

# Automotive Plastics News

Today, Tomorrow - Together

October 2004 Volume 34, Issue 1



## Automotive Composites Conference 2004

The new Porsche Carrera GT "Super" Sports Car was designed for "light" weight, superior handling, and high performance (605 bhp and 0 to 60 mph in 3.5 sec.) according to SPE's Automotive Conference & Exposition's keynote speaker Dr. Ing. Michael Holscher, Chief Engineer, Carrera GT Vehicle, Porsche AG. Light weight and high performance composites were apply fitting in the design scheme for the new Carrera GT. The use of carbon fiber composites for interior, underhood, powertrain, and the full chassis construction met or exceeded vehicle requirements. Dr. Holscher's presentation showed the depth, versatility, and usage of composites for world - class vehicle construction.

New composite applications are not limited to just "niche" vehicles or small volume applications. Marcia Kurcz, Market Manager, Quadrant Plastic Composites, Inc. presented an approach to high-volume, all thermoplastic composite spare wheel wells that have been adopted by DaimlerChrysler AG. Ms. Kurcz's point was that this composite application, developed in Europe, is now ready for adoption on a global basis by all OEM manufacturers.

The Conference's panel discussion on "The Current Health and Future of Automotive Composites" involved candid and realistic appraisals of the industry. Moderated by Dale



Brosius, of Brosius Management Consulting, the panel consisted of OE Materials Managers - Dr. Doug Denton, DaimlerChrysler, Dave Steenkammer, Ford Motor Co., Michael Bernas, Toyota, Dave Matthis, General Motors, Jay Batten, Delphi Corp., and Gary Lowndale, TransTech International.

Over 270 participants, speakers, and attendees benefited from SPE's 2-day Automotive Conference and Exposition, which was held at the Michigan State University's Management Education Center in Troy, MI, September 14 & 15, 2004. Although the majority of presentations were focused on composite materials, processes, and applications, the Conference had a variety of related topics, such as dealing in the China automotive



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## Innovation Awards Program - Page 8

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# Treasurer's Report

Brian Grosser

The current assets of the Automotive Division are \$84,514

The 2004 Golf Outing was a financial success as we made \$3,008 for the event (income of \$11,419 less expenses of \$8,411). Thanks to Jim Staargaard for organizing a great event.

We have received \$60,504 in registrations and sponsorships for the 2004 Composites Conference. Expenses to date total \$27,837.

Lastly, we have received our first sponsorships for the 2004 Automotive Awards event (\$9,800). To date, we have spent \$32,645 on this event. More updates on this event as the November date approaches.

## Automotive Division Meeting Schedule and Special Events Calendar

November 10, 2004 Burton Manor, Livonia, MI	Innovation Awards Program
December 6, 2004 APC, Troy, MI	Automotive Division Board of Directors Meeting
February 7, 2005 APC, Troy, MI	Automotive Division Board of Directors Meeting
April 11, 2005 APC, Troy, MI	Automotive Division Board of Directors Meeting

Automotive Division Board of Directors meetings are open to all SPE members. Call Monica Prokopysheh at 248.576.7349 for more information.

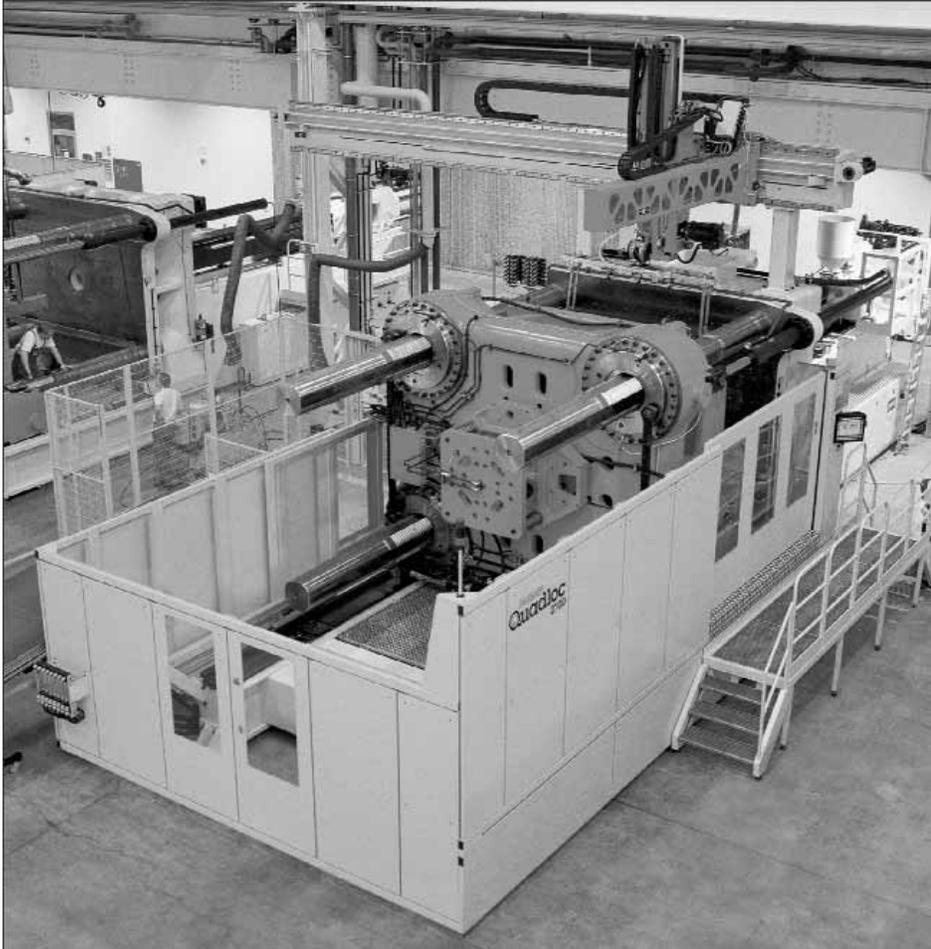
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# Chairman's Message

Monica Prokopyshen

The morning chill provides a brisk reminder that it is **harvest time** - not only for nature's bounty, but also a time for the Automotive Division members and constituents to enjoy the fruits of this year's hard work:

- SPE Automotive Division Golf Outing (July 26, 2004)
- Pride and Outstanding Achiever Awards
- Member Honors: Norm Kakarala (Fellow), Kevin Pageau and Suresh Shah (Honored Service Members),
- Growth in membership
- The phenomenal success and growth of the SPE Automotive Composites Conference and Exposition, jointly sponsored by the Automotive and Composites Divisions and held September 14-15, 2004
- High caliber nominations for the Annual Innovation Awards Program, November 10, 2004.

Fall is also the time that the Automotive Division goes **back to school**. September 28, the American Plastics Council and SPE Automotive Division kicked off a joint class project with the **Center for Creative Studies (CCS)**, Transportation Studies Group. The project focus is emerging interior and exterior surface technologies in materials and processes, to be executed in a ¼ scale polymer intensive "pick up truck". Division members who are interested in participating through a class presentation or project reviews and feedback can contact either Jim Kolb (APC) at (248) 244-8920 or Monica Prokopyshen (SPE AD) at (248) 576-7349, or by sending an email from the SPE AD web site (Contact Us). You can link to the CCS Transportation Project from the SPE AD Educational Support web page.

The Automotive Division and Detroit Section are again sponsoring the **PlastiVan™** this fiscal year. This program brings hands-on polymer science experiments to students in grades 3 through 12. If you are interested in bringing the program to a Metro Detroit Region School, please make a



reservation through our web site. If you are outside the metropolitan Detroit region, you may

contact the National Plastics Museum (plastivan@plasticsmuseum.org or (978) 840-1950) for further information.

**Explorathon** - Suzanne O. Frankie (Oakland Schools) was glad to hear that the Division will again be sponsoring a full day's "Designing with Plastics" program for the 2005 Explorathon, Friday, February 18, 2005 at Seaholm High School, Birmingham: "Great you will be back with us this year with that terrific PlastiVan!! Everyone's favorite workshop!" The program is a combination of hands-on polymer experiments and automotive design case studies. It is aimed primarily at students in grades 8 through 12 who might not otherwise explore careers in maths, sciences, and engineering. Students evaluated the session at 94% on a scale of 0 (low) to 100 (high.) Although comments were optional, 93% of the students provided them. Here are some representative comments:

What was most useful this session?

*How there are different plastics and what each plastic is used for.*

*She explained everything in a fun way. It is hands on. All the information & the experiments were awesome.*

*The hands-on activities and presenters' enthusiasm. Wasn't as boring as I thought.*

What might have made it better?

*Nothing, it was great.*

*Nothing keep as is.*

*More time to experiment.*

*It could have been longer.*

The most telling comment came from a student who had not selected the "Designing with Plastics" session but had been "assigned" to it by one of the teachers: "I had low expectations coming in, but it was great!" She had taken the time to both submit written comments and to share her enthusiasm for the session.

As a Division, continuous improvement is important to us, and it is not limited to our educational efforts. If you as a member have suggestions, they are always welcome.

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# 4th Annual SPE Automotive Composites Conference Draws World-Class Participants and Attendees



*Gordie Meisel (Ashland Chemical - Retired) and Annie Walter (Polywheels Design, Engineering & Sales) at the checkin desk.*

*Continued from page 4*

market, web-based tools for generating new business development, and overall trends, potentials, and competition for composite materials.

"The success of the Conference is directly related to our sponsorship support," according to Tim Simko, Conference Sponsorship Chair. Once again, over 20 companies provided the financial and program support. Also, again, the media and society support was well received. Peggy Malnati, Conference Co-Chair and Communications Co-Chair, arranged the participation by a variety of media, industry groups, and technical societies.

The SPE Automotive Composites Conference has become an annual event that draws speakers, sponsors, and participants from around the world. State-of-the Art composite applications, materials, and processes were



*Tino Fuhrmann (Volkswagon AG), Dr. Duane Priddy (Omnexus/Special Chem) and Automotive Composites Co-Chair Fred Deans (Azdel, Inc).*

discussed, as well as, on display. Organized by volunteers from SPE's Automotive and Composites Divisions, the Conference and Exposition is held every September.

We would like to thank all those who made this event possible.

## **Premier Sponsors:**

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**Paragon Die & Engineering**

**Plastics Technology Laboratories, Inc.**

## **Media and Society Sponsors:**

Composites Fabrication Magazine & American Composites Manufacturers Assoc. (ACMA)

Composites News Magazine

Composites technology & High-Performance Composites Magazine

Omnexus/Special Chem

Society of Manufacturing Engineers (SME) & Manufacturing Engineering Magazine

**Keynote Speakers:**

Robert Eller, Robert Eller Associates, Inc.  
Robert Nelson, GE Advanced Materials  
Dr. Ing. Michael Holscher, Porsche AG  
Dr. Duane Priddy, Jr., Omnexus/SpecialChem  
Jason Sprong, Vital Sourcing

**SPE Organizing Committee:**

Peggy Malnati, Malnati & Assoc.  
Dr. Michael Connolly, Huntsman Polyurethanes  
Dr. Enamul Haque, OC Automotive,  
Stuart Cohen, Ticona (retired)  
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Nippani Rao, DaimlerChrysler  
Terry Seagrave, Bayer Materials Science  
Dr. Suresh Shah, Delphi Corp.  
Jay Rasoni, Delphi Corp.  
Dr. Al Murray, Ecoplexus  
Greg Grotke, OC Automotive  
Tim Johnson, Nida-Core  
Dan Houston, Ford Motor Co.  
Mark Lapain, Intier Automotive  
Gordon Meisel, G. B. Meisel, Inc.  
Jackie Rehkopf, Ford Motor Co.  
Dale Brosius, Brosius Management Consulting  
Fred Deans, AZDEL, Inc.



Over 20 companies set up displays at the Conference, showcasing new components, materials, and technologies related to the automotive composites industry.

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# Councilor's Corner

Nippani Rao

Next Councilor's meeting is scheduled for October 8th and 9th, 2004 in Cleveland. I am planning to attend.

Current status and key agenda items:

**SPE National Financial Status 6/30/03:**

- Income \$3,102,717
- Expenses \$2,079,525
- Staff costs \$1,352,783
- Operating income (\$329,590)
- Non operating income \$7,387
- Total Net (\$322,203),
- Impact of rebate \$162,000
- June 30 Net Income/(Expense) (\$160,203)

**2005 Budget:**

- Income \$5,820,000
- Direct costs \$3,271,100
- Staff costs \$1,784,480

- Other overhead \$685,000
- Net contribution \$79,000
- Plus Rebates with held

• \$145,000 Attrition charge at ANTEC.

**ANTEC Financials:**

- Income \$935,474 vs \$1,095,400 Budget
- Expenses \$860,000 vs \$794,165 Budget
- Net Income \$75,474 vs \$301,235 Budget

**Other items**

- \$165,000 SPE Foundation expenses to be absorbed by SPE
- ANTEC is not working - we are not making money. We need to change. Alternate proposals will be discussed.
- Membership 20,132 projected for 2004 vs 19,475 for 2003. Current status 21,119
- New Pinnacle Award, combining PRIDE and STAR
- New Rebate system

## GPEC 2005: Global Plastics Environmental Conference: "Creating Sustainability for the Environment"

Preparations are well underway for the upcoming GPEC 2005 in Atlanta. Conference committee members are working hard to once again deliver an enlightening and thought provoking conference. This year's conference theme is "Creating Sustainability for the Environment". In keeping with this theme, we will have numerous papers presenting an array of topics that closely mirrors the needs of the industry supply chain. These papers will also be confronting the sustainability issue.

Atlanta represents a new venue for our conference. Many major corporations have both headquarters and operations either in the city or region. This year, the conference will be located at the Sheraton Gateway Atlanta Airport Hotel. The hotel is first rate and conveniently located adjacent to an airport that is a hub for many carriers thereby providing accessibility for both our domestic and international attendees.

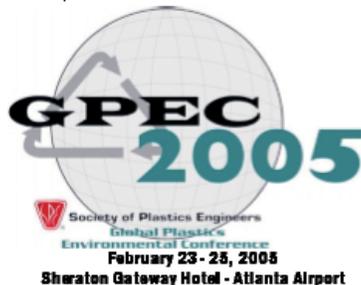
GPEC attendees will have an outstanding opportunity to gain valuable training in a workshop on "Competitive Intelligence Methodology." (see highlights on page 3)

We have again arranged for a "Connections Reception" along with the "Student Poster Presentations." This well attended reception provides an opportunity to meet and interact with fellow attendees, speakers, sponsors, students, and exhibitors.



**Bio-Based Materials 2003 Award:** Ashland Specialty Chemical Company, a Division of Ashland, Inc. met John Deere's environmental needs by developing a bio-based thermoset resin with enhanced processability over pure petroleum alternatives. ENVIRIZ 5000 resin system is the first commercial unsaturated polyester that uses a significant amount of soybean oil and ethanol from corn in its production.

The Annual Environmental Awards luncheon will highlight the efforts of companies and organizations, who that have demonstrated environmental leadership and excellence, through significant achievements. Press coverage at last year's awards ceremony was extensive and created an opportunity for award recipients to showcase their leading edge products and programs. Pictures and summaries of last year's award winners are shown in this brochure.



**Enabling Technologies in Processes & Procedures 2003 Award:** EREMA developed the "VacuKona" system for the recycling of RPET back into high grade, food use products such as a pellet for "Bottle to Bottle," thermoformable sheet, fibres and strapping. It has US FDA "non-objection" for food grade applications and is able to maintain 1V, or in certain cases raise the 1V.

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# Inter-Society Outreach

Mark Lapain

## SPE

### International Polyolefins Conference 2005

February 27-March 2, 2005, Houston, TX

### 4<sup>th</sup> Additives & Colors Conference

March 16-17, 2005, Dorint Quellenhof Hotel, Aachen, Germany

### Annual Technical Conference - ANTEC 2005

May 1-5, 2005, Sheraton Boston Hotel & Towers and The Hynes Convention Center, Boston, MA

## SAMPE

### 36th International SAMPE Technical Conference

November 15-18, 2004, Sheraton San Diego Hotel & Marina, San Diego, CA

### 26th Europe International Conference Forum and Tutorials/JEC

April 5-7, 2005, Paris, France

### SAMPE 2005 Symposium & Exhibition

May 1-5, 2005, Long Beach, CA

## SAE

### SAE Commercial Vehicle Engineering Congress & Exhibition

October 26-28, 2004, Donald Stephens Convention Center, Rosemont, IL

### 2005 SAE World Congress

April 11-14, 2005, Cobo Center, Detroit, MI

### Government-Industry Meeting

May 9-11, 2005, Loews L'Enfant Plaza, Washington, DC

## SME

### FABTECH International 2004 Exposition & Conference

October 26-28, 2004, I-X Center, Cleveland, OH

### EASTECH 2005 Exposition & Conference

May 24-26, 2005, Eastern States Exposition, W. Springfield, MA

### Midwest 2005 Exposition & Conference

September 13-15, 2005, Novi Expo Center, Novi, MI

## Miscellaneous

### K 2004 Show

October 20-27, 2004, Düsseldorf, Germany

### POLYCON 2005

February 17-19, 2005, Nashville Convention Center, Nashville, TN

### 2005 Midwest Conference - ACMA

March 15-16, 2005, South Bend, IN



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# 2004 SPE Automotive Division 34<sup>th</sup> Annual Innovation Awards Program

By Suzanne Cole, Awards Chairman

The 2004 Innovation Awards Black Tie Gala on Wednesday November 10 at Burton Manor in Livonia, Michigan is quickly approaching! Contact Pat Levine at the SPE Automotive Division office in Troy at 248.244.8993, to reserve your tickets. We are expecting a sold out crowd this year.

In today's frantic auto industry, pressure is on the entire supply chain to innovate faster, design faster, launch faster and produce faster with furious attention paid to price and quality in a race to sell more vehicles worldwide. Performance, customization and personalization are emerging as key trends within the automotive industry in the race to win more customers and market share worldwide. Our theme for the 2004 Innovation Awards Gala is "Fast and Furious".

The automotive industry is on the brink of a revolution, and the plastics industry is poised to play a major role. In North America and globally, new technology and partnerships are enabling improvements in safety, breakthroughs in fuel delivery, structural support and comfort as well as savings in energy efficiency.

Helping drive this revolution is the innovative use of plastics and plastic composites. The automotive plastics industry is beginning to accelerate the development of innovative breakthrough products deliver superior value to customers and help the automotive industry set new standards in design, safety and environmental performance.

This year's nominations have been overwhelming

with several cutting edge innovations, which break new ground for the plastics industry. Some of the trends that have emerged from our nominations and subsequent judging include larger plastic parts, more sophisticated design and processes, and breakthrough applications in under the hood and chassis components never seen before in the auto industry.

The "Fast and Furious" gala will feature the latest vehicle introductions from Ford, DaimlerChrysler, GM, Porsche and others including the Ford GT and all new Mustang, the newly introduced Porsche Carrera GT with an all composite engine frame, the Crossfire Convertible, Dodge Powerwagon, Corvette C-6, customized vehicles displaying the latest technologies and plastic materials as well as cutting edge commercial footage from automakers' latest vehicle introductions. We are receiving an overwhelming response and request for gala tickets, so order now as we fully expect this year to be a record setting event!

One of the compelling reasons for our near sold out status is the outstanding caliber of our Executive Award Recipients. Our Executive Leadership and Lifetime Achievement Award Recipients are industry "All Stars". The two executives are extremely deserving, hard hitting leaders who stand out within the global automotive industry, their achievements are unparalleled and both have demonstrated their support of plastics in vehicle applications worldwide.

The SPE Automotive Division Executive Leadership Award for 2004 is Jim Padilla, Chief Operating Officer, Ford Motor Company, and





*Jim Padilla, Chief Operating Officer, Ford Motor Company, and Chairman, Automotive Operations.*

Chairman, Automotive Operations. He is responsible for the global automotive business. Padilla was most recently president, North America and South America Operations. In that role, he was responsible for all operations in the development, manufacturing, marketing and sales of Ford, Mercury and Lincoln vehicles in the United States, Canada, Mexico and South America. He had been appointed president of North America Nov. 14, 2002, and added oversight of South America on Sept. 10, 2003.

Padilla, 57, previously was group vice president, North America. Prior to that, he was group vice president, Global Manufacturing and Quality. From January 1999 until July 31, 2001, he was group vice president, Global Manufacturing.

The SPE Automotive Division Lifetime Leadership Award Recipient is Tom Moore, Vice President, Liberty and Technical Affairs, DaimlerChrysler (retired). Tom has been a major force in promoting the use of plastics in automotive applications for many years. Tom held leadership positions at DaimlerChrysler and Ford Motor Company.

From February 1989 to July 2003, Tom was Vice President - Liberty



*Tom Moore, Vice President, Liberty and Technical Affairs, DaimlerChrysler (retired)*

and Technical Affairs at DaimlerChrysler in Auburn Hills. Tom was the leader of a well-known "skunkworks" conducting all of the Chrysler Group's advanced technology development (5 to 10 years before production). Liberty focused on finding, inventing, or developing technical solutions to meet the customer needs, regulatory requirements, and profit levels that are vital to producing competitive future cars and trucks. There was a major cultural tendency toward urgency with a strong bias for concentrating on moving new ideas into concept prototype vehicles to quickly prove out customer appeal, function, packageability, and economic viability.

Liberty was a group of 100 people who formed the core DaimlerChrysler activity, but were greatly expanded through the use of the automotive supplier community. The term "iceberg organization" had been coined to show that most of the team's resources were hidden below the organization chart, at the supplier, but were managed by the core team to produce concept prototypes that met functional, cost, and timing targets.

Major accomplishments that have been shown publicly include: the PNGV "super car" called Dodge ESX3 (72 mpg hybrid electric diesel w/ plastic body), Jeep Commander 2 (methanol fuel cell powered hybrid concept vehicle), Dodge Power Box ("thru-the-road" hybrid (T. Moore patent) using compressed natural gas fuel w/350 mile range), "cone-of-sound" speaker system to allow each seat to have unique sound w/o headphones, Jeep Grand Cherokee Concierge (ten novel new customer features), and the well publicized "Natrium" minivan powered by a fuel cell using NaBH4 fuel - a world first.

**Break Through Plastic Innovations Are the Core of This Years Category Finalists**

At the heart of this year's event are the innovative component finalists within our 9 judging categories, which have been chosen by our Board of Directors.

An elite group of Blue Ribbon judges comprised of

Continued page 10

automotive and plastics journal editors and automotive industry experts will unite to select the category winners on October 15 for announcement on the evening of November 10. Hence a lot of excitement and anticipation will be in the air for this extraordinary event.

The 2004 "Fast and Furious" Gala is an event you will want to attend to see the break through automotive plastic components that are charting new territory in the materials race, breakthroughs that haven't been seen in over a decade.

Winners will be selected from nine categories, which include Body Interior, Body Exterior, Chassis/Hardware, Process/Assembly/Enabling Technologies, Powertrain, Materials, Environmental, and Performance/Customization. In addition the Hall of Fame and Grand Award (which is selected from the 9 category winners) recipients will be announced at the event.

Innovative finalist nominations range from the Porsche Carrera GT carbon fiber reinforced composite engine frame to the Ford GT SIB fuel tank assembly, to the 2005 Ford Mustang door trim with integrated acoustic chamber and subwoofer, to plastic hard doors for the GEM DaimlerChrysler Electric Vehicle to the running boards for the 2005 GM SSR Roadster and many other very innovative plastic components.

Winners in each of the 9 categories as well as the Hall of Fame and Grand Award Winner will not be announced until the evening of the Innovative Awards Gala.

Overall the "Fast and Furious" Innovation Awards Gala is an event you will want to invite your company executives and clients to attend. Our executive award recipients are icons in the auto industry and our finalists are truly exceptional! We fully anticipate a sold-out event so order your tickets today to avoid last minute disappointment.



*Robert Schad, President and CEO of the Husky Corporation, received the SPE Automotive Division "Executive Leadership Award" from Awards Program Chairman Stuart Cohen at the 33rd Annual Innovation Awards Program.*



*Above: The 03MY smart™ Roadster roof module, developed by ArvinMeritor, uses General Electric's new LEXAN SLX film. The Class A surface module replaces painted steel resulting in a 50 percent weight savings. The lightweight targa top, available in solid or metallic colors, is easily removed and easily repaired.*



*Left: The 2003 SPE Automotive Division "Most Innovative Use of Plastics" Grand Award Winning Team - smart Roadster Roof Module*

# Attend the 34<sup>th</sup> Annual Innovation Awards Program



Don't miss this fantastic evening. See first hand the latest innovations in the award categories of Body Interior, Body Exterior, Environmental, Materials, Chassis/Hardware, Performance & Customization, and Process/Enabling Technologies.

All nominated applications will be on display for you to review in detail. It is an evening you do not want to miss!

## Ticket Information

- ◆ Tickets are \$100 each
- ◆ Tables of ten (10) are available for \$1,000 and include Corporate Signage



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# A Case for Replacing Steel with Glass-Mat Thermoplastic Composites in Spare Wheel Well Applications

Marcia Kurcz, Burak Baser, Harri Dittmar, Joachim Sengbusch, Hans Pfister  
Quadrant Plastic Composites, AG

**Editors Note:** This is an edited version of a paper presented at the 2004 Automotive Composites Conference

This paper will discuss the use of glass-mat-thermoplastic (GMT) composite to replace steel in spare-wheel wells (SWW) by European automakers and tier suppliers. Although this application has been successfully translated across multiple OEMs and platforms in this geography for 10 years, it is still little known and less understood in the Americas and Asia/Pacific despite its numerous advantages. In an attempt to help automakers and tier suppliers in other parts of the world understand the benefits of this technology, the paper will discuss OEM performance criteria, design requirements, tooling and manufacturing of the part, as well as requirements for finished assembly into the vehicle vs. traditional steel systems.

## Background and Requirements

The spare-wheel well is a common component on most passenger vehicles with a trunk or rear hatch (back door). This round or square pan is mounted into the trunk opening, where it holds an extra wheel, tire iron, and jack. A loadfloor usually covers its. The loadfloor may also be carpeted, to provide an integral surface inside the floor of the trunk.

This component must pass a number of tests. Spare-wheel wells mounted into the vehicle must meet impact requirements. The wheel well must stay attached to the vehicle frame after a crash. Impact performance is influenced not only by the structure of the well itself, but also by the amount of energy that is absorbed by the steel or aluminum wheel hub. This test is considered to be the most important requirement for any SWW design to pass by all European OEMs.

SWW components are also subjected to tests that evaluate resistance to noise/vibration/harshness (NVH), hot and cold climates, flammability, common automotive chemicals, and long-term heat aging. Additional tests include drivability over rough roads, a test simulating driving up over a curb and scraping the bottom of the vehicle, and various standard mechanical tests conducted on complete parts for impact, tensile strength, elongation, etc.



Spare Wheel Well (SWW) on the Mercedes C-Class

## Switching from Steel to Composites

Although steel is the long-time incumbent in SWWs, for the past decade, European OEMs has been using increasing amounts of composite materials for this application to reduce weight and costs. By virtue of their lower specific gravity, polymer composites have generally had the advantage of lighter weight parts vs. metals. Now, steel's price increases can often provide composites with an advantage in terms of systems costs too, especially for shorter production-run vehicles where the high cost of steel tooling takes longer to amortize.

## Typical Composite Options

The most common polymer composites in use in conventional passenger vehicles include:

- Glass-mat thermoplastic (GMT) - a sheet-form composite comprised of a thermoplastic matrix (typically polypropylene, but theoretically may be virtually any thermoplastic) with various types of glass mat (continuous strand, randomly oriented, short chopped fiber, unidirectional or a woven glass cloth. Various types of GMT composite can be stacked in the mold to tune a part without changing the tool. GMT offers better preservation of glass fiber length (30 - 50 mm or greater) for higher impact and stiffness vs. LFT and SMC.
- Long-fiber thermoplastic (LFT) - a direct, in-line compounding process that combines a thermoplastic matrix (typically polypropylene, but theoretically may be virtually any thermoplastic), with additives, then uses the melt to wet-out and impregnate long glass fiber rovings, which are subsequently cut to size to form a reinforced sheet that can subsequently be molded by compression or compression-transfer molding. Fibers, after molding, typically have an average length of 5 - 20 mm.
- Sheet-molding compound (SMC) - a precompounded sheet-form prepreg of thermosetting polyester resin and chopped glass fiber (25 or 50 mm) that is processed by injection or compression molding; must be kept refrigerated prior to processing and has shelf-life constraints.

GMT and LFT are thermoplastic materials that can be melt-reprocessed, whereas SMC is a thermoset. Use of thermoplastic components facilitates recycling both in-plant scrap and post-consumer components - an important feature in Europe where all vehicle components must be able to be recycled. GMT and LFT have polypropylene resin matrices, offering lower specific gravity than polyester-based SMC for lighter weight parts at comparable wall

thicknesses. Additionally, SMC is known to be brittle, so is not well suited for applications subject to impact. SMC is also characterized by relatively long cycle times, on average 2-3 min for a part like a spare-wheel well.

### Overall Composite Benefits

Polymer composites provide:

- Reduced weight and systems costs.
- Smaller package space required for stowing the tire.
- Better sound damping vs. steel for a quieter vehicle.
- Opportunity to add additional ergonomic features, stowage, and other space- and parts-consolidation at no additional processing costs.
- Lower tooling costs
- Reduced assembly-line space and cost
- Improved worker ergonomics and efficiency attained by maintaining an open trunk through manufacturing.
- Better NVH due to plastics' inherently better sound damping properties.
- No corrosion issues.

With all these advantages, it is natural to ask why composites have not been used in SWW applications outside of Europe. Switching materials does necessitate making changes. For instance, on the assembly line, the SWW is installed after e-coat - ideally, late in the assembly process. Additionally, changing the way tooling costs are amortized - not just piece price based on total vehicle build, but equations that also factor in a total reduction in tooling costs for a given program - also makes composite wheel wells more attractive. Finally, at least in the case of North American OEMs, switching to composite SWW components involves moving work currently done by unionized autoworkers out to tier suppliers.

Implications to North American assembly operations of moving to a GMT composite SWW are as follow:

- The fuel tank can now be put into position from behind or above (through the trunk lid opening). This allows the tank assembly to take place when the vehicle is being worked on at the "ground level."
- The same robot that applies the windshield adhesive applies the adhesive that connects the composite wheel well to the body.
- The adhesive/sealant used to glue the SWW to the BIW is the same 2-part urethane used to attach the windshield.
- In Europe, the trunk is considered a separate component from the chassis. Engineers examine it for opportunities to reduce cost and weight, increase functionality, and consolidate components. In North America, the trunk is not "owned" by one particular design group but rather is considered to be part of the frame, making it harder to find an internal champion for the conversion.

Vehicle programs that are candidates for a conversion to composites have the following attributes:

- New model with flexibility in assembly-line design;
- Desire for molded in features like storage compartments, battery trays, etc.;

- Accounting advantage given for cost-effective tooling (\$500,000 USD or less);
- Build volume of 100,000 - 300,000 vehicles
- Design requirement to protect spare wheel from heat and environment by storing them internally, without also impeding on passenger space.

### Decade of Success in Europe

Composite spare wheel wells (SWW) have been used successfully in Europe for more than a decade on at least 10 platforms produced by 5 different OEMs. Several additional vehicles are currently in the pre-production phase and should be commercial before year's end.

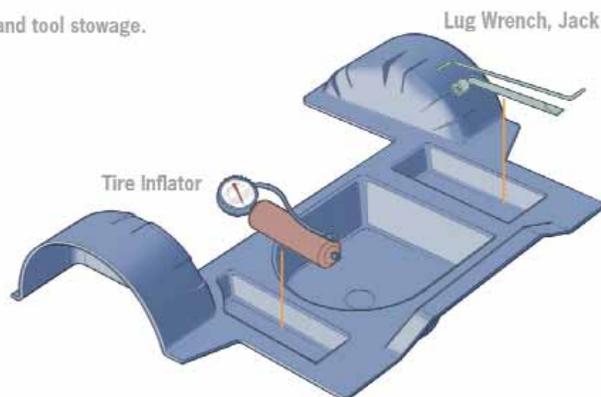
As noted previously, composite SWWs were initially targeted at low-volume vehicles of 150,000 units or less. However, experience has confirmed that this change can be beneficial to any program where it is desirable to reduce overall tooling costs, regardless of build volume and amortization schedule. Hence, newer programs that are making use of composite SWWs include platforms with 300,000 or greater production capacity per year.

The composite technology of choice has been glass-mat thermoplastics. These materials use a PP matrix and a 40% by weight chopped fiber mat, with selective reinforcement of a high-strength woven glass mat to improve crash performance and stiffen the floor of the part so it does not move or vibrate. Use of the woven mat has proven to be critical for passing high-speed impact tests.

### Summary

Composite SWWs will be most attractive to North American OEMs on vehicles where it is desirable to reduce overall tooling costs (not just component costs) on the platform upfront. It will also be attractive where opportunities to add functionality and reduce components and weight are seen as a value add that is attractive to customers, such as the opportunity to create a "multifunctional box".

Floorpan design with integrated wheel wells and tool stowage.



Advanced concept integrating spare tire storage, integrated wheel wells, and tool storage.

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