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# CMM

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Lowering  
Costs for  
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**How Auto Composites Are Like Money in the Bank**

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Lowering Costs for

# OEMs

## How auto composites are like money in the bank

By Denny Beck

**P**roposed new regulations for making U.S. cars and trucks more fuel efficient will have automotive engineers taking a closer look at composites to make vehicles lighter weight. However, borrowing from the real estate adage, the three most important factors that will clinch the sale of composites to the automotive industry are lower cost, lower cost and lower cost.

The Automotive Composites Alliance (ACA) of the American Composites Manufacturers Association (ACMA) is redoubling its mission to educate OEM (original equipment manufacturer) engineers on the cost-effectiveness of composite systems. The message is underscored with end-use applications that demonstrate the benefits of transportation composites and the capabilities of the companies who produce them.

Three ACA composite manufacturing members presented the three “showcase” applications that accompany this article. These applications validate how OEMs are rewarded when they work with resources who know how to optimize composites for lower cost and mass.

### A Direction That Favors Composites

“Depending on the application, composites are generally more cost-effective in volumes up to 100,000,” pointed out Keith Bihary, Automotive Sales Manager for Molded Fiber Glass Companies and Chairman of the ACA. “More vehicle and optional part volumes are falling within that parameter, so the automotive industry is starting to move in a direction that favors composites. But there are still engineers who think composites are too expensive.”

Design-engineering with composites is a more holistic exercise than specifying metals. When the engineer looks at the entire process – from the concept in the mind to the vehicle shipped out of the assembly plant – the bottom line for composites is impressive.

This is especially true when assessing the composite benefit of parts consolidation. Dozens of primary and secondary steps – stampings, subassemblies, weldments, attachments, drilling, routing and crimping – are eliminated as a single, complex component comes out of the mold.

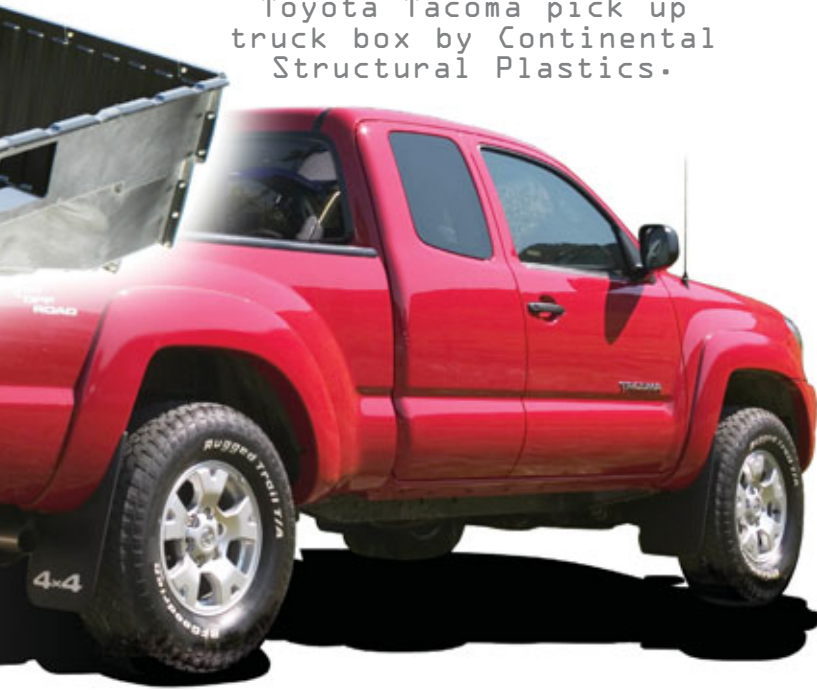
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Preforming Processes for Liquid Composite Molding • Advances in Glass Mat Thermoplastics  
Composite Materials and Applications • Advancements in Closed Molding of Sandwich  
Structures • Composites and Leadership in Energy and Environmental Design*





## Toyota Tacoma pick up truck box by Continental Structural Plastics.



**About Automotive Composites Alliance (ACA)** - Since 1988, ACA has served as the composite industry's experts with automotive customer's and the media. ACA focuses on educating engineers and promoting composites to domestic and import OEMs. ACA represents FRP composite manufacturers and material suppliers who actively promote the benefits and use of thermoset composites for the automotive and truck industries. The ACA member network provides technical benchmarking information and industry statistics, helping member companies meet OEM objectives to increase the amount of composites used in the automotive and transportation markets. The ACA is an industry council of the American Composites Manufacturers Association (ACMA), Arlington, Va.

Thomas Hilborn, Vice President, Sales & Marketing, for Continental Structural Plastics noted a number of ways that the cost benefits of parts consolidation go beyond reduced assembly and labor. "Purchasing and inventory control are simplified, and consolidating parts opens up OEM plant space," he said. "With composites, the OEM can, in effect, expand a facility without capital investment. We're doing this for customers every day."

### Tooling Advantage Lowers Cost

Another key selling point for composites is lower tooling costs. In an example provided by Bihary, a one-piece metal stamping tool to create a bottom splash shield for a new car model was quoted at approximately \$805,000. The same tool quoted for a composite molding was \$278,000 with only 60 percent of the lead time.

The lead time advantage with composite tooling is a real cost benefit but does not show up directly on the balance sheet. Shorter lead times make it easier and far less costly to make incremental changes late in the design cycle. And it gets the product to the market faster.

Tooling costs are coming down even more through global sourcing. "To reduce costs, manufacturing large parts and modules needs to be close to the assembly plant," said Hilborn. "However, functions such as design, engineering, materials analysis, tooling, prototyping and testing can be accomplished anywhere. The composites industry is starting to internationalize these functions to give us an even greater cost advantage."

"The quality of international resources is closely

### Trunk Divider Panel Composite Components

1. SMC upper reinforcement
2. SMC panel
3. Flax fiber-filled polypropylene panel w/carpet covering
4. Glass-filled polypropylene grocery hook (four total)
5. Glass-filled polypropylene hinge (left & right)
6. Glass-filled polypropylene latch component



monitored,” said Dan Dowdall, Vice President – Engineering and Product Development, for Meridian Automotive Composites. Commenting on global tooling sources, Dowdall said, “Before tooling is approved for shipment, it must produce molded parts that meet all required manufacturing targets such as surface quality, and dimensional accuracy.”

While the emphasis is on lower cost, ACA members also find opportunities to promote other composite benefits such as corrosion resistance and improved noise/vibration/ harshness characteristics. But composites’ ability to reduce mass (as automotive engineers refer to weight reduction) is especially getting renewed attention.

### CAFE Gives Composites an Edge

The U.S. Congress is proposing lower “CAFE” (Corporate Average Fuel Economy) standards which would require automakers to produce more fuel-efficient vehicles. One primary tactic for improved fuel economy – mass reduction – gives composites an edge over steel.

“Cars like the flashy, electric-powered Tesla are calling attention to lightweight carbon-fiber composite parts,” said Bihary. “But a lot of carbon fiber components are overdesigned. When engineers start to understand the material better, they will be able to accept reduced wall thicknesses, which reduce the cost as well as mass.”

“Selective use of carbon fibers with glass reinforcements in hybrid composites is the more likely carbon fiber solution for higher volume vehicles,” Dowdall said. Composite manufacturers are also developing proprietary material systems that incorporate low density nanofillers to reduce mass.



Pontiac Solstice  
Convertible

While ongoing R&D in composite mass reduction is good, Hilborn pointed out that the future of lightweight composites is already here. “Let’s not jump too far ahead to what is coming,” he said. “Mass reduction has always been at the heart of what composites have to offer. Low mass is integral to composites. What we have right now is a winner.”

### COST-SAVING CASE STUDIES

*Composites Versatility Takes Center Stage*

#### Application:

- Rear Compartment Vehicles:
- Pontiac Solstice Coupe [Model Year 2009]
- Pontiac Solstice Convertible
- Saturn Sky Convertible
- Opel GT
- Manufacturer:
- Molded Fiber Glass Companies

The Pontiac Solstice Convertible, Saturn Sky and Opel GT sport a composite rear compartment. The composite manufacturing process is the time-honored liquid compression molding with a directed fiber preform. Molded Fiber Glass (MFG) may have a second generation Morrison leading the company, but its liquid compression

molding (LCM) and preforming processes are numerous generations removed from the technologies introduced more than 50 years ago. Ever-evolving design and manufacturing software keeps elevating the process’s precision, quality, productivity, consistency and cost-effectiveness.

According to Bihary, the preform used in the LCM process ensures that the corners of the part will be filled with reinforcing fibers. The process can also accommodate deep draws, complex geometry, and part consolidation. Part consolidation has the capability of reducing tooling cost dramatically.

The long-awaited coupe version of the sprightly Pontiac Solstice was originally designed exclusively in a standard sheet molding compound (SMC) material. The compartment is approximately 38 inches front to back by 63 inches corner to corner by 15 inches deep. Composites design allowed for variable thicknesses that result in a mass reduction of approximately 5 pounds (2.27 kilograms) per vehicle. The part is 3.5 mm thick at attachment areas to ensure proper strength where needed but is 1 mm thinner throughout the main body of the part. In composites, this unique design feature is provided out of the mold. Varying wall thickness in a metal part of this type could not be accomplished without adding significant costs.

“Additionally, through close work with the design and material engineers, we may have the opportunity save another 6 pounds (2.73 kilograms),” said Bihary. “We’d accomplish this by custom formulating a resin system in LCM and/or using nano-filled technology to meet the specific needs of this part. All these changes can be handled without tool cost impact or delays during the build, right up to design freeze which is about eight weeks before tool completion.”

#### Application:

- Trunk Divider with Upper Reinforcement
- Vehicle:
- Nissan Sentra
- Manufacturer:
- Meridian Automotive Systems

For its 2007 model year redesign, the high-selling Nissan Sentra launched the new Divide-N-Hide™ trunk system. The system uses a special divider panel that can be positioned three different ways to create a hidden storage area, two separate storage areas or accommodate larger items.

For the divider panel, Meridian engineers created a unique hybrid solution that syner-



Ford Explorer  
Sport Trac



gistically combines the advantages of three different composite material systems. The panel is a two-piece assembly that is 44 inches wide, by 18 inches high by 1.5 inches thick.

To provide most of the assembly's structural properties, one piece is compression-molded of 30 percent fiberglass-reinforced polyester SMC. This side of the hybrid solution faces the rear seat when the divider panel is in the upright position.

The other side of the assembly is compression-molded of natural flax fiber-filled polypropylene with an outer layer of carpeting that is inserted in the mold along with the flax/polypropylene sheet. When the flax/polypropylene (PP) sheet is compression molded, the thermoplastic resin melts to form fiber-reinforced composite panel. During this process, the PP resin in the carpet melts and combines with the PP resin in the substrate, eliminating the need for an additional adhesive bonding operation. Meridian then bonds the SMC and flax/PP panels together with an ambient-cure urethane adhesive. The completed hybrid panel meets the aesthetic requirement of one side and the functional requirement of the other.

Other composite parts that complete the divider panel assembly are hinges, grocery hooks and a latch component that are injection molded of a 45 percent glass-filled PP. The assembled divider panel is shipped to the OEM plant with an upper reinforcement component which Meridian also molds of 30 percent glass-reinforced SMC.

This product has been so well received by the customer that Nissan has made it standard on all Sentras from a previous up-level trim option.

**Application:**

Pick Up Truck Box

Vehicles:

Toyota Tacoma / Ford Sport Trac

Manufacturer:

Continental Structural Plastics

The Budd Plastics business that is now part of Continental Structural Plastics (CSP) revolutionized the pick up truck by introducing the first composite box on the 2001 model year Ford Explorer Sport Trac. The Sport Trac is a crossover vehicle that combines pick up features with a sport utility vehicle. When the Sport Trac was redesigned for 2007, the box was enlarged and added underfloor storage compartments. CSP compression molds the box and storage components of fiberglass-vinyl ester SMC.

The initial composite box on the Sport Trac established a new standard of cost and

performance for the application. Toyota took notice and specified a composite box for the 2005 model year Tacoma, Toyota's first larger-than-compact pick up. CSP was selected to design and mold the box.

Thomas Hilborn, CSP Vice President, Sales & Marketing, stated, "Steel could never provide a box like this in one hit. And as for performance, customers have really expressed appreciation for a box that does not dent or rust. Many users also say they like how the one-piece composite design eliminates the need for big assembly bolts

which can be a nuisance during loading."

The Tacoma pick up box is providing a platform for engineers to consider other large, structural composite applications. Hilborn concluded, "A lot is possible when the OEM works with someone who really knows how to design in composites and who has a real understanding of composite properties." **CM**

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