud Assembly	PP
1971	Ford Motor Co.	Transmission Reactor	Phenolic

SPE FOUNDATION

SPE® STILL ACCEPTING DONATIONS FOR DR. JACKIE REHKOPF ENDOWED SCHOLARSHIP

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 PhD 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 Co. 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.

HOW TO CONTRIBUTE

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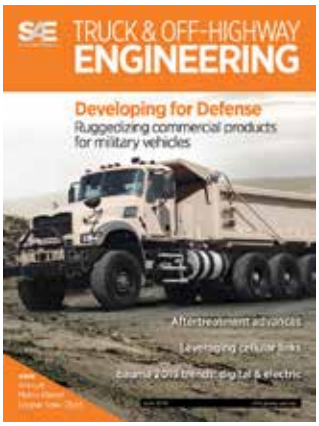

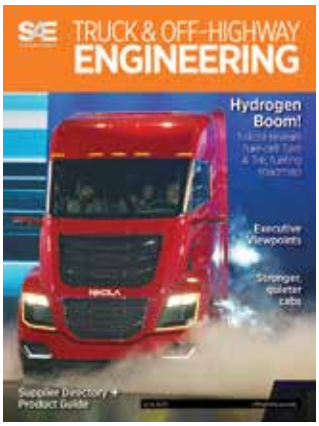

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