



# Automotive Plastics NEWS

MARCH 2015  
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## 2015 ACCE Update Dates, Theme and Location Announced *by Fred Deans and Dale Brosius, SPE ACCE Event Co-Chairs*

For the fifteenth time in as many years, the Automotive and Composites Divisions of SPE® have announced the dates, theme, and location for this year's Automotive Composites Conference & Exhibition (ACCE). The SPE ACCE is the *world's leading forum for automotive composites* and draws over 900 exhibitors, speakers, and attendees from 15 countries on five continents. This year's show, whose theme is **Composites: The Next Generation of Lightweighting**, returns September 9-11, 2015 to The Diamond Banquet & Conference Center at the Suburban Collection Showplace in Novi, MI, USA in the Detroit area.

"There's been a lot of talk in the past year about the inroads made by aluminum on notable vehicles like Ford's *F-150* pickups," explains Dale Brosius, chief commercialization officer, Institute for Advanced Composites Manufacturing Innovation (IACMI) and 2015 SPE ACCE conference co-chair. "However, when I speak with automakers, what they nearly always say is that aluminum is a short-term fix but that composites are the *next generation* of lightweight materials and will become more critical the closer we get to the stringent fuel-economy and emissions mandates of 2025."

"One of the best things about attending the SPE ACCE is that you quickly learn that composites aren't some exotic material that our industry will use someday," adds Fred Deans, chief marketing officer at Allied Composite Technologies LLC and SPE ACCE conference co-chair. "A quick walk around our show floor and visits to our technical sessions shows you just how many different types of composites are already being used on cars and trucks today. As the needs of transportation OEMs have changed, the supply base has responded with more efficient materials, faster processes, and more ways to use this incredibly diverse and effective class of materials. It's what keeps this show and this industry lively and exciting."



## COMPOSITES The Next Generation of Lightweighting

### September 9-11, 2015

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## AUTOMOTIVE DIVISION MEETING SCHEDULE & SPECIAL EVENTS CALENDAR



### AUTOMOTIVE

#### SPE Annual Technical Conference (ANTEC)

Orlando, FL USA

ALL DAY  
March 23-25, 2015

#### SPE Auto. Div. Board Meeting

American Chemistry Council - Auto. Ctr.  
Troy, MI USA

5:30 - 7:30 p.m.  
April 13, 2015

#### 9<sup>th</sup>-Annual SPE Automotive Engineering Plastics Conference (AutoEPCON)

Troy Marriott  
Troy, MI USA

ALL DAY  
May 5, 2015

#### SPE Auto. Div. Board Meeting

American Chemistry Council - Auto. Ctr.  
Troy, MI USA

5:30 - 7:30 p.m.  
June 8, 2015

#### 15<sup>th</sup>-Annual SPE Automotive Composites Conference & Exhibition (ACCE)

The Diamond Banquet & Conference Center  
at the Suburban Collection Showplace  
Novi, MI USA

ALL DAY  
Sept. 9-11, 2015, 2015

#### First Round - Automotive Innovation Awards Judging

Celanese Corp.  
Auburn Hills, MI USA

8:00 a.m.- 5:00 p.m.  
Oct. 1-2, 2015

#### 17<sup>th</sup>-Annual SPE TPO Automotive Engineered Polyolefins Conference (Auto TPO)

Detroit-Troy Marriott  
Troy, MI USA

ALL DAY  
Oct. 4-7, 2015

#### Second Round / Blue Ribbon - Automotive Innovation Awards Judging

Celanese Corp.  
Auburn Hills, MI USA

8:00 a.m.- 5:00 p.m.  
Oct. 12, 2015

#### 45<sup>th</sup>-Annual SPE Automotive Innovation Awards Gala

Burton Manor  
Livonia, MI USA

5:00-11:00 p.m.  
Nov. 11, 2015

Automotive Division Board of Directors meetings are open to all SPE members. All events are listed on our website at

<http://speautomotive.com/ec>

EEmail Steven VanLoozen at

[auto-div-chair@speautomotive.com](mailto:auto-div-chair@speautomotive.com) for more information.

## TREASURER'S REPORT

by Dawn Stephens

Current finances for the SPE Automotive Division remain healthy. As of February 2, 2015 we have \$208,456.55 in checking, and \$27,430.75 in savings, for a total of \$235,887.30 USD





## CHAIR'S MESSAGE

by Steven VanLoozen,  
SPE Automotive Division Chair



*Welcome to 2015.* I do hope all of our members were able to relax and enjoy their families over the holidays. With the new year already a couple of months old, it's right back to work for most of us. The exciting challenges that we have all been working to meet and exceed remain before us. I believe the collaborative spirit is the reason SPE remains such a strong organization and it will be a catalyst that enables the automotive industry to meet and exceed all the goals it has around lightweighting vehicles.

SPE is uniquely equipped to help the industry meet these challenges as we add new and younger members through educational outreach and scholarship opportunities. We already have some of the best minds and a wealth of experience throughout our membership. I can't stress enough the importance of sharing what we have learned with the next generation of plastics and composites engineers.

Many of you know that SPE's Annual Technical Conference (ANTEC®) is only weeks away, and with the conference in Orlando, FL, USA this year and being held in conjunction with NPE® 2015 it should be extremely well attended. I hope the sun shines both figuratively and literally on all the SPE members lucky enough to attend. The call for presentations is out for the 10th-annual AutoEPCON being held May 5<sup>th</sup> in Troy, MI, USA. Please submit your abstracts as early as possible and we look forward to seeing you there. Going forward the 15<sup>th</sup>-annual ACCE will be held September 9-11 in Novi, MI, USA. SPE's Automotive and Composites Divisions co-sponsor this event, which is widely considered the world's leading automotive composites forum. I am truly looking forward to seeing the innovations showcased there in September.

Our 45<sup>th</sup>-annual Automotive Innovations Awards Gala will be held again this year at Burton Manor in Livonia, MI, USA. As many of you know, this event is an excellent way to showcase plastic/composite innovations that have been brought into production, and allows the industry to congratulate the people who helped bring these ideas into reality. Our theme this year is: *The Future Looks Light*. It's never too early to submit the application for an award and I do hope everyone is starting to think about applications worthy of consideration.

The Automotive Division's board of directors would again like to extend our sincere gratitude to all of our members for their continued support. We hope all of you have a very productive, healthy, and happy 2015.

Kind Regards,

*Steven VanLoozen*

Steven VanLoozen

SPE Automotive Division Chair

## Call for Papers Issued

Those interested in speaking at this year's event should submit non-commercial abstracts by **March 31, 2015** and full non-commercial papers or presentations by **May 29, 2015** to the review committee via [ACCEpapers@speautomotive.com](mailto:ACCEpapers@speautomotive.com). Authors who submit papers (not presentations) are eligible for the conference's *Dr. Jackie Rehkopf Best Paper Awards*, which are given for papers that achieve the highest ratings during peer review. Winning author teams are honored during the event's opening ceremony.

Copyright transfer forms, an author's guide, paper templates and more can be found on the event's webpage at <http://speautomotive.com/comp.htm>. Program guides and papers/presentations from the previous 14 years of the conference can be found in the ACCE Archives at <http://speautomotive.com/aca.htm>.

## Parts Competition Nominations Welcomed

The SPE ACCE organizing committee also issued its annual call for nominations for its parts competition. Prizes will be awarded in three categories — *Material Innovation* and *Process Innovation* (selected by members of the SPE ACCE committee), and *People's Choice* (selected by conference attendees) — with winning teams receiving recognition and a trophy after lunch on the last day of the show.

There is no cost to enter the competition. Any registered conference participant (speakers, sponsors/exhibitors, or attendees) may nominate original equipment or aftermarket composite parts on passenger cars or light trucks from any geography. **The only requirement is that parts must be on a vehicle available for commercial sale and the OEM must give permission.** Nomination instructions will be found under 2015 SPE ACCE Forms at <http://speautomotive.com/comp.htm>. Preliminary descriptions and photos about the application's innovations are due **August 30, 2015** and should be eMailed to [ACCEpapers@speautomotive.com](mailto:ACCEpapers@speautomotive.com). Physical parts must be brought to the SPE ACCE for final review by judges at the show.



Last year, the *Body Exteriors* award went to Mitsubishi Rayon Carbon Fiber & Composites, which nominated the CFRP (carbon fiber-reinforced plastic) decklid made by prepreg compression molding process featured on the *Nissan GT-R* supercar by Nissan Motor Co. Ltd. Dr. Michael Connolly (left), program manager-Urethane Composites at Huntsman Polyurethanes and 2014 SPE ACCE conference co-chair presents the trophy to Koichi Akiyama (right), group leader-automotive composites material development group at Mitsubishi Rayon Co., Ltd.



The 2014 SPE ACCE *People's Choice* award (chosen by conference attendees) went to Momentive Specialty Chemicals Inc. for its nomination of lightweight carbon fiber door structure with Class A appearance on the *Porsche 911 GT Cup* supercar produced by Porsche AG. Dr. Michael Connolly (right), presents the trophy to Cedric Ball (left), business development & global marketing-Automotive at Momentive Specialty Chemicals Inc. (now Hexion).

In 2013, Plasan Carbon Composites swept the competition in all three categories. The company's nomination of the hood for the *Corvette Stingray* sports car from General Motors Co., produced in carbon fiber-reinforced composites via Plasan's new out-of-autoclave pressure press technology, won the *Body Exterior* category. And Plasan won both *Body Interior* and *People's Choice* awards with its nomination of the engine X-brace on the *SRT Viper* supercar from then Chrysler Group LLC (now Fiat Chrysler Automobiles) produced in autoclave-cured carbon composites.

In 2012, the first year that the SPE ACCE featured a parts competition, Asahi Kasei North America, Inc. won the *Best Part* award with its nomination of the twin-sheet thermoformed glass-reinforced polypropylene composite on the Ram Box assembly with lid on *Dodge Ram pickups* from then Chrysler Group LLC.

## Students Invited to Submit Poster-Competition Abstracts

Since 2008, the SPE ACCE also has featured a student poster competition. Judges made up of media, industry experts, and SPE board members review all posters with student authors on the first day of the conference. First-, second-, and third-place awards (plaques and monetary prizes) will be given in both *graduate* and *undergraduate* categories during a special ceremony after lunch on the second day of the conference, September 10th.

Students and their posters will be ranked according to the following criteria:

- Content (student and poster demonstrate clarity of topic, objectives, and background);
- Motivation for research and technical relevance to conference theme;
- Methodology and approach to problem;
- Quality of proposed research results/findings;

- Conclusion are supported by information presented);
- Presentation (display aesthetics are pleasing and there is a logical flow between sections;
- Knowledgeable (presenter has a good grasp of the subject);
- Understandability (poster is effective even without student being present to explain it); and
- Overall rank vs. other posters and presenters.

The SPE ACCE poster competition is organized annually by Dr. Uday Vaidya, SPE Composites Division board member and education chair, and professor and director-Materials Processing and Applications Development (MPAD) Center, Department of Materials Science & Engineering at University of Alabama at Birmingham (UAB). He is supported by Dr. Leonardo Simon, professor, Chemical Engineering Department, University of Waterloo and Dr. David Jack, professor, School of Engineering & Computer Science, Baylor University.

Students interested in participating in the 2015 competition should contact Dr. Vaidya at [ACCEposters@speautomotive.com](mailto:ACCEposters@speautomotive.com).



In 2014, four students won the show's annual student poster competition: Sarah Stair, Baylor University (shown above, left receiving award from Dr. Uday Vaidya) and a 2013 SPE ACCE scholarship winner took first place in the *graduate* category; Siddhartha Brahma, University of Alabama-Birmingham was the second-place *graduate* winner; while Anup Shastry, Clemson University and Avinash Akepati, University of Alabama-Tuscaloosa tied for the third-place *graduate* poster award; and Kelly Krumm of Clemson was event's *undergraduate* winner.

## Scholarships Offered for 2015-2016 Academic Year

Since 2007, the SPE ACCE has offered scholarships for students whose work in automotive composites or an allied field shows promise for ground-transportation applications. For the past three years, the Michigan Economic Development Corp. (MEDC, Lansing, MI USA) has sponsored the two \$2,000 USD historic SPE ACCE graduate scholarships plus a \$2,000 USD scholarship for an undergraduate or graduate student enrolled in a Michigan educational program. Applications for all three scholarships are due **July 20, 2015** and forms can be found at <http://speautomotive.com/comp.htm>. Winners will be selected from a pool of qualified applicants and announced in early August 2015 before this year's SPE ACCE show. Students able to make

the 2015 conference can pick up their checks during opening ceremonies. All students who receive an SPE ACCE scholarship are expected to submit a formal written paper on their research and to present that work at the following year's ACCE conference.

"The State of Michigan is committed to ensuring that our auto industry has the pipeline of talent it will need for the future," said Kevin Kerrigan, MEDC's senior vice president, Automotive Office. "Michigan's future as the global leader in automotive and manufacturing innovation and new technologies depends on engineering talent and SPE's Automotive Composites Conference and Exhibition focuses on both the current and future needs of Michigan's most significant industry. Every dollar that we invest in these engineering scholarships is an investment in Michigan's success in the future."



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The Michigan Economic Development Corp (MEDC) serves as the state's marketing arm and lead agency for business growth, jobs, and opportunity with a focus on helping grow Michigan's economy. For more on the MEDC, its initiatives, visit: <http://www.michiganbusiness.org>. For Pure Michigan travel news, updates, and information, visit <http://www.michigan.org/>.

## Learn More About the SPE ACCE

Held annually in suburban Detroit, the ACCE draws over 900 speakers, exhibitors, sponsors, and attendees and provides an environment dedicated solely to discussion and networking about advances in the transportation composites. Its global appeal is evident in the diversity of exhibitors, speakers, and attendees who come to the conference from Europe, the Middle East, Africa, and Asia / Pacific as well as North America. Fully one-third of attendees indicate they work for automotive and light truck, agriculture, truck & bus, or aviation OEMs, and another 25% represent tier suppliers. Attendees also work for composite materials, processing equipment, additives, or reinforcement suppliers; trade associations, consultants, university and government labs; media; and investment bankers. The show has been jointly sponsored by the SPE Automotive and Composites Divisions since 2001. For more information on the SPE ACCE, see <http://speautomotive.com/comp.htm> or <http://specomposites.com>.

# SPE AUTOMOTIVE COMPOSITES CONFERENCE & EXHIBITION

World's Leading Automotive Composites Forum

SOCIETY OF PLASTICS ENGINEERS  
AUTOMOTIVE & COMPOSITES DIVISIONS

# COMPOSITES

The Next Generation of Lightweighting

## Call for Papers

Exhibit & Sponsorship Opportunities

September 9-11  
2015

### ATTEND THE WORLD'S LEADING AUTOMOTIVE COMPOSITES FORUM

The Automotive and Composites Divisions of the Society of Plastics Engineers (SPE®) invite you to attend the 15<sup>th</sup>-annual SPE Automotive Composites Conference and Exhibition (ACCE), September 9-11, 2015 in the Detroit suburbs. The show – which has become *the world's leading automotive composites forum* – will feature technical paper sessions, panel discussions, keynote speakers, networking receptions, & exhibits highlighting advances in materials, processes, and applications technologies for both thermoset and thermoplastic composites in a wide variety of ground-transportation applications.

**PRESENT BEFORE AN ENGAGED, GLOBAL AUDIENCE**  
The SPE ACCE draws over 900 attendees from 15 countries on 5 continents who are interested in learning about the latest composites technologies. Fully a third of

attendees work for a transportation OEM, and roughly a fifth work for a tier integrator. Few conferences of any size offer such an engaged, global audience vitally interested in hearing the latest composites advances. Interested in presenting your latest research? Abstracts are due **March 31, 2015** and Papers on **May 29, 2015** to allow time for peer review. E-mail abstracts or papers to [ACCEpapers@speautomotive.com](mailto:ACCEpapers@speautomotive.com). Approved papers will be accessible to attendees on a cloud-based server and later will be available to the general public.

### SHOWCASE YOUR PRODUCTS & SERVICES

A variety of sponsorship packages – including displays, conference giveaways, advertising and publicity, signage, tickets, and networking receptions – are available. Companies interested in showcasing their products and/or services should contact Teri Chouinard of Intuit Group at [teri@intuitgroup.com](mailto:teri@intuitgroup.com).



FOR MORE INFORMATION  
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<http://speautomotive.com/comp>

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**SUBURBAN COLLECTION SHOWPLACE**

The Diamond Banquet & Conference Center at the Suburban Collection Showplace  
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- ***Plastics Application Technology for Lightweight Automobiles***, by Sudhakar Marur, focuses on plastics use in automobiles - both traditional applications and more advanced uses such as under-the-hood components. **Read more at [books.sae.org/r-415](http://books.sae.org/r-415).**
- ***Design of Automotive Composites***, by Srikanth Pilla, Charles Lu, reports on successful current designs of automotive composites. **Visit [books.sae.org/pt-164](http://books.sae.org/pt-164) for more information.**
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- **Composite Materials Standards Subscription** is a subscription that includes 72 standards that specifically address the design, analysis, and performance of composite materials. **For more information, visit: [subs.sae.org/sub-std-00008](http://subs.sae.org/sub-std-00008).**

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## winners **love** losing

Here's the skinny: BASF is no stranger to the Society of Plastics Engineers Automotive Innovation Awards. We know that it takes bold innovation and absolute focus to meet the challenges facing today's automotive manufacturers and suppliers. The demand for lighter, smarter, more fuel efficient vehicles has never been stronger, and we've never been more driven to deliver. When it comes to lightweight solutions, we are the heavy hitters. Learn more at [www.plasticsportal.com/usa](http://www.plasticsportal.com/usa)



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## PROGRAM SCOPE:

The Society of Plastics Engineers (SPE) invites you to attend a 1-day technical conference & exhibition showcasing innovative developments in the design, materials, processing and use of engineering plastics for the global automotive industry.

## WHO SHOULD ATTEND:

This conference is specifically designed to inform, update and educate the OEM and supplier communities about advances in both thermoset and thermoplastic engineering polymers. Learn how these widely used materials can help improve performance and productivity, while reducing cost and mass.

## PRESENTATIONS:

Hear technical presentations on the newest advances in engineering materials related to: design engineering, materials development, lighting, thermal management, processing and enabling technologies, predictive engineering, new applications and more.

## EXHIBITS:

See exhibits from engineering plastic suppliers, compounders, molders, additives and reinforcement suppliers, design and engineering firms and machinery suppliers. Experts will show you how to apply the latest technologies to your next project or program.

Conference includes a full day of technical presentations, plenary and keynote presentations on automotive business trends, lunch and coffee breaks, exhibits of advanced technologies and an evening reception.



## Featured Keynote Speakers

### *The Role of Plastics in Automotive Interiors*

Rose A. Ryntz, Ph.D., Vice President  
IAC Advanced Development and  
Material Engineering



Plastics have often been used in automotive interiors to provide design freedom and enhance craftsmanship. With the recent push to light weighting plastics are playing a larger role in interior design. Combined with new processing technologies, plastics can afford all of the advantages of low temperature impact resistance, improved haptics, and enhanced recyclability. This talk will focus on the enhanced customer requirements in the automotive interior and discuss some of the new technological advances that will allow the plastics industry to achieve them.

### *Regulations Driving Market Demand*

Suzanne Cole, CEO  
Miller Cole LLC

Federal regulations are driving profound changes that are underway with propulsion technology, under the hood components and the lightweighting of conventional passenger cars and light duty trucks; as a plethora of new innovative technologies and materials aim to substantially boost fuel economy and reduce mobile greenhouse gas emissions. As we move to the midterm evaluation of MY 2022-2025 standards; technology development and consumer response is being closely scrutinized. This presentation examines the opportunities and challenges confronting the light-duty sector, on going research and research gaps with an eye towards informing the upcoming midterm review and the potential opportunities for plastics in the future of vehicle construction.





# BATTER'S BOX

## The Changing Work Environment for Engineers Today

Mike Jackson, Director, North America,  
Vehicle Production Forecasting, IHS Inc.

*As* part of its editorial mission, IHS Engineering360 recently conducted new research called "Pulse of Engineering." The online survey asked engineers and technical professionals in the industrial sector about the pace of engineering, available resources, knowledge management practices, performance measurements and more. The research offered an opportunity to validate what many people already think is true about the profession, and to uncover information about market dynamics and industry trends that otherwise might not be apparent. Some trends uncovered by the research mirror those found in other fields; other trends are specific to engineering.

### About the Survey Respondents

Of the 2,162 survey respondents:

- 34% work at companies that employ 10 or fewer engineers; 22% work for companies with more than 500 engineers.
- 16% work in engineering/tech design services; 10% in aerospace and defense; 8% in utilities/energy; 7% in automotive; and 7% in oil and gas.
- 30% are design engineers; 13% are in engineering / consulting; 13% are process/production engineers.
- 32% are team leaders/supervisors and 25% are managers / senior managers.
- 36% have been in the engineering field for 30 or more years; 27% for 20-29 years; and 21% for 10-19 years.
- 49% are based in the U.S.; the rest came from around the world, including countries as diverse as India, Great Britain and Northern Ireland, South Africa, China, France, and Australia.

The survey reveals three key challenges facing engineers and allied professionals almost everywhere in the world:

- appropriate skill levels and expertise,
- adequate time to complete projects, and
- effective communication among design team members, managers and clients.

A lack of all three was cited time and again, with each constraint affecting a company's bottom line and impacting the engineer's ability to do his or her job effectively.

"The biggest obstacle is the lack of preparation ahead of the project, with a too-quick study of customer pains, needs and desires and a too-weak valuation of the development budget," wrote one respondent to a survey question. Another said that the biggest challenge is to "get the right message communicated to the customer." And a third summed up the broader organizational challenge by writing "the bigger the group, the slower the progress without a competent leader."

### Faster Pace, Tighter Resources

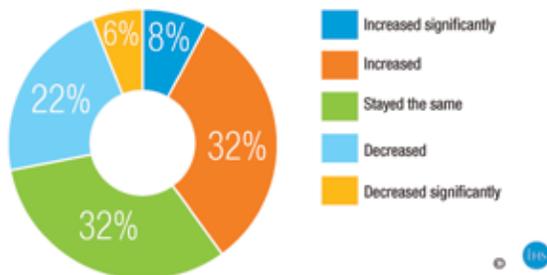
At a high level, responses validated the idea that both the pace of engineering is accelerating and that engineers are asked to do more with fewer resources. One question asked respondents to indicate the types of resource and competitive issues facing their company. Fully 57% said they are required to do more with less. Another 52% said that the pace of engineering is accelerating. Nearly 30% said that new hires were being added to handle increasing workloads and not just to replace vacant positions, a positive sign that employment growth is happening. A relatively small number (18%) said they felt overwhelmed by information.



## Batter's Box CONTINUED FROM PAGE 11

"Actual, real-world knowledge and experience is lacking in all too many of the engineers I interview," wrote one respondent. "There is a distinct lack of basic knowledge of materials' properties and reliance on unvetted information (Wikipedia specifically) and unfounded opinions."

In the past two years, how has the size of your company's engineering workforce changed?



Fewer than half of respondents (46%) said that technology was improving their productivity. This aligns with the notion that, despite sizeable recent investments in R&D and enabling technology, companies are not actually more productive.

Engineers who took part in the survey range from those who specialize in aerospace and defense to those whose primary focus is on field and technical design services and general manufacturing. Some write software and others engineer robots. Their employers include the government, public companies, private firm and — in some cases — sole proprietorships.

Most are involved in engineering and design, consulting, or process and production. There are project managers along with those doing research and development. About 81% of those who responded to the survey said they were at the manager level or lower; another 7% categorized themselves as C-level executives, and 9% considered themselves directors.

### Seasoned Veterans and Eager Newcomers

Respondents overall were an experienced group, with about 84% saying they have 10 or more years of engineering experience, and 36% saying they have 30 or more years in the profession.

"Been here a long time, low-hanging fruit is gone," wrote one engineer.

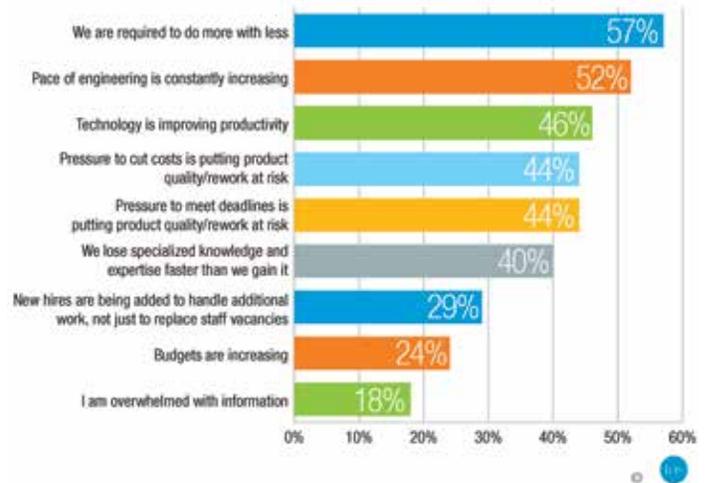
Just 1% reported having been an engineer for one year or less.

"I'm pretty new to the game, so I have to figure things out as I go, which slows me down," wrote one. "Also, I can feel my skills from school waning since I hardly have to use them."

Regardless of their longevity in the profession or even their geographic location, respondents agreed on a number of factors that are affecting their day-to-day work:

- budgetary and time constraints,
- a shortage of resources to do their job effectively, and
- a lack of people entering the field with sufficient knowledge to replace those who have retired or who soon will.

Which conditions do you believe accurately portray the situation at your company?



These constraints were reflected in responses to survey questions that asked whether respondents agreed or disagreed with a number of statements:

- that the designs they are working on are more complex and sophisticated,
- that product design cycles are shrinking,
- that there are fewer design "win" opportunities available, and
- that there are more time-to-market pressures.

Most respondents were neutral when asked about the volume of design win opportunities, but agreed that designs are more complex and that design cycles are shrinking. They also strongly agreed that time-to-market pressures are increasing.

One engineer described working in an environment with "extremely aggressive schedules" and project scopes that were "still being defined as we execute." Another wrote of "complicated designs (that) require more time than allowed, especially when we are entering a new field of development."

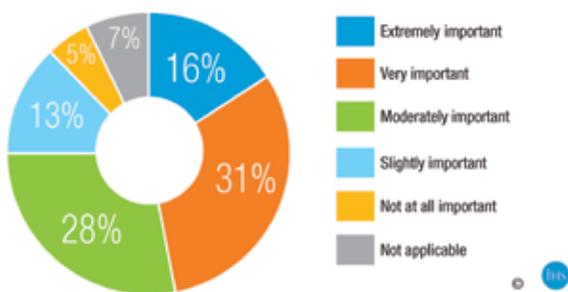
A third engineer wrote, "We are not pioneers in the field, so we have to do better than the Number One." As a result, the firm's product "has to give the lowest operating cost per unit of output. In our product line especially (hydraulics) product life is interlinked with parameters such as pressure and drive speed. If we overdo parameters, the customer will have less life from (the) machine. Design optimization poses the tough constraint."

## Batter's Box CONTINUED FROM PAGE 12

Many engineers noted that they are increasingly asked to work on more complex and sophisticated designs but also tasked with completing them in shorter time frames, in part due to pressure to get products to market faster. Many of the comments about these issues mentioned a lack of sufficiently trained personnel and smaller budgets for upfront design work and troubleshooting. That led to more than 70% of respondents agreeing that constraints on resources, specialized knowledge, budgets and time were jeopardizing productivity, product quality, and innovation at their firm.

The increasingly global nature of engineering has increased time pressures for companies, although most respondents think their company is adapting at least as well as the competition to new technologies. While technical skills and expertise were cited as problems, nearly 72% of those who answered said the engineering workforce at their company has remained the same or increased over the past two years.

How important was knowledge and/or information loss as employees left the company?



### Knowledge-Management Challenges

However, while the number of engineers employed may have risen, the loss of institutional knowledge represents an important survey finding. Nearly three of every four respondents said knowledge management was at least of moderate importance to their company; 47% said that knowledge loss through retirement or other separation either was very important or extremely important. Even so, nearly half of respondents (47%) said their company has no formal practice in place to capture and retain knowledge that otherwise may depart.

More than one in three respondents works for a company that employs 10 or fewer engineers, an indication of the important role that small firms play. However, more than 20% of respondents said their company is at the other end of the spectrum, employing more than 500 engineers.

Regardless of the firm's size, some 55% of respondents said the average size of the design team they work on ranges between one and five people. Small teams predominate regardless of the overall size of the firm.

Given that many respondents work at a small engineering firm, it comes as little surprise that 28% said their company's annual revenues are less than \$10 million. Of the 36% who said their company's annual revenues topped \$250 million, around 20% pegged their company's annual take at greater than \$1 billion.

As for the designs they're working on, those surveyed noted things such as video compression, wavefront mirrors, robotic manufacturing cells, military fighters and helicopters, and new power plants. Responses also included instrumentation and controls for an unmanned offshore oil and gas platform, new technologies for automotive parts, and gas turbines.

One respondent may have spoken for many others with the comment, "I like working with products that are new because they pose challenges that are not easy to overcome."

### Engineering for Sustainability

Designing and developing environmentally sustainable products was cited as being very important or extremely important by 50% of respondents, an important finding. Work to achieve product and process energy-efficiency goals was noted as the primary driver. As for regulations that are the most significant drivers of sustainability, responders frequently cited the European Union's Restriction on Hazardous Substances (ROHS) directive; its Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) directive; and regulations that focus on conflict minerals and energy efficiency. Respondents generally agreed that regulatory pressures around sustainability are increasing and rules are becoming more complex.

Improving energy efficiency, reducing resource consumption, and cutting emissions into the air, water and land were cited as the most important sustainability strategies being used. Reduced packaging, the use of eco-friendly packaging and the use of eco-friendly disposal practices were among the strategies cited the least among respondents. For the most part, respondents said the number of design teams, along with the size of their company's workforce, has either increased or at least remained steady during the past two years. That may be seen as an encouraging sign after much of the global economy suffered through a downturn that in many areas lasted four or more years. Of the engineers who responded to a question about the direction of the number of designs/projects they work on, more than 63% said that number had either stayed the same or had increased. By contrast, 21% said that number had fallen or decreased significantly.

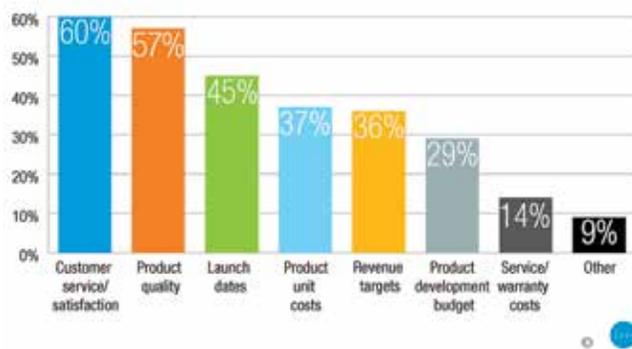


## Batter's Box CONTINUED FROM PAGE 13

### Financially Healthy

Revenue targets were not cited as the leading objective used to measure a team's or department's performance. Instead, customer satisfaction was the metric cited most often (60%), followed by product quality (57%) with respondents able to select more than one answer. Achieving revenue targets and product unit cost each was cited by 36% of respondents as a performance metric. When asked how frequently specific targets were being met, nearly 75% said they always or frequently meet that standard.

Which target goals/objectives are used to measure your team/department performance?



Although management issues were often cited as a productivity deterrent, most of those (83%) who responded consider their company to be either the leading or at least an average performer relative to the competition. Loyalty also prevailed as just 2% considered their company to be a lower performer compared with other firms.

Engineers in general value their career and current job, with 83% of respondents saying they think they are likely to be employed at the same company five years from now. However, when asked what would cause them to leave their current role nearly 30% said it would likely be to move to a different company. Another 5% said they would work for a competitor. Less than one in four said that a change in role would involve a promotion to a more senior job. Nearly 25% said they are likely to retire in the next five years.

Those looming retirements again highlight the issue of the potential for lost knowledge and expertise in the engineering field, something companies will need to address as competition continues to increase. But as the Engineering360 survey has found, the profession has a strong pulse and remains an attractive career in every part of the world.

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<http://www.globalspec.com/events/eventdetails?eventId=759>  
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## ABOUT MIKE JACKSON

In his role as director, North American Vehicle Forecasting, Mike Jackson directs the company's North American forecasting practice at IHS Automotive and as such is considered to be a global product planning and strategy expert in the automotive market. He is a highly respected public speaker who regularly presents to executive leadership teams and industry conferences in North America, Japan, Korea, and Western Europe and is frequently quoted by leading print, broadcast, and electronic media on the state of the automotive industry and the light vehicle production environment.



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November 11, 2015

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part nominations for this year's competition are due **Sept. 10, 2015**.

See forms and fliers at: <http://speautomotive.com/inno> and review 15 years  
of previous Innovation Awards nominations at <http://speautomotive.com/awa>.



## 2015 SPE Automotive Innovation Awards Update

by Dr. Jeffrey Helms

SPE Automotive Division has announced the date, location, and theme for its **45th-annual Automotive Innovation Awards Gala**, the oldest and largest recognition event in the automotive and plastics industries, as well as deadlines for the event's annual parts competition.

Plastics and composites have never looked better to automakers as they work to increase fuel efficiency and decrease greenhouse-gas emissions ahead of new legislative mandates for 2025. Given these pressures, last year's **SPE Automotive Innovation Awards Gala** had the highest attendance in its history and the Division expects that trend will continue in 2015, which is reflected in this year's theme: *The Future Looks Light*.

There is no cost to nominate parts. However, nominations must be submitted by **September 10, 2015** and those accepted into the competition need to be presented (in person or by webinar) by their nominating teams during the first round of **Automotive Innovation Awards Competition** judging, **October 1-2**. Finalists from that round will advance to a second presentation before a panel of Blue Ribbon judges on **October 12**. Winners will be honored during the **Automotive Innovation Awards Gala** on **November 11** at Burton Manor ([www.burtonmanor.net](http://www.burtonmanor.net)) in Livonia, MI, USA. This annual event typically draws over 700 OEM engineers, automotive and plastics industry executives, and media. Funds raised from the event are used to support SPE educational efforts and technical seminars, which help educate and secure the role of plastics in the advancement of the automobile.

Since 1970, the **SPE Automotive Innovation Awards Competition** has highlighted the positive changes that polymeric materials have brought to the automotive and ground-transportation industries, such as weight and cost reduction, parts consolidation, increased safety, and enhanced aesthetics and design freedom. At the time the competition started, many OEM designers and engineers thought of plastics as inexpensive replacements for more "traditional" materials. To help communicate that plastics were capable of far more functionality than their typical use as decorative knobs and ashtrays indicated, members of SPE's Automotive Division board of directors created the competition to recognize successful and innovative plastics applications and to communicate their benefits to OEMs, media, and the public. Over the years, the competition drew attention to plastics as an underutilized design tool and made industry aware of more progressive ways of designing, engineering, and manufacturing automotive components. From its humble beginnings, the competition has grown to be one of the most fiercely contested recognition events in the plastics and automotive

industries. Today, polymeric materials are no longer substitutes for more expensive materials, but rather are the materials of choice in hundreds of different applications throughout the vehicle. Without plastics, many of the auto industry's most common comfort, control, and safety applications would not be possible.

Current competition categories include:

- Body Exterior,
- Body Interior,
- Chassis / Hardware,
- Electrical Systems,
- Environmental,
- Hall of Fame,
- Materials,
- Process / Assembly / Enabling Technologies,
- Powertrain, and
- Safety.

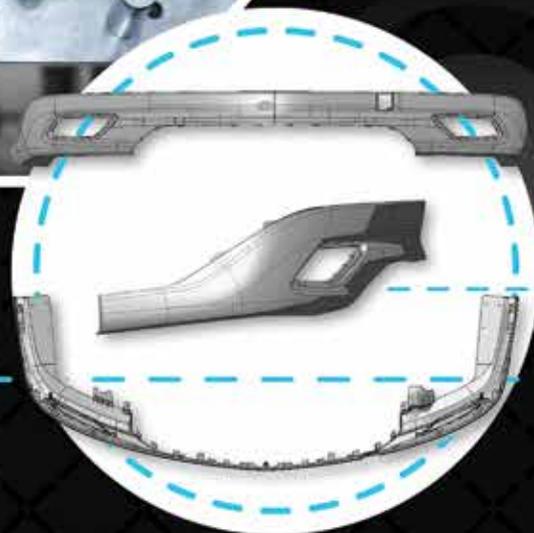
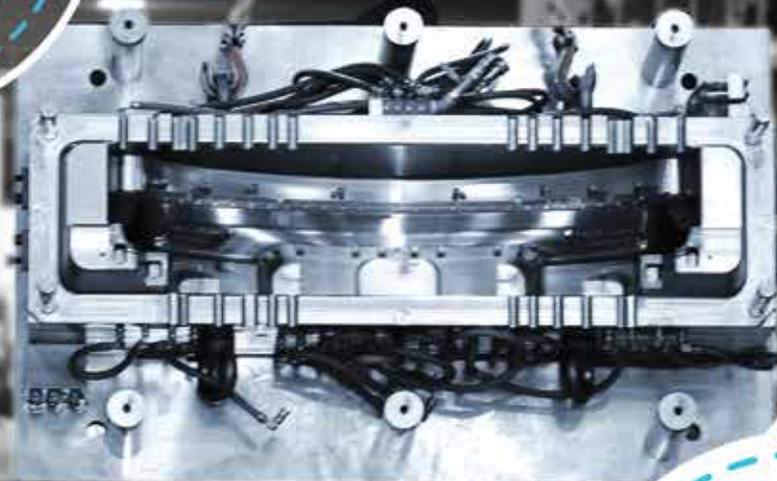
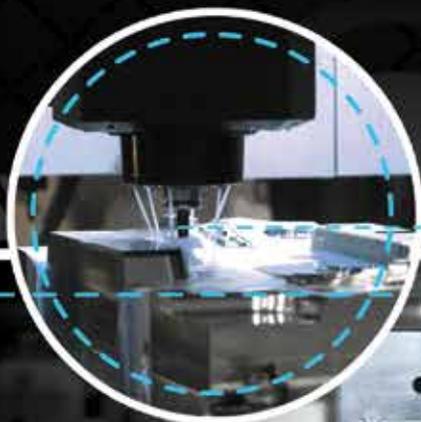
During the competition phase of the event, dozens of teams made up of OEMs, tier suppliers, consultants, and polymer producers work for months to hone submission forms and presentations describing their part, system, or complete vehicle module and why it merits the claim as the year's **"Most Innovative Use of Plastics."** To win, teams must survive a pre-competition review and two rounds of presentations before industry and media judges.

Learn more at <http://speautomotive.com/inno> and <http://speautomotive.com/awa>.



Shown above are members of the team that developed last year's *Safety* category as well as *Grand Award* winner of the **Automotive Innovation Awards Competition**, the active glove box on the 2015 model year *Ford Mustang* sports car produced by Ford Motor Co.

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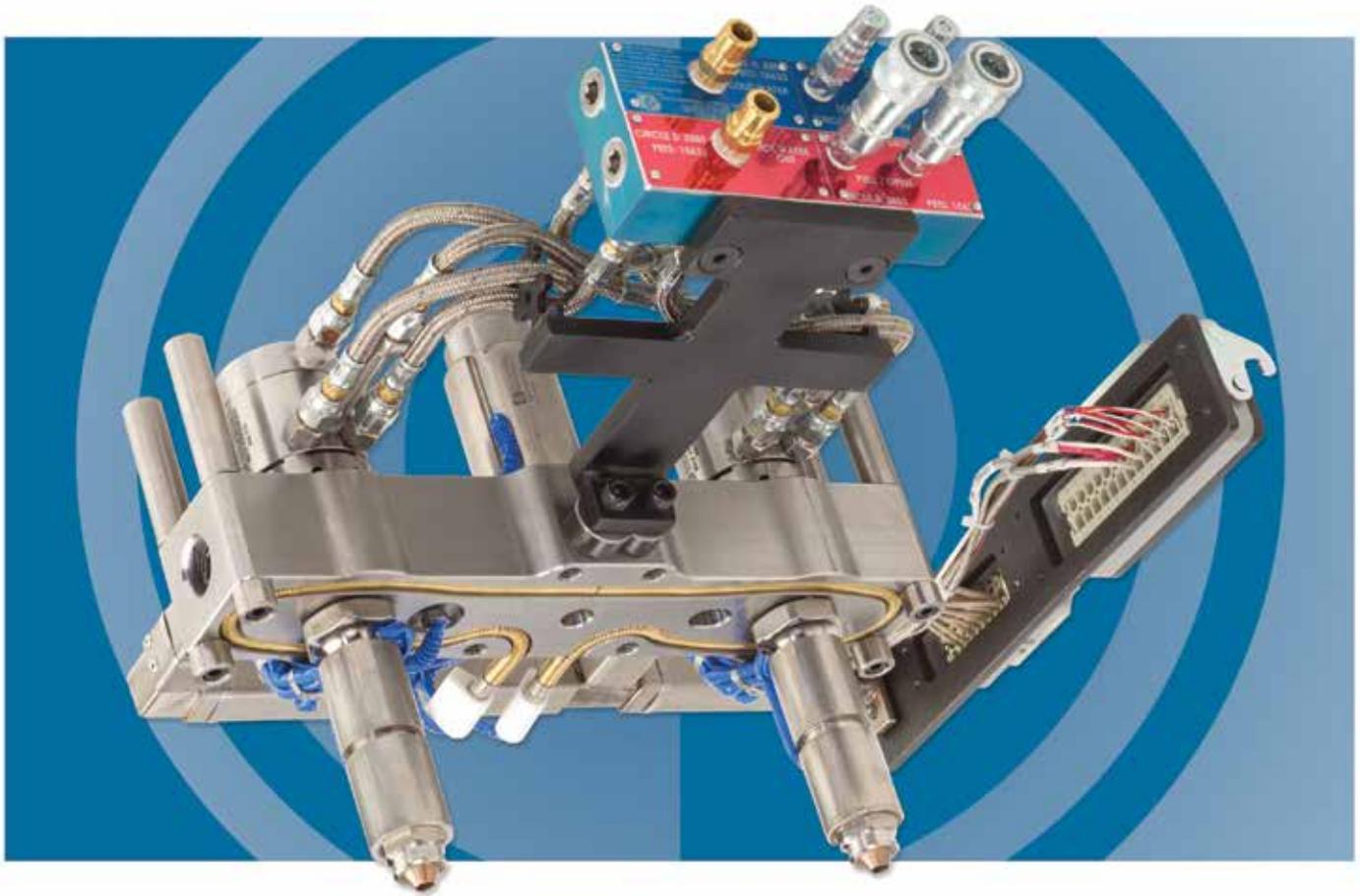
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# SPE ANTEC® 2015

## ANTEC® REPORT

Anthony Gasbarro, Technical Program Chair  
Automotive Session, ANTEC® 2015

*Hello everyone,* I'm so glad you're taking a minute to read this today.

As a reminder, SPE's Annual Technical Conference, ANTEC® 2015 will be co-located with the National Plastics Exposition (NPE® 2015) next month in Orlando, FL, USA. Held every three years, the NPE is organized by the Society of the Plastics Industry (SPI®). NPE lasts five days and is North America's largest plastics tradeshow, while ANTEC lasts three days and is North America's largest plastics technical conference. We are fortunate that this year both ANTEC and NPE are held at the same location and at the same time. This should really help maximize your time. If you haven't done so already, I'd strongly suggest you book your hotel arrangements now. Things start to get really expensive as we get closer to the show in March.

I'm happy to say that we have finalized our time for the Automotive Session of ANTEC 2015. It will be held on Wednesday, March 25 starting at 1:00 pm. We currently have six papers scheduled to be presented as well as two keynote addresses. Our board's very own Dr. Suresh Shah will speak about receiving the prestigious *SPE Research and Technology Award*. Below is an outline of the program:

Paper ID	Start Time	Title	Name	Institution
Keynote Address	1:00 p.m.	Driving Innovation in Automotive Plastics	Suresh Shah	SPE Automotive Div. and Retired, Delphi Automotive LLP
2135762	1:45 p.m.	Selected Failure Modes in Automotive Plastic Parts	Matthew Carroll	General Motors Co.
2092601	2:15 p.m.	An Effective Material Concept for a New Generation of Battery Supports within Premium Class	Werner Posch	Dräxlmaier Group
2139428	2:45 p.m.	Effect of Thin Walling and Foaming on TPO Part Performance	Jason Fincher	Advanced Composites, Inc.
2091850	3:15 p.m.	Low Gloss PC/ASA Blends for Automotive Interior Applications	Bin Sun	SABIC
Keynote Address	3:45 p.m.	Developments of Bio Filler in Polyolefin Blends	Thoi Ho	Flint Hills Resources
2103033	4:15 p.m.	Biocomposites and Bioblends Based on Engineering Thermoplastics for Automotive Applications	Mihaila Mihai	National Research Council Canada (NRCC/CNRC)
Business Meeting	4:45 p.m.	SPE Automotive Division Business Meeting	Anthony Gasbarro	SPE Automotive Division

More detailed information (such as session room location) will be released as ANTEC gets closer. The best way to keep abreast of the most up-to-date ANTEC information is through the SPE Events App. You can download the free app in your Android® or iOS® device's app store or access it on the web at <http://spe.eventsential.org>.

Please try to attend our Automotive Division business meeting, which is a great way to show your support of our division.

That's all for now – please come and visit us at ANTEC 2015 as we would love to see all of you.

Thank you.

*Anthony Gasbarro*

Anthony Gasbarro  
Technical Program Chair-Automotive Session, ANTEC® 2015



## Meet Your SPE Staff: *Barbara Spain*



*If* you've presented a paper or organized a technical session at ANTEC® in the last four years, you've likely talked to or exchanged eMails at least once with Barbara Spain, who is the next SPE staff member we'd like to introduce to members.

Although she's not living there at the moment, Barbara Spain was born, grew up, went to school, and has worked for most of her life in the U.S. State of Connecticut — minus a short period spent in the Western U.S. and her current digs on Martha's Vineyard, an island off the coast of Massachusetts. Although her background is varied, each major job has helped prepare her for her work at SPE.

Originally, she studied Radiology in college but near graduation realized this path was not for her. From there, she joined Perkin-Elmer Corp., where she worked for the next 15 years. She started as a clerical worker in the "computer room" — yes, there once were such things — and eventually convinced her boss to let her become a computer operator. That's when she discovered her "first love" (computers). Changing to the night shift, she went back to college (days) to study Computer Science. Thinking she might want to get into hardware engineering, she even dabbled with some engineering classes during this period before picking up her Computer Science degree.

As Perkin-Elmer began divesting divisions, Spain moved on to several other companies focused on computer software where she held such roles as technical trainer, technical writer, and technical support. While at a company that provided software used by the entire U.S. insurance industry, she was offered a position at the company's office in Boulder, Colorado, USA. She and her husband moved out. While the job was okay, the location wasn't. "I hated Colorado," Spain recalls. "It was way too far from water for me." After two years, she and her husband made the difficult decision to quit their jobs and move back to Connecticut. Fortunately, a friend's beach house awaited and they spent the summer and fall enjoying the ocean while looking for new jobs and a home of their own.

During that job search, a friend heard that Spain was back in Connecticut and invited her to interview at Dictaphone Corp. for a product manager job opening in the marketing department. She was hired and not long after, owing to her technical background, was moved over into program management where she worked for 11 years and really loved her job. Ultimately, she ended up as director-Program Management of a division of the company responsible for 25 hardware and software products associated with voice, data, and video recorders. The company was just starting to move into voice recognition technology when Spain's division was sold to an overseas company and she and her colleagues were suddenly out of a job.

The job market was again flat, so Spain and her husband ended back in Danbury, Connecticut where she spent five years looking for a new job and caring for her elderly father during his final years. In 2011, at her husband's prompting, she started working with a temporary (job) agency.

Ironically, she was the very last person called in for an interview with SPE for a short-term position in customer relations. Spain got the job and she started two days later for a six-month assignment.

Four months into this temporary position, a colleague who handled SPE's webinars announced she was leaving the organization with the imminent birth of her first child. After a short interview process, Spain was offered the job and was told she'd officially become an SPE employee as of November 1 handling the society's webinar program and working for the events director. Two days before she was to transition from temporary staff to permanent employee, her new boss gave notice. With ANTEC close at hand, and given Spain's previous experience managing large programs, her new responsibilities shifted slightly to events program manager and she quickly became submerged in all things ANTEC. "The rest," as she says, "is history."

Now on her fourth ANTEC, Spain works closely with SPE volunteers and authors to develop technical programs and plan various aspects of the conference including event marketing, designing SPE's own booth, and finding new ways to digitize everything — from the proceedings to the program to the student posters (new in 2015). When ANTEC is not in full swing, she's thinking of new ways to improve next year's program. She also travels to other SPE TOPCONs (topical conferences) to meet members and volunteers and provide on-site support, and she helps out with other tasks as needed. For example, she's recently been involved in the rollout/implementation of the new SPE mobile app, worked with SPE global teams to produce international ANTECs, collaborated with the design and implementation teams on SPE's new website and networking tool, The Chain, and, of course, continued work on the webinar program.

What does she think of her job three years later? "I can truly and honestly say that I feel like I came home when I came to SPE," she notes. "I love working with and learning from the volunteers and am humbled by the amount of knowledge they possess. That I can act as a conduit to help create exceptional experiences with our event offerings gives me such a great feeling of accomplishment. It also makes me very happy to have the opportunity to be an accepted participant."

What does she do when not working hard on SPE matters? Spain says she loves her husband, her cats, visiting her sister in France, cooking eclectic cuisines, walking, reading, working on stained glass projects, and enjoying the beach. Occasionally, she finds herself leaving the Atlantic Ocean to "go to America" to visit friends and work in SPE's Connecticut headquarters.

To reach Barbara Spain, SPE Events Program Manager:  
email: [bspain@4spe.org](mailto:bspain@4spe.org) or call +1.508.338.2646.



# Progressive Failure of CFRP Coupons and Automotive Parts

Benoît Bidaine, Sylvain Calmels  
*e-Xstream engineering*

## Abstract

Continuous Carbon Fiber Reinforced Plastics (CFRP), a category of composites, are considered to be the best choice for new concepts in automotive for parts submitted to the most severe loads. For body-in-white, openings, under-the-hood zone or drivetrain, most carmakers design more and more metal replacement concepts which use these advanced materials for their high stiffness and strength properties. The simulation must then be able to reproduce the correct failure behavior of the composite for safety purposes.

The aim of safety simulation is not only to detect the initiation of damage in the material, but to describe correctly its post-failure behavior. Through its Digimat software suite, e-Xstream provides a full methodology for the creation of progressive failure CFRP models reaching both these goals. They are based on a simple calibration with coupon test results. Such models are built on the evolution of the damage in each constituent and each ply of the composite. Instead of a brutal rupture in all directions in the ply, they are able to represent a decrease of stiffness in the meaningful direction only. When applied to a structural part, they provide accurate simulation results in terms of deformation scenario and dissipated energy which are 1st order criteria for safety simulation.

This paper will address the application of e-Xstream multi-scale material modeling strategy to the specific needs of post-failure behavior simulation of continuous fiber composite parts submitted to dynamic loads. This will demonstrate how simulation can be improved, for safety design simulations in particular, in the automotive industry, helping to reduce design delay, cost and weight of the structures.

**Sylvain Calmels**, business development manager - automotive at e-Xstream engineering, an MSC Company, was named a winner of the *Dr. Jackie Rehkopf Best Paper Award* by the peer-review committee for the **SPE® Automotive Composites Conference & Exhibition (ACCE)**. Calmels along with Benoît Bidaine, also from e-Xstream engineering co-authored a paper entitled *Progressive Failure of CFRP Coupons and Automotive Parts*, which was presented by e-Xstream colleague, Kurt Danielson on September 9 at the 14th-annual **SPE Automotive Composites Conference & Exhibition (ACCE)** in Novi, Michigan in the suburbs of Detroit. Sylvain Calmels has worked at e-Xstream engineering for the past year where he is responsible for understanding and anticipating auto industry needs in order to lead developments in the company's software product, *Digimat* to offer the best balance of accuracy and efficiency/speed needed by this market. Prior to joining e-Xstream, Calmels worked from 2006 to 2013 for PSA Peugeot Citroën as a methodology and FE modelization specialist where he worked on continuous improvement for FE tools and models and provided technical support for simulations involving body-in-white (BIW) structures and openings. Before that, he spent three years working for Alten Group providing technical support for FE simulations of BIW/openings for Alten client, PSA Peugeot Citroën. Calmels also worked as an FE simulation engineer for Bertrandt Group from 2000-2004 serving customers in the automotive and aeronautics industries. He is a 1998 Graduate Engineer with a specialization in structural analysis from École Centrale de Nantes (ECN) in France. Interestingly, this is the first paper he has authored or co-authored.

## Continuous Fiber Composites

Continuous fiber composites consist of polymer matrices, typically epoxy, reinforced with continuous fibers, often made of carbon. These materials are stiffened by the fibers when the latter are aligned with the direction of loading. Hence these materials are usually engineered in stacks of several plies exhibiting various fiber alignments, called unidirectional (UD) laminates. They are also characterized by a certain mass or volume fraction of fibers.

Due to the large spread in constituent properties, continuous fiber composites exhibit very different failure behaviors depending on the angle between loading and fiber directions. In particular, UD laminates host various failure mechanisms in different regions (cf. Figure 1). In aligned plies, where loading and fiber directions correspond, the stresses are mainly transmitted through the fibers. Hence fiber breakage initiates failure in these plies. In transverse plies, both the matrix and fibers support the loading but the matrix or the fiber-matrix interface get damaged first. Hence matrix cracking mainly accounts for failure in those plies. Taking into account this disparity in mechanical behavior, a separation between plies of different fiber orientation can also appear leading to delamination.

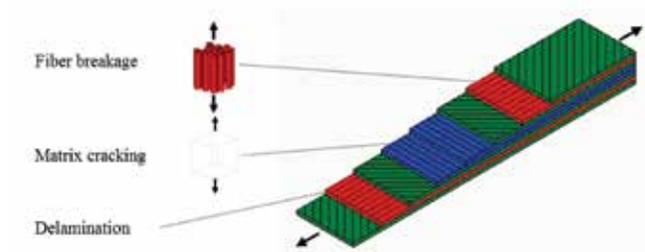


Figure 1: Failure of a UD laminate under tensile loading. Various mechanisms occur in and between plies.

Composite properties are characterized through experimental testing [1]. Various tests are performed, triggering different failure modes: on single plies or laminae or on laminates; at various loading angles for laminae (e.g., in the fiber – or  $0^\circ$  – and transverse – or  $90^\circ$  – directions) or for various layups for laminates; with or without structural characteristics such as notches or holes; in tension, compression or shear.

By way of example, the material system IM7/8552 by Hexcel exhibits the typical anisotropy of continuous carbon fiber composites, both in terms of stiffness and strength (cf. Figure 2). Such properties have been characterized by the National Institute for Aviation Research and are publicly available [2].

- The tensile modulus of a lamina is more than 15 times larger in the  $0^\circ$  direction than in the  $90^\circ$  direction. It adopts an intermediate value for a so-called quasi-isotropic (unnotched) laminate i.e., with an equal number of plies hosting fibers aligned at  $0^\circ$ ,  $45^\circ$ ,  $90^\circ$  and  $-45^\circ$  with respect to the loading direction. It is generally slightly larger than the corresponding compressive modulus.
- The tensile strength of a lamina is more than 40 times larger in the  $0^\circ$  direction than in the  $90^\circ$  direction. It adopts an intermediate value for a quasi-isotropic laminate (unnotched or open hole). It is generally larger than the corresponding compressive strength, apart for the  $90^\circ$  test for which it is much smaller. The process results in multiple layers, and should result in a high alignment of the GnP.

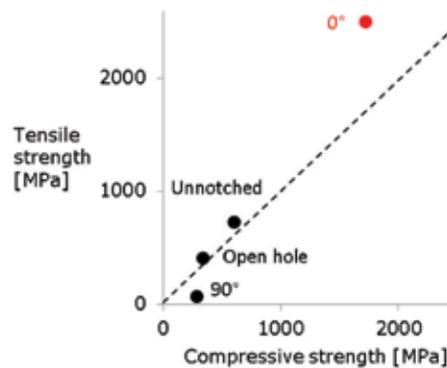


Figure 2: Mechanical properties of the material system IM7/8552 by Hexcel. The properties exhibit a large variability depending on the loading direction (along fiber – or  $0^\circ$  – direction or transversely –  $90^\circ$  – considering a single ply or lamina) or type (tension/compression) among others. They reach their maximum values for the  $0^\circ$  direction.

## Material Modeling

The simulation of continuous carbon fiber composites advantageously combines micromechanics, deriving composite properties from constituent properties e.g., through mean-field homogenization, and progressive failure.

### Mean-Field Homogenization

As composite properties depend on the material microstructure including fiber amount and orientation, they are adequately modeled from micromechanics. In particular, mean-field homogenization combines the properties of the underlying constituents of a multi-phase material so that the original heterogeneous material is represented by an equivalent homogeneous one. Implemented in the Digimat software [3], this technology has proven effective for a broad range of materials. For CFRP, it represents the matrix material as isotropic elastic (or even elastoplastic), the fiber material as transversely isotropic elastic and accounts for the actual fiber volume fraction.

Mean-field homogenization provides a means to investigate the origin of the experimental variability of composite properties. In particular, it reveals their sensitivity to micromechanical parameters (cf. Figure 3). In turn, these parameters can be considered as effective parameters enabling fits of sets of different composite measurements. For instance, the experimental variability of the quasi-isotropic tensile modulus (labeled “Unnotched” in Figure 2) can be compared to the corresponding simulated variability from 10% variations of different matrix or fiber properties: varying the fiber longitudinal modulus or the fiber volume fraction yields similar modulus ranges.

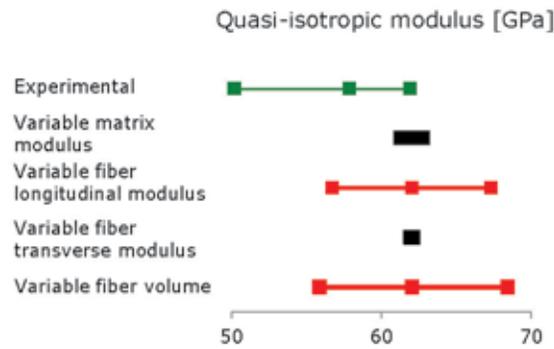


Figure 3: Sensitivity of the quasi-isotropic tensile modulus to micromechanical parameters

Mean-field homogenization provides access to per-phase properties. It enables a finer interpretation of simulation results as it distinguishes the matrix and fiber behaviors. In particular, it enables the definition of failure criteria at the phase level while they are usually or at first defined at the composite level.

### Progressive Failure

Several strategies can be used to deal with the failure of quasi-brittle materials. The simplest method consists in abruptly degrading the material stiffness when a failure criterion, i.e., a given combination of stress/strain components, reaches a critical value. A drawback of this method is that the material stiffness is reduced in every direction, which is unrealistic for laminate composites: a UD ply that fails in the transverse direction (due to matrix cracking) still exhibits a significant stiffness in the fiber direction. Some models, such as the Chang and Chang model [4], were developed in order to account for this kind of anisotropic degradation. An enhancement of this method was formalized by Talreja [5] through the Continuum Damage Mechanics (CDM) framework, which uses damage state variables in order to apply a gradual (and not instantaneous) degradation of the material, translated in a softening of the stress-strain curve before failure.

Progressive failure consists in linking failure criteria to stiffness degradation through damage variables. A popular application of this formalism is the Matzenmiller-Lubliner-Taylor (MLT) model [6], in which the stress-strain behavior of the composite material (considered at the macroscopic scale) is represented by the equation

$$\begin{Bmatrix} \varepsilon_{11} \\ \varepsilon_{22} \\ \varepsilon_{12} \end{Bmatrix} = \begin{bmatrix} \frac{1}{(1-D_{11})} \times \frac{1}{E_1} & \frac{-\nu_{12}}{E_1} & 0 \\ \frac{-\nu_{12}}{E_1} & \frac{1}{(1-D_{22})} \times \frac{1}{E_2} & 0 \\ 0 & 0 & \frac{1}{(1-D_{12})} \times \frac{1}{G_{12}} \end{bmatrix} \begin{Bmatrix} \sigma_{11} \\ \sigma_{22} \\ \sigma_{12} \end{Bmatrix}$$

where  $\boldsymbol{\varepsilon}_{11}$ ,  $\boldsymbol{\varepsilon}_{22}$  and  $\boldsymbol{\varepsilon}_{12}$  denote components of the strain tensor,  $\boldsymbol{\sigma}_{11}$ ,  $\boldsymbol{\sigma}_{22}$  and  $\boldsymbol{\sigma}_{12}$  components of the stress tensor,  $E_1$ ,  $E_2$  and  $G_{12}$  Young's and shear moduli,  $\nu_{12}$  the Poisson's ratio and  $D_{11}$ ,  $D_{22}$  and  $D_{12}$  damage variables. These variables are often expressed from failure criteria, e.g. for the Hashin tape failure criterion:

$$D_{11} = \varphi(f_F), \quad D_{22} = \varphi(f_M) \quad \text{and} \quad D_{12} = 1 - (1 - D_{11}) \times (1 - D_{22}), \quad \text{with}$$

$$f_i \text{ such that } \mathcal{F}_i\left(\frac{\hat{\sigma}}{f_i}\right) = 1, \quad \mathcal{F}_F(\hat{\boldsymbol{\sigma}}) = \begin{cases} \left(\frac{\hat{\sigma}_{11}}{X_t}\right)^2 + \left(\frac{\hat{\sigma}_{12}}{S}\right)^2 & \text{if } \hat{\sigma}_{11} > 0 \\ -\frac{\hat{\sigma}_{11}}{X_c} & \text{otherwise} \end{cases} \quad \text{and} \quad \mathcal{F}_M(\hat{\boldsymbol{\sigma}}) = \begin{cases} \left(\frac{\hat{\sigma}_{22}}{Y_t}\right)^2 + \left(\frac{\hat{\sigma}_{12}}{S}\right)^2 & \text{if } \hat{\sigma}_{22} > 0 \\ f(\hat{\sigma}_{22}, \hat{\sigma}_{12}, Y_c, S) & \text{otherwise} \end{cases},$$

where  $\boldsymbol{\sigma}$  stands for the effective (or undamaged) stress tensor.  $X_t, X_c, Y_t, Y_c$ , and  $S$  longitudinal tensile, longitudinal compressive, transverse tensile, transverse compressive and shear strengths and  $\varphi(f)$  for a damage law.

The damage law shapes the stress-strain behavior between damage initiation and ultimate failure. It can follow several generic formulations implemented in Digimat, among which the 2 following simple examples:

$$\varphi(f) = \begin{cases} 0.99 & \text{if } f \geq 1 \\ 0 & \text{otherwise} \end{cases} \quad \text{(instantaneous damage)}$$

$$\varphi(f) = \begin{cases} 0 & \text{if } f \leq f_{min} \\ \frac{f - f_{min}}{f_{max} - f_{min}} & \text{if } f_{min} < f \leq f_{max} \text{ (linearly increasing damage)} \\ 1 & \text{otherwise} \end{cases}$$

The first example eventually switches the stiffness almost off, however in a single direction (cf. Figure 4 showing results of the MLT model applied to a UD IM7/8552 lamina loaded in the fiber direction, labeled "0°" in Figure 2). The second example yields a gradual stiffness decrease after the maximum stress has been reached (with  $f_{min} = 1$  and  $f_{max} = 2$ ) or even introduces a nonlinear behavior before the maximum stress (with  $f_{min} = 0.75$  and  $f_{max} = 3$ ).

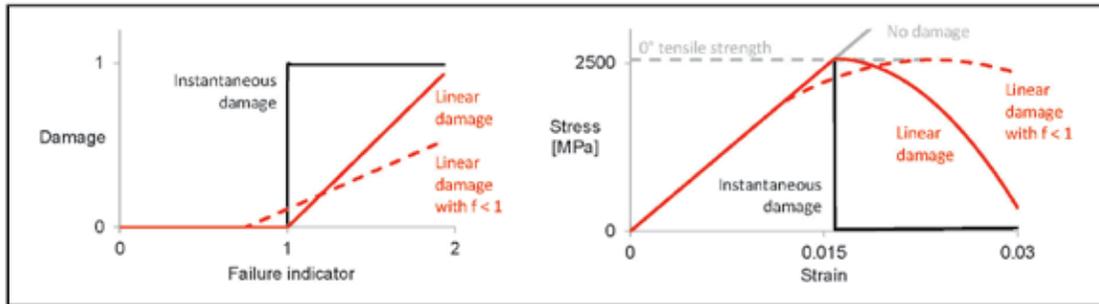


Figure 4: Results of the MLT model applied to an IM7/8552 UD lamina loaded in the fiber direction: various damage laws (left plot) and consecutive stress-strain behavior (right plot)

Combining several failure description strategies enables to represent simultaneously the intrinsic characteristics of different coupon tests using a single material model. Such a model involves several simplified Hashin failure criteria representing each a limited number of failure modes, i.e., considering some strengths as infinite in the above-defined formula. For instance, a Hashin failure criterion considering only finite longitudinal strengths can be defined to initiate element deletion and represent the most critical 0° failure modes. Other criteria linked successively to power (quadratic) and instantaneous damage laws yield stress-strain behaviors representative for an In-Plane Shear (IPS) test (cf. Figure 5).



Figure 5: Progressive failure results with multiple damage. The combination of quadratic and instantaneous damage laws (left plot) yields a stress-strain behavior representative for an In-Plane Shear (IPS) test (right plot).

### Application on an open hole coupon FEA

Above-described material models bring more realistic material knowledge to structural simulation. In the framework of coupled FEA, they provide homogenized material properties at the integration point level based on the local microstructure. When these properties vary over a part because of the manufacturing process, micromechanical material models enable thus a more accurate description of the part performances: the multi-scale approach reveal the influence of the microscopic properties on the macroscopic performances.

In particular, progressive failure improves the realism of structural simulations after damage initiation, a local event in both space and time. In a classical implicit FEA, damage initiation is inferred from failure criteria. However the analysis becomes unrealistic after this moment as the material behavior is not modified in the damaged region. In an explicit FEA, elements where a failure criterion has reached a critical value can be deleted. However such element deletion actually corresponds to mass removal and, unless the elements are very small, induces structural instability and precipitated failure path propagation. On the contrary, progressive failure accounts for material damage within an element by gradually decreasing the stiffness in the corresponding direction.

Combined to an instantaneous damage law and used in the framework of an Marc analysis coupled to Digimat, the material model described in previous section predicts the open hole tensile strength within the experimental range (Figure 6) for a coupon made of a quasi-isotropic laminate i.e., with a  $(45^\circ/0^\circ/-45^\circ/90^\circ)_2s$  stacking sequence (Figure 7). This material model implemented in Digimat provides Marc with stress increments corresponding to strain increments through a user subroutine.

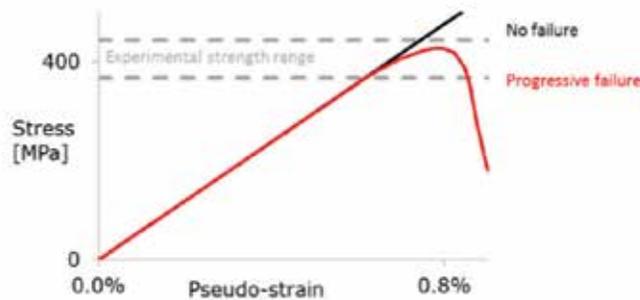


Figure 6: In the framework of the simulation of an open-hole tensile test on a quasi-isotropic laminate, the progressive failure mechanism provides a realistic stress-strain curve – i.e., a curve whose stresses do not actually exceed a maximum value comparable to the strength – unlike a simulation that does not involve failure or simple failure criteria. In this example for the Hexcel IM7/8552 material, the progressive failure mechanism predicts the strength with 5% average error.

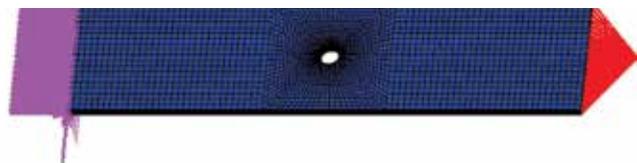


Figure 7: Finite element model of the coupon submitted to the open-hole tensile test

The progressive failure mechanism represents the failure sequence more realistically by producing a stress decrease in plies with different orientations successively. This results in a different stress distribution among the plies when the strength is reached (Figure 8). In particular, the transverse plies – the first to be damaged in the loading direction – undergo larger compressive stresses in the fiber direction. The aligned plies, having first taken more load following the damage of the other plies, have their stresses decreased in the loading direction due to the damage of their stiffness in the fiber direction.

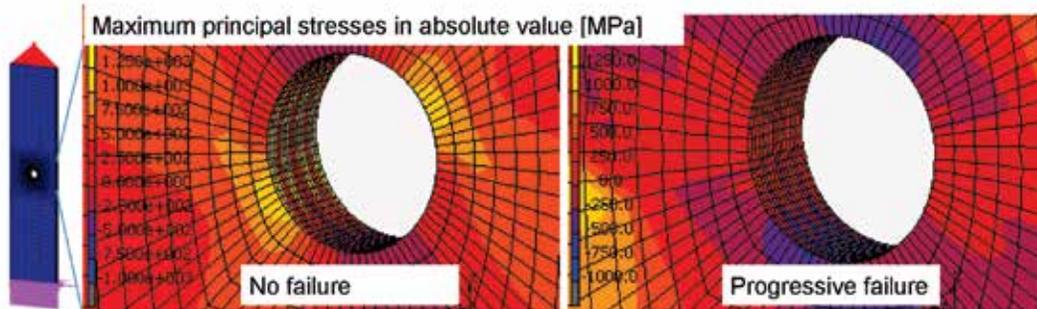


Figure 8: With progressive failure (right plot), the maximum principal stresses in absolute value exhibit lower values than without failure (left plot) when the coupon strength is reached. Without failure, they reach values larger than the composite strength in the fiber direction (about 1800 MPa) in the aligned plies (2nd and 6th outer plies) in the lateral zones of the hole. With progressive failure, they drop in these areas following the damage of the ply longitudinal stiffness. In the transverse plies (4th outer and two central plies), they highlight the compression occurring in the fiber direction – perpendicular to the tensile direction – in the upper and lower zones of the hole but also in the lateral zones. In the latter areas, they even become more negative with progressive failure due to the damage of the ply transverse stiffness.

The progressive failure mechanism produces different effects depending on the relative orientation between the fiber and loading directions. Indeed it relies on the Hashin failure criterion that exploits separately the components of the stress tensor in the aligned and transverse directions with respect to the fiber direction and drives corresponding damage variables. Therefore the different expressions of this criterion and the related damage variables exhibit complementary patterns, especially when the coupon strength is reached (Figure 9). We have not been able to compare these patterns to actual failure patterns as such information is not available from the test report underlying this work [1]. The expression of the Hashin criterion associated to matrix tensile failure exceeded 1 in the non-aligned plies at a lower loading level. Consequently these plies exhibit an advanced damage state. Meanwhile the aligned plies took over the load and began to damage in the fiber direction aligned with the loading direction.

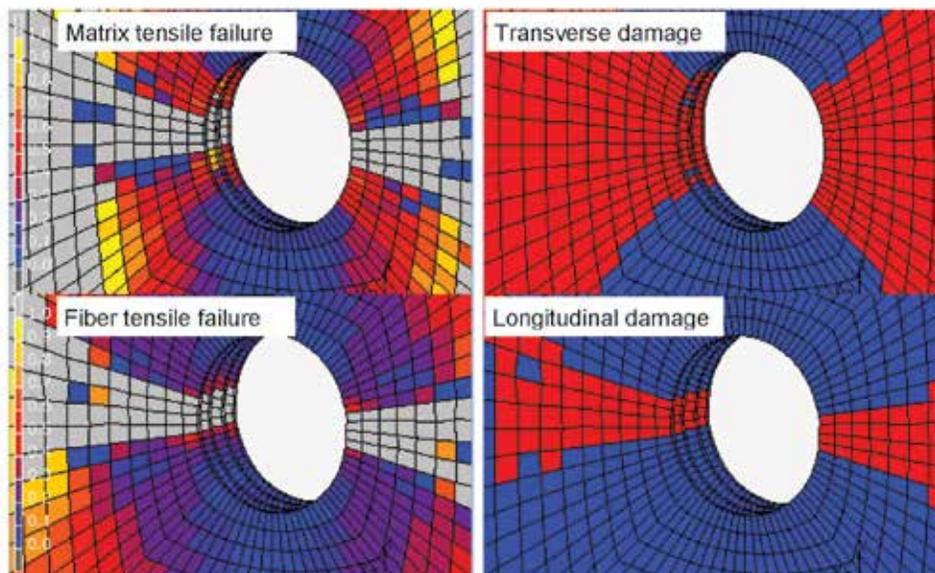


Figure 9: When the coupon strength is reached, the expression of the Hashin failure criterion associated to matrix tension (top left plot) exceeds 1 especially in the transverse plies which subsequently exhibit transverse damage (top right plot) introduced much earlier. In some elements, the failure indicator has even decreased back to a value smaller than 1 after having initiated damage. The expression of the Hashin failure criterion associated with fiber tension (bottom left plot) exceeds 1 in the aligned plies which begin to damage in the fiber direction (bottom right plot).

### Pole side impact on a sub component

The study of a sub component conclusively reveals all the interests of using a progressive failure model for the simulation of CFRP behaviors at a design level, especially with the purpose of predicting crash performances. For example, the load seen by the lower beam of the body-in-white (BIW) under the poles impact can be considered similar to a 3-point bending case applied on a sub component with a double omega shape (cf. Figure 10). By analyzing this simple case, the effect of the progressive failure model on the main drivers of the behavior description can be highlighted, i.e.,

- the deformed shape,
- the cracks,
- the maximum force at failure,
- the dissipated energy.

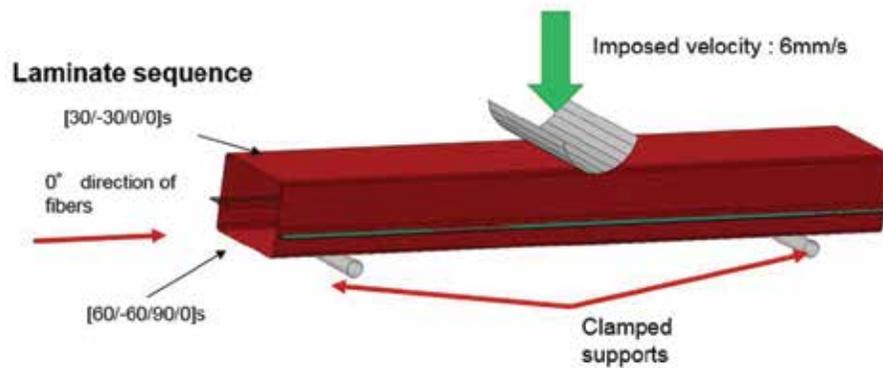


Figure 10: 3-point bending on a sub component to represent a typical pole side crash case

### Material models

3 different material models are compared in this study. These models involve

- a common definition of stiffness and microstructure;
  - > UD carbon fibers + epoxy matrix
  - > Elastic and isotropic stiffness for the resin and the continuous carbon fibers
  - > Volume fraction of fibers = 60%
- 3 different failure definitions.
  - > Standard failure based on a single Hashin criterion involving 6 strengths, i.e., 0°/90° tensile, 0°/90° compressive, in-plane/transverse shear
  - ~ Element deletion is activated per ply when the criterion reaches 1

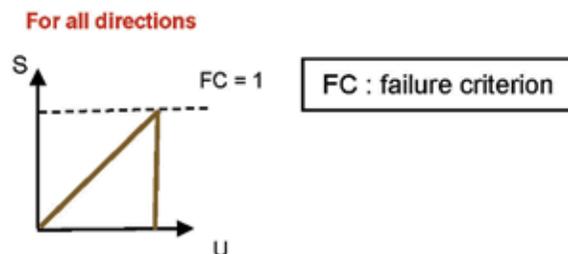


Figure 11: S-U diagram of the standard failure model

# Technical Paper CONTINUED FROM PAGE 29

- > Basic progressive failure based on the Hashin criterion
  - ~ No element deletion
  - ~ Progressive loss of stiffness per direction of load and per ply following a unique instantaneous damage law

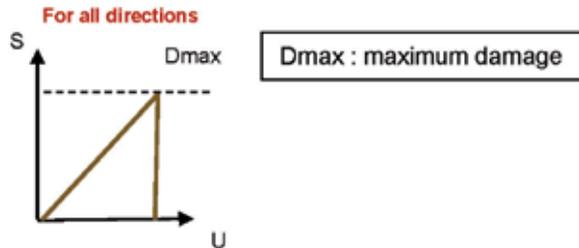


Figure 12: S-U diagram of the basic progressive failure model

- > Evolved progressive failure based on the cumulative effect of 4 failure criteria to yield a specific failure behavior per failure mode
  - ~ Failure #1: element deletion activated per ply if a first Hashin criterion reaches 1 in fiber direction, in tension or compression
  - ~ Failure #2: instantaneous loss of stiffness activated per ply for transverse tensile loading when a second Hashin criterion reaches 1
  - ~ Failure #3: nonlinear behavior for transverse compressive loading through a third criterion associated to a power damage law
  - ~ Failure #4: nonlinear behavior for shear loading through a fourth criterion and second power damage law

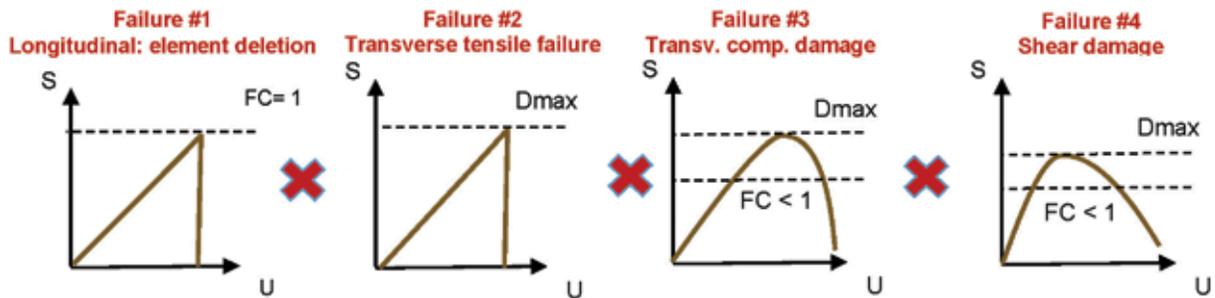


Figure 13: Combined S-U diagram of 4 failure modes for evolved progressive failure model

## Deformed shape and crack prediction

Figure 14 compares the deformed shapes obtained with the 3 material models. The standard failure definition provides a nonrealistic result, whereas both progressive failure definitions allow for the prediction of a more reliable deformation scenario. This figure shows similar results between the 2 progressive failure models.

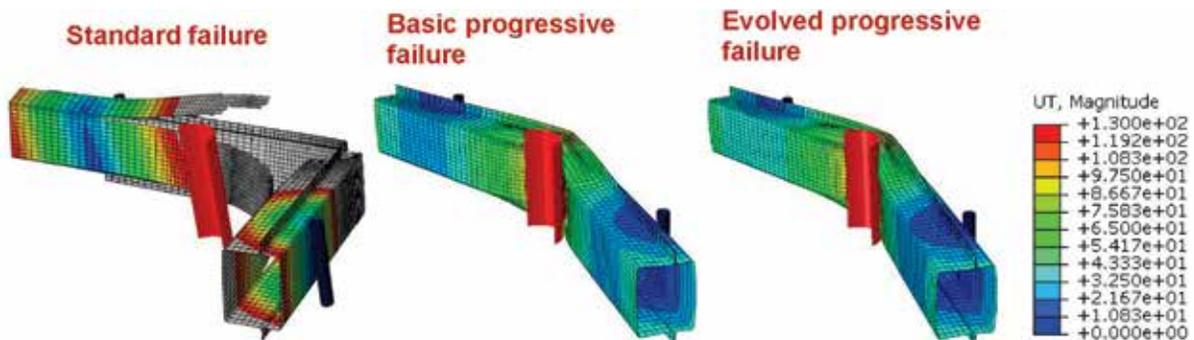


Figure 14: The deformed shape is totally wrong with the standard failure definition. The evolved progressive failure definition helps to refine the global behavior and optimizes the prediction of the deformed shape.

Figure 15 shows the element deletion status and a local focus on the deformed element shapes. The evolved progressive failure definition is accurate and complete enough to be able to predict cracks, whereas the basic progressive failure one does not contain any capability for this specific detail. This leads to different local deformation predictions which will have an influence in a full car simulation, for which the prediction of a global deformation scenario must be accurate.

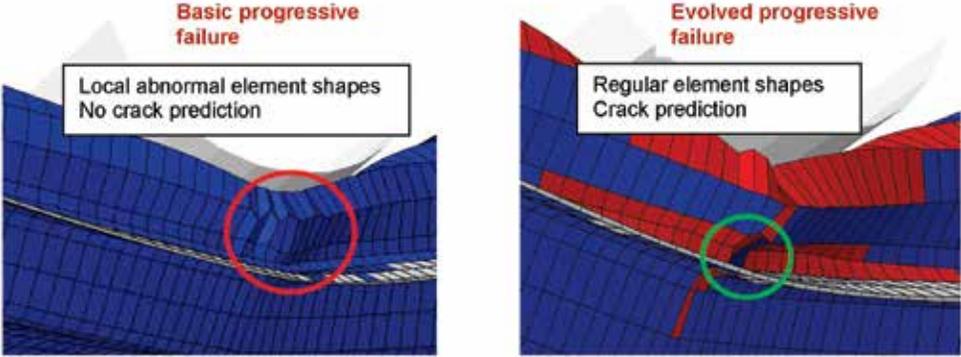


Figure 15: Element deletion status. The evolved progressive failure definition offers the possibility to predict cracks thanks to the combination of element deletion and multiple damage laws.

### Maximum force at failure and dissipated energy

Figure 16 shows the very different predictions made according to the settings chosen for the material models. Both the estimation of the maximum force at failure and the dissipated energy are highly underestimated by the standard failure definition. Doing direct element deletion when a failure criterion reaches a critical value leads to a correct simulation of failure initiation but the post failure behavior is wrong. The failure propagates too quickly through the plies, the global loss of stiffness of the structure is overestimated and the predicted dissipated energy is totally false. The effect at design level will be directly to overdesign the component.

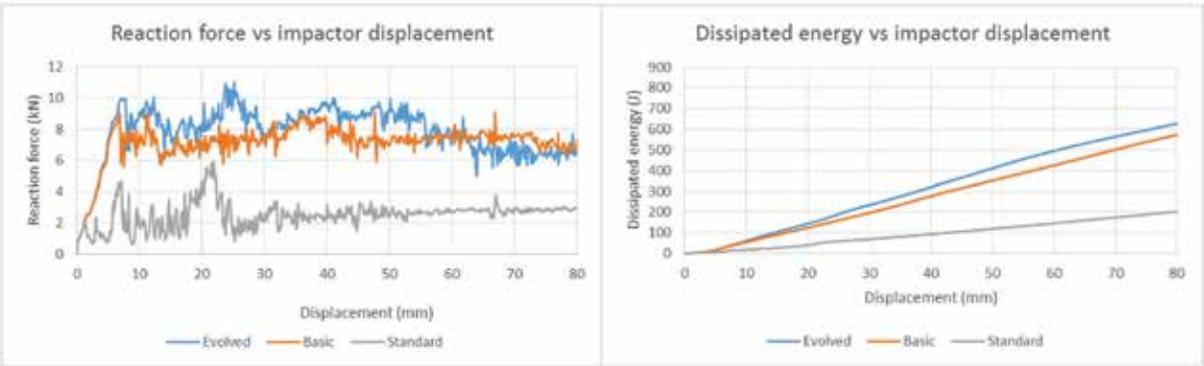


Figure 16: Progressive failure is required to predict accurately the crash behavior of CFRP.

The 2 models using a progressive failure definition predict a more consistent global behavior of the structure. The maximum forces at failure reach values twice larger than with the standard failure definition, and the final dissipated energy is 3 times larger. The post failure stiffness of the structure is larger as well. These differences on a complex assembled structure like a BIW will lead to an accurate prediction of the deformation scenario and a better optimization of its design.

In addition, the capability to define different failure behaviors for different failure modes enables to refine the material model definition. Such definition employs experimental data collected from tests on specimens revealing the different failure modes and yields not only an anisotropic stiffness behavior but an anisotropic post failure behavior as well.

## Summary and Next Steps

Efficient material models exist to answer the actual growing use of continuous fiber reinforced plastics in the automotive industry. Such models relying on progressive failure are highly recommended for crash evaluations to avoid any overdesign risk. The concrete added value is the capability to capture a progressive loss of stiffness per ply and per direction according to the continuously evaluated levels of damage in the material.

In addition, an advanced technology allows to define different progressive failure behaviors for different failure modes of the material in order to take into account not only its anisotropic stiffness but also its anisotropic failure behavior. This is an absolute requirement to obtain an accurate prediction of the post failure behavior of the structures, and then designing lightweight components.

Further developments will include a microscopic damage formulation, relating per-phase failure criteria to constituent stiffnesses, as well as the capability to take into account the effects of the manufacturing process on the local microstructure definition of the material through the final product. This will increase the level of accuracy of the simulation and allow to optimize even more the design of the components.

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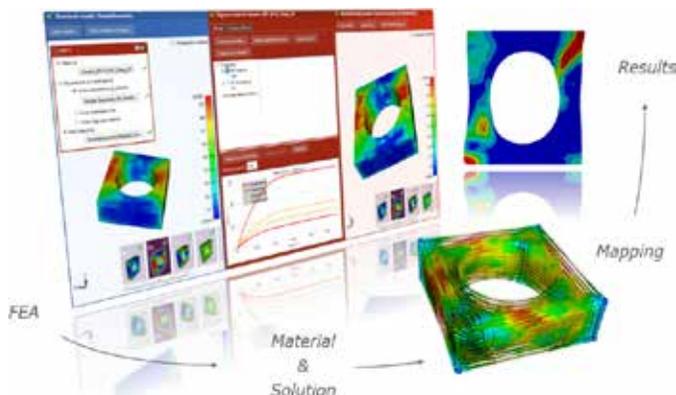
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# SECRETARY'S REPORT

## SPE Automotive Division Board

### Dec. 08, 2014 Minutes

Next BOD Meeting: Monday Feb. 9, 2015



#### ATTENDEES

Teri Chouinard	Peggy Malnati	Nippani Rao	Dawn Stephens
Norm Kakarala	Tom Pickett	David Reed	Steven VanLoozen
Ed Luibrand	Ron Price	Suresh Shah	Umesh Gandhi
Kevin Pageau	Monica Prokopyshen	Elias Shakour	

Meeting was held at the ACC in Troy, MI from 5:30 p.m. – 7:10 p.m.

#### EDUCATION – Monica Prokopyshen

Content for an SPE Automotive Division (SPE AD) education brochure suitable for distribution at Explorathon™, social, and other division-sponsored events was discussed, including bio reprints from the division newsletter, scholarship information, Plastivan™ information, a heptagon tower article, contacts, web links, and some college information. Inclusion of student chapter and Detroit Section education information was proposed by Ron.

#### SOCIAL MEETING – Teri Chouinard

Forty people signed up for the December 9th Ruth's Chris Steakhouse networking event. A sponsor appreciation event was proposed for 2015.

#### MEMBERSHIP – Steven VanLoozen

The 2014 OEM membership drive brought in more than 20 new OEM members. Dr. Umesh Gandhi (Toyota) has expressed interest in joining the SPE AD board and was invited to the Dec. 8, 2014 BOD meeting. Division membership has grown 34% year over year, from 1,048 (Nov. 30, 2013) to 1,402 (Nov 30, 2014).

#### TREASURER'S REPORT – Dawn Stephens

As of December 8, 2014 the account balances were as follows:

Checking:	\$95,596.42
Savings:	\$27,428.89
Total:	\$123,025.31 USD

Steve and Dawn will follow-up with HQ on the negative impact of the new HQ revenue sharing policy to division finances.

#### COUNCILOR'S REPORT – Tom Pickett

There has been no Councilors' meeting since the last SPE AD board meeting.

#### ANTEC 2015 – Suresh Shah

Six papers will be presented in the Automotive Session, which begins at 1:00 pm, Wednesday, March 25th. Please read the December newsletter for additional information. Anthony and Suresh are moderators.

#### MARCOM – Peggy Malnati

**AutoEPCON 2015:** May 5, 2015 at the Troy Marriott. The Detroit Section is coordinating all marcom through SPE HQ.

**ACCE 2015:** Sept. 9-11, 2015 at Diamond Center in Novi. Fred Deans and Dale Brosius return as event co-chairs. The M8 concept car is the inspiration for the program guide cover.

**IAG 2014:** Nov. 12, 2014, Burton Manor, Livonia. Five extra tables were added for a total of 710 place settings. The awards module and winners' press release were posted Nov. 12. The 26 GB of event photos took 4 days to load on Flickr.

**SPE AD Online:** November 2014 set a new all-time record for highest unique visits in a month (57,681), surpassing the previous high of 55,163 set in August 2013. SPE AD doesn't pay for position. The blog has 1,044 followers and twitter has 995.

**SPE AD Dec. 2014 Newsletter:** The lead article is the 2014 Awards Gala winners. The key columns are: *An Engineer's Life* (Norm Kakarala); *Service through Science* (Creig Bowland, SPE Composites Div.); *Batter's Box* (Herm Dillon, editor of AutoNewswire.net) and the new feature *Meet Your SPE Staff* (Pedro Matos, SPE HQ).

**Other Marcom:** Pinnacle and Communication Excellence reports were submitted. The website banner and buttons will be updated in December 2014. Discussions with HQ are taking place to determine how the new advertising policy affects swap deals with publishers and other conferences.

#### SPONSORSHIP – Teri Chouinard

There are 9 newsletter sponsors totaling \$32,700 and 35 2015 ACCE early-bird sponsors.

#### OTHER BUSINESS

- House Chair – Dawn Stephens
- Intersociety Chair – Maheen Khan
- Chair Elect – Elias Shakour
- Committee to manage Jackie Rehkopf scholarship includes Fred and Peggy.

Next meetings: Mondays in 2015: Feb. 9, Apr. 13, and June 8.

#### NEW BUSINESS

Steve introduced the 3D Printing TopCon proposal and emphasized the rapid growth of this field, its current use by large Tier 1s, the variety of polymers used, and the new and innovative part designs possible with this technology. Suresh and Umesh will form a subcommittee to investigate launching this concept. The initial discussion included the following considerations:

- a) Select a time period that doesn't conflict with other conferences.
- b) Explore introducing the topic via a technical session within an existing conference.
- c) Establish a LinkedIn Group.
- d) Explore biopolymers and sustainable materials in mass-production vehicles.
- e) Explore innovative designs possible with the technology.



# SECRETARY'S REPORT

## SPE Automotive Division Board

### Feb. 9, 2015 Minutes

Next BOD Meeting: Monday April 13, 2015



#### ATTENDEES

Teri Chouinard	Umesh Gandhi	Tom Pickett	Steve VanLoozen
Peter Bejin	Jeff Helms	Monica Prokopysphen	Mike Whitens
Mark Bahm	Ed Luibrand	Nippani Rao	
Matt Carroll	Mark Lapain	Suresh Shah	
Fred Deans	Peggy Malnati	Dawn Stephens	

Meeting was held at the ACC in Troy, MI from 5:30 p.m. – 7:39 p.m.

#### EDUCATION – Monica Prokopysphen

The American Association of University Women (AAUW) announced that Explorathon® 2015 will be held at Cranbrook Kingswood Middle School on Wednesday, March 25, 2015. Elizabeth Johnston Tengler (SPE AD), Elizabeth Egan (PlastiVan™ Educational Program), and Monica Prokopysphen (SPE AD) will be presenting the “Designing with Plastics” sessions. Handout preparations are underway. Roy Sjöberg provided an article on the “heptagon tower” principle and Peggy Malnati provided Service through Science and Engineer’s Life articles. A PlastiVan® flier and SPE AD history are also included.

#### SOCIAL MEETING – Teri Chouinard

December’s Ruth Chris Steakhouse networking event was well received. An education on wine tasting and the benefits of SPE membership was proposed for April 30th (with a 2nd choice of May 7th). The event budget is \$750 – \$1,000 USD for 40 people at The Cellar Door in Auburn Hills.

#### MEMBERSHIP – Steven VanLoozen

Steve proposed extending the successful OEM membership drive into 2015. Division membership has grown 34% (354 new members) year over year, from 1,048 (Nov. 30, 2013) to 1,402 (Nov 30, 2014). The increasing division membership trend contrasts with a declining trend for SPE as a whole. Dr. Umesh Gandhi (Toyota Motor Corp.) joined the SPE AD board in December 2014 and Matt Carroll (General Motors Co.) joined as of this meeting. The membership committee will present ideas for membership growth at the April meeting.

#### TREASURER’S REPORT – Dawn Stephens

The fiscal year is July 1 to June 30. As at February 9, 2015 the account balances were as follows:

Checking:	\$204,040
Savings:	\$27,430
Total:	\$231,471 USD

Awards Gala outstanding payments have been paid. Event chairs need to provide cash flow forecasts to Dawn for planning purposes so that she can maintain cash flow for division initiatives and operations.

The early-bird funds are currently paid directly to the division. If we were to move all registration for the ACCE to the SPE HQ system, then HQ would like to process not only individual registrations but also sponsorship money. However, concerns were expressed that

insufficient cash flow for division expenses and initiatives may result. Peggy, Dawn and Teri have expressed concerns to HQ about the 2014 HQ ACCE registration system. Even though the ACCE conference paid the 12% rate, not all registration costs were covered by HQ. By opting to add badge printers (to streamline and speed onsite badge collection), the event paid an additional \$7,000 to rent 3 machines and pay time and travel costs for a representative of the vendor to run the system. The ACCE and TPO conferences have the most complex registrations of any SPE event at this time.

Fred, Peggy, Teri, Dale Brosius (Composites Div.), and Dawn provided ACCE “lessons learned” to Russ Broome on Nov.13th and discussed TOPCON policy with respect to extended services. Jeff has also sent concerns over to Wim and Russ for their review and will follow up in person in Orlando. The ACCE experience last year was summarized as “more negatives than positives with the new revenue sharing policy.” The new policy penalizes the division, despite its record of excellent membership growth and revenue for SPE HQ. A subcommittee (Jeff, Steve, Dawn, Peggy, and Fred) will verify the TOPCON and MINICON definitions and applicable rates.

#### COUNCILOR’S REPORT – Tom Pickett

There has been no Councilors’ meeting since the last SPE AD board meeting.

#### ANTEC 2015 – Suresh Shah

Six papers will be presented in the Automotive Session which begins at 1:00 p.m., Wednesday, March 25th. Please read the December newsletter for additional information. Anthony and Suresh are moderators. Jeff or Tom will accept the Communication and Pinnacle awards at ANTEC. Suresh is also receiving a major award. The SPE AD nominated 6 parts, selected from the top ACCE and IAG winners, for the ANTEC global parts competition.

#### MARCOM – Peggy Malnati

**AutoEPCON 2015:** May 5, 2015 at the Troy Marriott. The Detroit section is coordinating all marcom through SPE HQ.

**ACCE 2015:** September 9-11, 2015 at Diamond Center in Novi. Theme: *Composites — The Next Generation of Lightweighting.*

A motion to pay the 2014 outstanding fees for four-year SPE student memberships (ACCE paper & poster presenters) was passed. The cost of \$128/student is shared 50:50 with the Composites Division. The estimated cost is \$1,920 for the SPE AD.

## February BOD Minutes CONTINUED FROM PAGE 34

The new graphics for the 2015 ACCE program cover and website have been approved and implemented. The call for papers flier has been printed and some ads have been submitted to publishers. Four press releases are in review. Abstracts are due at the end of March, presentations at the end of May.

**IAG 2014:** November 11, 2015, Burton Manor, Livonia. Theme: *The Future Looks Light*

First Round Judging: October 1-2, Celanese, Auburn Hills.

Blue Ribbon Judging: October 12, Celanese, Auburn Hills.

The cover design is complete and the first press release has been approved.

Preliminary financial results for the 2014 event were reported by Jeff. Total revenue thus far is \$212,917 and total expenses are \$184,154 for revenues of \$28,763. After the 6% revenue royalty payment (\$12,775) to SPE HQ, net AD revenues for the 2014 IAG are \$15,988. In the past, royalties were not required. Costs are rising; investigate options to increase revenue and further control costs. Mark will provide the final 2014 table count for the next meeting.

**SPE AD Online:** The website banner and buttons have been updated for 2015. December 2014 set a new all time record for highest unique visits (62,539), surpassing the previous high of 57,681 set November 2014. January 2015 set the 2nd highest all time record at 58,500 and the highest January ever (by almost 23,000 hits). SPE AD doesn't pay for position.

**SPE AD Dec. 2014 Newsletter:** The lead article for the March newsletter is the 2015 ACCE. The key columns are: *An Engineer's Life* (Suresh Shah); *Service through Science* (Suzanne Cole); *Batter's Box* (Mike Jackson, IHS, Changing Work Environment for Engineers), *OEM Corner* (Ed Luibrand), *Meet Your SPE Staff* (Barbara Spain, SPE HQ), and; the new feature *Designer's Den/Corner on Design* (Rodger Assaker, e-Xstream engineering). The technical article is the last 2014 ACCE best paper winner.

**Other Marcom:** The SPE AD received the highest Pinnacle and Communication Excellence awards. Every event swap henceforth must be pre-approved by HQ and only division or section logos may be used, not the generic SPE shield. HQ approved the *Infocast 2<sup>nd</sup> Lightweighting Summit* (March 3-5, 2015) swap. SPE AD members receive a 15% discount, the Auto Div. has a booth, and division literature will be distributed.

**Jackie Rehkopf Endowed Scholarship:** The lawyer provided information on "The Community Foundation of SE Michigan (CFSEM)." This organization has over 30 years' experience managing endowed funds including those for non-profit groups. Tax laws make it difficult to grant international scholarships. As well, scholarships should go to the school to be disbursed to the student, or students who are US citizens will owe taxes on the scholarships. A minimum of \$100K is required to establish an endowed scholarship. The management fee is 1% per annum and 4-5% of the fund is typically disbursed each year. The motion to issue a "call for funding" was approved. If we fail to reach the minimum, a memorial fund to provide enrichment funds to schools and universities is an alternative to an endowed scholarship. Next steps: Clarify whether it is possible to set up a permanent scholarship at the University of Waterloo, Jackie's *alma mater*.

### SPONSORSHIP – Teri Chouinard

There are 9 newsletter sponsors totaling \$32,700 and 60 2015 ACCE sponsors.

### GOLF OUTING – Fred Deans

The ACCE golf outing will be held again at Fieldstone, which has maintained prices. Last year's \$15K golf outing generated a net revenue of \$6K. Fred recognized Teri's long-term success managing sponsorships for the event.

### 3-D PRINTING CONFERENCE

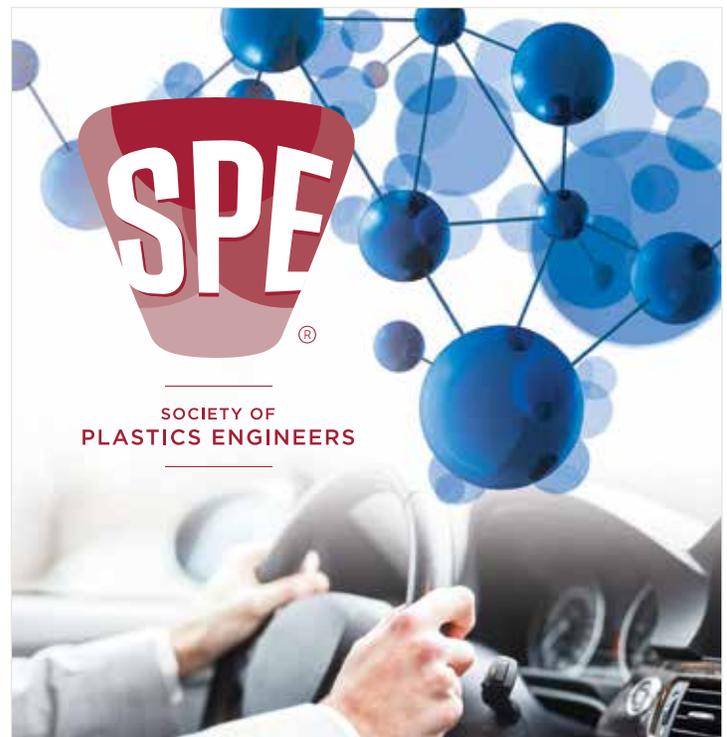
A subcommittee comprised of Steve, Suresh, and Umesh Gandhi will meet to determine approaches for launching the 3D printing MINICON or module within another event. Refer to the December 8, minutes for the initial proposal discussion.

### OTHER BUSINESS

The committee to manage the Jackie Rehkopf scholarship includes Fred and Peggy.

Elias is the Chair Elect and Ed is Vice-Chair. Discuss candidates for the next Vice-Chair at the April 13th board meeting. In June Ed transitions to Chair Elect and Elias to Chair.

**Next meetings:** Mondays in 2015: April 13 and June 8.



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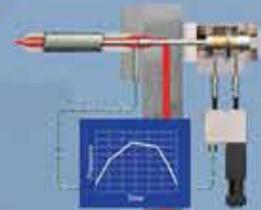
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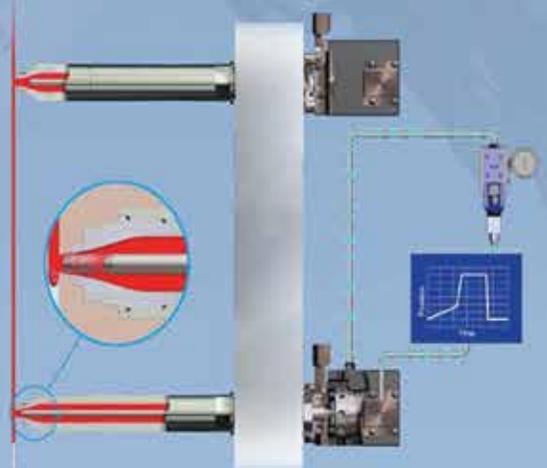
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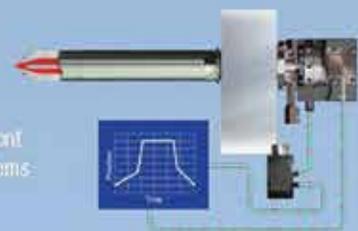
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# SOCIAL REPORT

Teri Chouinard,  
SPE Automotive Div. Social Chair



## 2014 Holiday Mixer Proved Fun for All

Close to 30 new and current SPE Automotive Div. members enjoyed delicious food, beverages, and camaraderie at December's Holiday Mixer at Ruth's Chris Steak House in Troy, MI, USA. New OEM members in attendance were from the FCA US LLC (Fiat Chrysler Automobiles) and Hyundai Motor Co. New and current members from Abaris Training Resources, Inc., Addcomp North America Inc., Advanced Innovative Solutions, Ltd., Asahi Kasei Plastics North America Inc., BASF Corp., DSM Engineering Plastics, Flint Hills Resources, Global Polymer Solutions, Hanwha Azdel, Inc., Hengst Automotive, IAC Group, Inteva Products LLC, Incoe Corp., Kaco USA, Matheson Group, Miller Cole LLC, Plasan Carbon Composites, PolyAd Services, and Sumitomo Chemical Group also enjoyed the evening. Having representatives from such a large variety of companies made the evening especially interesting and fun. Everyone expressed appreciation for the event and their gratitude to the SPE Automotive Div. for adding value to their SPE membership. Here are a few comments from some of the attendees:



- "There are very few opportunities to meet 'plastics people' in such a nice setting," notes Jim Bott, business development manager, Incoe Corp.
- "I had great fun, renewed old acquaintances, and made some new connections," adds David Reed, retired, General Motors Corp.
- "For all our technology today," said Bill White, marketing consultant, Abaris Training Resources, Inc., "There's a lot to be said for face-to-face communications. I learned more about current market trends and made new friends."
- "SPE events are always great for reconnecting with old friends who've moved on to other companies," explains Edward Luibrand, materials senior specialist-Organic Materials Engineering, FCA US LLC. "I ran into several materials-supplier representatives who called on me years ago."
- "These outings are a great way to network with other SPE members and enjoy the holiday season," adds Bill Windscheif, president, Advanced Innovative Solutions, Ltd.





Social CONTINUED FROM PAGE 37



## Next Social Event: April 30th @ The Cellar Door in Auburn Hills

Mark your calendar and watch for more information by eMail on our next Detroit-area social event, which will be held on Thursday, April 30th, at The Cellar Door wine academy (<http://www.cellardoorclub.com/>) in Auburn Hills, MI, USA. "Wine 101" will include a 30 – 45 minute introduction to the wonders of fine wine, including varieties available, the proper glassware for serving, and pairing wine with food for maximum flavor. Each guest will be offered 2 oz sample pours of 5 – 6 different wines with cheese and bread to enhance the experience. Guests will enjoy this truly unique and unforgettable winery setting while learning more about fine wine and the fine benefits of being an SPE member. The event is limited to 40 people so register quickly if interested in attending at: <http://spead-social.com>.



## 2015 SPE Automotive Division Golf Outing & ACCE Welcome Reception



Another opportunity to get out and meet fellow SPE members will be at the 21st annual SPE Automotive Div. Golf Outing on Tuesday, September, 8th at Fieldstone Golf Club in Auburn Hills, MI (<http://www.fieldstonegolfclub.com/>). The day-long outing will take place one day before the 15th-annual SPE Automotive Composites Conference & Exhibition (ACCE) at a beautiful and award-winning course. September usually has some of our best weather in Michigan. Sponsorship opportunities are available. Please see the ad in this newsletter or go to our SPE Automotive Division Golf Outing webpage at <http://speautomotive.com/golf.htm> for more info.

That very same evening, those attending either the golf outing or SPE ACCE are invited to continue with more SPE networking at our welcoming reception in The Fireside Lounge at the Hyatt Place Detroit/Novi hotel (attached to the Diamond Conference Center at The Suburban Collection Showplace where the ACCE show will be held). The gathering runs from 8:00-10:00 p.m. and will feature light appetizers and a cash bar. Of course, the SPE ACCE runs from Wednesday through Friday, September 9-11 at the Diamond Center.

We hope to see you soon at an upcoming SPE social event or educational conference.

The purpose of the SPE Automotive Div. Social Events is to nurture networking, have fun, and build membership. If you have an idea for a social event, which may include a tour of your facility or other educational and fun ideas that will interest our membership and draw new members, please email [teri@intuitgroup.com](mailto:teri@intuitgroup.com) or call +1.810.797.7242.



## MEMBERSHIP REPORT

Steve VanLoozen

SPE Automotive Div. Membership Chair



*The Automotive Division's* 2014 OEM membership drive was such a success that we are extending it into 2015. We were able to add 20 new OEM members to our division's membership roster along with two new board members: Dr. Umesh Gandhi (Toyota Motor Corp.) and Mr. Matt Carroll (General Motors Co.). We would like to thank both Umesh and Matt for offering to get more involved with SPE. Certainly, their contributions to our division will help grow our vision as well as help guide the board regarding what value we can help deliver to automakers.

Having greater participation from OEMs is critical to our growth as they represent the very top of the supply chain we serve. Of course, the automotive supply chain is one of the largest and most complex of any industry and to this end our overall membership grew by 34% in 2014 (354 new members). This growth is absolutely astounding and we would love to believe we can continue this in 2015. Thank you to all of our new members and we look forward to hearing from all of you on how we can deliver the most value for your membership.

Kind Regards,

*Steven VanLoozen*

Steven VanLoozen

SPE Automotive Division Membership Chair

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