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CM Online Exclusive
Writers at Composites Manufacturing magazine often gain so much insight from sources during interviews that we can’t fit it all into our print publication. That was the case this issue when ACMA Communications Coordinator Terin Bufford talked to Robert Gibson, owner of Composite Rebar Technologies Inc., for the infrastructure article on page 10. After you read about the company’s patented hollow FRP rebar, visit the magazine online at compositesmanufacturingblog.com. Click on the “CM Interviews” tab for an in-depth Q & A with Gibson, where he discusses the future of the infrastructure market, progress made by ACMA’s FRP-Rebar Manufacturers Council and more.
Volunteers Drive the Association and Reap Rewards

There are so many things happening at ACMA, most of which involve volunteer members like you. We all have busy day jobs. I know we all believe that we simply cannot add another thing to our plate. However, I believe that by volunteering for your association, you not only generate and perpetuate activity for ACMA, but you gain credibility in the marketplace for your own business. You gain insights and relationships that you cannot develop alone. You can help develop ideas, projects, programs and standards that will help the entire composites industry grow. The effort put into volunteering will come back to you in your own business.

One of our primary opportunities to volunteer is with the Composites Growth Initiatives (CGI). The CGI is run by volunteers, with excellent support from ACMA staff. CGI is divided into 12 committees based on a variety of focuses, including market segments or process technologies. The current roster of CGI committees includes the Pultrusion Industry Council, the Green Composites Council, the High Performance Council and the Architectural Division, among others. (For a list of all 12 committees, and more information about each, visit acmanet.org/marketdevelopment/cgi.)

Each CGI committee works diligently to open new markets and expand existing ones. For example, the Architectural Division has successfully developed standards for the use of composites as building materials. The standards are showing up in more and more places, thereby exposing architects to the possibilities of composites. The Architectural Division is made up of folks using open molding, VIP and RTM. Companies have displayed at the American Institute of Architects (AIA) national convention to drive more architects to composites. For the AIA 2014 Convention, the Architectural Division is considering displaying in a “composites pavilion” to help increase visibility. The point here is that as a group, we may be able to make more progress, faster, than we can individually.

But all of the CGI committees are only as good and successful as the people who volunteer. The groups are led by people who have a particular passion for the work of that the committee. These individuals generally have strong backing by their companies and receive the benefit of being intimately involved with the direction of the committee. ACMA provides staff members to help run meetings and disseminate information and communications. But the real drivers are the volunteers.

ACMA is a member-driven association. If you are already a member, I say thank you. If you are not volunteering, I ask that you consider it.
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Strengthen Your Vision to Strengthen Your Business

By Kevin McArdle

When many business owners and executives look to push their organizations to the next level, they consider tweaking their marketing strategy, improving their sales process or making their processes more efficient. However, many leaders overlook the impact of a strong vision on shaping a powerful future for their companies.

Every exceptional business starts with a vision – and a leader behind that vision. Your vision is bigger than you. It’s also bigger than the current state of your organization. Your vision takes stock of what you have now and offers new insight into what your organization can become in the future – and who you can become for your customers. People like Henry Ford, Jack Welch, Bill Gates, Steve Jobs, Jeff Bezos and even Martha Stewart all started with a vision for the behemoth brands they’ve built today.

Creating a bold vision requires you to dig deep. It will challenge your courage, your creativity and your drive to invent – and require both determination and resources to implement it. But without a vision, your company simply won’t move forward in any significant way.

Momentum requires focus and direction: Vision provides both. Imagine if everyone in your organization was 100 percent on the same page. Your team and their staff would understand their goals, both short-term and long-term, and work together to make them happen.

How strong is your current vision? Start by asking the following eight questions, which will both help you assess where you are now and act as a roadmap moving forward.

1. What are your core values?
2. What is your core focus?
3. What is your 10-year target?
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Your vision takes stock of what you have now and offers new insight into what your organization can become in the future – and who you can become for your customers.

4. What is your marketing strategy?
5. What is your 3-year picture?
6. What is your 1-year plan?
7. What are your quarterly wildly important goals (WIGs)?
8. What is your issues list?

If you can answer each with confidence – and could say the same about your staff – congratulations! Your vision is running strong. However, if you stumble on any of these, or doubt that your staff would share your point of view, you could benefit from considering these questions on a deeper level.

Start by putting your own answers to paper. Then, once you’ve solidified your ideas, gather your senior leaders. Share your answers with them, and ask for their feedback. Remember that your entire team may not agree with your answers. It’s your job as their leader to make a final decision for your organization.

Once you feel confident you’ve arrived at the answers that will move your business toward a bright future, make a plan to communicate these to your entire staff. Even if you have a solid vision, you can’t do it alone. To create real momentum, you’ll need everyone working together toward the same goals.

There are many ways you can roll out your company vision. I suggest some combination of the following:

- **Hold a company-wide kick-off meeting** to unveil your vision. Make sure to include question-and-answer time to give employees a chance to understand the new vision from all angles.
- **Every 90 days, have a short “state-of-the-company” meeting** – no longer than 45 minutes – with all employees to share progress and success stories related to the vision. This also will be a great reality check as to how your company’s vision is working in the real world.
- **Each quarter, conduct a complete review of the eight questions** with your leadership team to evaluate your progress and make any necessary mid-course correction.

By creating an inspiring vision to guide your company – and putting in place the right mechanisms to reinforce it over the long-term – you’ll create energy and momentum behind a unified front. This focus will create real results and act as the first step toward securing a strong future for your company.

Kevin J. McArdle is the founder of McArdle Business Advisors. For additional best practices resources and articles on moving your business forward, visit McArdleBusinessAdvisors.com.

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**Industry Insight from CM Online**

Composites Manufacturing magazine introduces two new blogs:

- **Market Development blog** – John Busel, vice president of ACMA’s Composites Growth Initiative, brings you the latest news about growth opportunities for the composites industry.
- **Government Affairs blog** – John Schweitzer, ACMA’s vice president of government affairs, shares an insider’s view of legislative and regulatory issues.

To access the blogs, visit compositesmanufacturingblog.com and click on the tabs marked “Government Affairs” and “Market Development.”
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Reconstructing traditionally-built architectural works of art using fiber reinforced plastic (FRP) can be a demanding – yet ultimately rewarding – enterprise. Just ask Vipul Fadia, president of FRP Accessories USA Inc., which recently reconstructed an ornate dome on a Hindu temple in Pomona, N.Y. The new FRP dome is not only visually impressive, it was faster to build than its predecessor and will be much more durable.

The original dome was built in 2001 using brick and cement stucco over a metal support. Ten artisans from India worked on the temple’s roof for 20 months. Each diamond shaped roof tile, statue and decorative detail was constructed by hand. After just 12 years, however, the dome had seriously deteriorated. Rain, snow and extreme temperature fluctuations caused the masonry to crack, crumble and, in some sections, collapse.

In 2012, temple trustees solicited proposals to replace the dome, and FRP Accessories won the contract. With locations in Monmouth Junction, N.J., and Mumbai, India, FRP Accessories manufactures various architectural composites, including wall panels, cornices, columns, corbels, railings, statues and, increasingly, specialty domes for places of worship or other ornate buildings. Recently, the company has provided intricate architectural items for a Hindu temple in Columbus, Ohio.

From the start, the New York project was challenging. The new dome needed to replicate both the Pomona temple’s previous dome and the centuries-old original Srirangam temple in India after which it was patterned. But no written records, architectural drawings or dimensions of these structures were available.

To begin, a design team from Magnus Composites, FRP Accessories’ subsidiary in India, created drawings from photographs and measurements of the existing temple dome. The dome’s curvatures, which varied tremendously both vertically and horizontally, were more difficult to design than Fadia had anticipated. “The most challenging was the diamond shape on the top part of the dome,” he says. “We used 2-D and 3-D computer-aided design drawings to understand how to make the diamonds, as we had to take care of two-axis curvatures.”

Ironically, FRP Accessories then constructed a full-scale model of the dome using traditional methods. “After detailed discussion, we decided to go for a brick and plaster structure,” explains Fadia. “It was the only way we could recreate such a complex design exactly.” The company used 12,000 bricks to create the model dome and carved decorative designs by hand. The pace of these first two phases – the design and model building – was frustrating, admits Fadia, who waited in New Jersey while Magnus Composites handled the work.

Once the model was complete, however, things proceeded more smoothly. FRP Accessories made 12 molds by applying fiberglass and resin over the model using a wet lay up process. A proprietary liquid release agent was used to ensure that the mold would release from the plaster model. Meanwhile, rubber molds were constructed for the additional 840 pieces needed to create the dome’s detailed add-on...
pieces, including 10 statues, the diamonds that cover the roof and religious symbols such as elephants and swans.

Next the team fabricated 45 FRP sections for the dome. The pieces were then trimmed and joined together to form seven larger pieces, the add-on designs were affixed and the sections were shipped to FRP Accessories USA in two 40-foot containers. Once in the United States, the pieces were power washed to remove the release agent and painted with an epoxy paint. For the final touch, Gilders Studio Inc., Olney, Md., covered the structure in 23.75 karat gold leaf. The completed pieces were then shipped to the Pomona temple, where final assembly was completed in just two days.

The finished product, unveiled in July, is a stunning replication of the original dome. Despite Fadia’s concern, the project was completed in six months – a fraction of the time the original construction required. At just 7,000 pounds, the composite dome is approximately two-and-a-half times lighter than the brick and cement structure it replaced.

Perhaps most importantly, the new composite dome is extremely durable: It will last at least 40 years, and the gold leafing is guaranteed for 25 years, according to Fadia. “If anything does happen to it, the dome can be easily repaired with minimal cost,” he says. “This project proves that composites can be successfully used to replicate master architectural design work.”

Melissa Haley O’Leary is a freelance writer based in Cleveland. Email comments to mxh144@case.edu.

For more stories like this, visit compositesmanufacturingblog.com and search “architecture.”
In the late 1990s, a group of engineering professors at Oregon State University designed an innovative product – hollow fiber reinforced polymer (FRP) composite reinforcing bar that is lighter and stronger than traditional rebar. The unique rebar caught the eye of Robert Gibson, owner of Composite Rebar Technologies Inc. (CRT), Madison, Wis., so he purchased the exclusive license for the patented technology more than a decade ago.

Gibson raised money through a private placement – a non-public offering of shares – to continue developing and refining the hollow rebar. “We then built a production machine to manufacture the rebar and conducted all of our testing at the University of Miami,” he says. Now that prototypes have been constructed and tested, CRT is deciding how to manufacture the product en masse.

According to Gibson, CRT’s hollow composite rebar is the only product of its kind and is 50 percent stronger and 25 percent lighter than traditional rebar. “CRT is working on expanding the coverage of our patent so that our hollow bar qualifies for not only infrastructure, but building applications for both national and international markets,” he says.

Traditional solid rebar, often made from steel, is commonly used to reinforce concrete for structures such as bridges and roads. CRT’s rebar features a hollow, load-carrying GFRP core over molded with a corrosion-, impact- and UV-resistant carbon fiber reinforced outer shell to add durability. The company uses a modified pultrusion process to manufacture the hollow rebar.

Because the rebar is hollow, it has the potential to act as a conduit in a piece of concrete, says Gibson. For example, fiber optic cables or wires could run through the rebar in com-
commercial buildings to allow electrical and communication outlets to be installed in the middle of large open areas.

Bringing a new product to market can be daunting. “We participate in a lot of conferences that deal with construction, and we have had display and information booths at everything from ACMA to the World of Concrete shows,” says Gibson.

CRT is banking on its experience in the infrastructure industry to help promote hollow rebar. In addition to the rebar, the company developed Long Life Dowels™, which encapsulate steel in a corrosion-resistant, durable resin and fiber sleeve. “Steel dowels have terrific strength and do the job perfectly, except they are in joints in the highway that are exposed to corrosive materials, salted roads during the winter or close to the ocean,” says Gibson. The sleeve of Long Life Dowels prevents contact between the steel and corrosive elements. Departments of Transportation (DOT) in Wisconsin and Minnesota have approved the Long Life Dowels for use in highway construction.

Gibson hopes that DOTs and other potential customers are equally interested in hollow rebar. “It really is tickling the curiosity of a broad range of people,” says Gibson.

Terin Bufford is the communications coordinator at ACMA. Email comments to tbufford@acmanet.org.

For more stories like this, visit compositesmanufacturingblog.com and click on “infrastructure.”
Freezing temperatures and harsh Arctic conditions didn’t deter two extreme athletes from a 348-mile trek from the south to the northernmost point of the Norwegian island of Spitsbergen. Eric Folz, an engineer at Ticona, the engineering polymers business of the Celanese Corporation, and Mike Fuchs, a full-time photographer, embarked on a three-week tour last March and April dubbed “Mission Icefox.” In this frigid climate, a man is only as good as his equipment and these men each relied on one important item during their journey – a composite sled.

Folz and Fuchs skied across the Arctic pulling pulka sleds loaded with necessities: Pulkas are shell-shaped sleds, resembling the front half of a canoe, with flat runners. Hikers often use them to transport equipment over snow-covered terrain. “The pulka represents a less strenuous means of transport for the two athletes and for their equipment essential for survival over the long ski tour,” says Henning Kull, head of communications for Ticona Europe. “The reliability of the sled was of vital significance to us,” says Folz. “We couldn’t take the equipment essential for survival like satellite phone, gas cooker, gas, tent, clothing, etc., more than 348 miles in 23 days without it.”

The sleds were made from Celstran continuous fiber reinforced thermoplastic (CFR-TP) composites and ultra-high molecular weight polyethylene GUR®, a special polyethylene that is shatterproof and scratch resistant even under extreme stress.

Each pulka measures 67 x 25 inches and weighs only 5.2 kilograms (11.5 pounds) but has a maximum load of 80 kilograms (176.3 pounds). “All the pulka components were designed for optimum support for the expedition participants,” says Kull. The runners are made from GUR and the shell from CFR-TP unidirectional (UD) tapes, which provide excellent stiffness, help prevent deformation and maintain load-bearing capacity no matter what the terrain.

Acapulka – a Norwegian company that creates expedition equipment for journeys to the Arctic, Antarctic and Greenland – designed and manufactured the sleds. Ticona supplied the Celstran CFR-TP UD tapes.

The CFR-TP offered many benefits. Dr. Simon Scholl, engineer at Acapulka, says that carbon fiber’s measure of stiffness is three times higher than aluminum. “Another advantage of composites, in this case, is that they are especially suited for thin-walled structures like the pulka sled and give more design freedom,” he says.

Teams from both Ticona and Acapulka discussed the heavy loads the pulkas would be exposed to during the Arctic trek. “We improved the glide characteristics with a lower friction outer skin, reducing the weight by using materials designed to do just that, and increasing wear resistance with a carbon fiber outer skin,” says Alexander Bierwald, director of Acapulka. The fiber/polyethylene matrix combination selected also is very light weight and ensures low moisture absorption.

Acapulka used an isotropic laminate structure to layer the sled with the unidirectional tapes. After the tape placement, the part is set under vacuum and heated up above the melt temperature of the polyethylene matrix, then removed from the mold after cooling. The consolidation process only takes about 30 minutes.

Both pulka sleds underwent testing before embarking on this intense journey. The most important structural tests on the sled shell included...
a drop test to simulate the maximum conceivable impact during an expedition. The shell also was tested for fatigue, tip and track stability at high speeds as well as in deep snow. Another concern was the friction properties of the runners. “All the tests were performed at cold to very cold temperatures, -15 to -35 degrees Celsius,” says Kull.

Both pulkas passed all the tests. “We were so impressed with the results of each test, and the sleds appeared as if they could be used again after this voyage,” says Kull. “The expedition would not be at any risk from material failure, as these materials were delivering ultra-high performance.”

Terin Bufford is the communications coordinator at ACMA. Email comments to tbufford@acmanet.org.

For more stories like this, visit compositesmanufacturingblog.com and click on the “sports” tab.
ACMA and SAMPE have come together to create a singular, unified event designed to engage and promote the composites and advanced materials industry. CAMX will be the one source for connecting and advancing all aspects of the world’s composites and advanced materials communities.

PLAN NOW TO ATTEND.
Taking Care of Business

Profitable companies care as much about shrewd business practices as they do about production.

By Terin Bufford and Susan Keen Flynn

YOUR CORE BUSINESS IS COMPOSITES, but being an expert in resins and reinforcements isn’t enough to thrive. Successful companies combine industry know-how with business management savvy. They choreograph efforts between operations, human resources, marketing, sales and finance. That’s not an easy task.

Both brick-and-mortar and online libraries are filled with information on running a business. This article examines three critical functions from the unique perspective of composites manufacturers. It offers a behind-the-scenes view on how companies handle – and excel – at plant safety, employee training and business marketing.
During one of MFG Composite Systems Company’s weekly safety audits in September, Chuck Lawson chatted with a tow motor driver. The driver shared with Lawson – the health, safety and environmental manager at CSC – that new employees were walking down the center of aisles rather than using designated walkways. This could lead to an accident if the driver of a tow motor loaded with materials doesn’t see someone in the aisle. The following week, Lawson conducted an educational session with plant employees on pedestrian safety.

“You can’t manage safety from your office chair,” says Lawson. “I’ve got a hundred topics I could talk about, but if they aren’t the issues CSC is having, there’s no sense in covering them. Topics have to be driven from the floor.” Lawson and CSC supervisors make unannounced weekly rounds of the plant floor, rewarding employees for safe behaviors and noting any unsafe situations that need correcting. The latter typically become topics for the company’s safety education.

CSC is one of 13 nationwide operating entities of Molded Fiber Glass Companies (MFG), which serves customers in markets such as wind energy, automotive, heavy truck, defense, construction, material handling and water treatment. While MFG’s corporate office mandates plant safety, each facility creates its own safety program. “We have corporate policies and procedures, but we generally believe that safety should be managed at the entity level,” says Perry Bennett, corporate health, safety and environmental director for Molded Fiber Glass Companies. “It’s not one-size-fits-all when it comes to safety.”

At CSC, safety training is about more than merely meeting government requirements. “OSHA has a lot of mandated training on everything from personal protective equipment to hazard communications,” says Lawson. “Unfortunately, a lot of companies offer what I call ‘check-the-box’ training. You sit down for a couple hours once a year and go through safety training.” CSC promotes plant safety year-round in three primary venues: monthly management meetings, company-wide safety education sessions and on-the-floor training called “toolbox talks.”

The general manager leads the monthly management meetings, which include updates on production, accounting, quality and more. At each meeting, Lawson presents information on an OSHA requirement. After filling in managers, he schedules safety education sessions during all three shifts to reach as many employees as possible. Lawson reviews a topic, such as hand safety and the need for nitrile gloves, then provides real-life case studies to reinforce the importance of his message.

“Once employees have a sound understanding and buy-in from the educational sessions, we use toolbox talks to review the key components as they relate to their job,” says Lawson. For instance, he might explain to employees who work with isopropyl alcohol why they don’t want to get it on their hands. “I don’t just tell them they need to use gloves,” says Lawson. “I want them to understand why.” Toolbox talks are scheduled in groups by job function.

In addition, CSC provides separate training for its maintenance team and departments that require specialized training, such as the mix room where resins are blended. It also offers one-on-one education to employees, if necessary.
Lawson’s goal is for safety to become second nature to employees. That often requires changing ingrained behaviors – not an easy task, he admits. Maybe an employee runs a machine without the guard because it’s easier or a maintenance person stands on the top rung to change a light bulb because he doesn’t have a bigger ladder. “Not everyone understands the hazards like safety professionals think they do,” says Lawson. “My job is to promote safe work behaviors and show people there are better ways to do things.” Or, in the case of the ladder, simply buy a larger one.

CSC employees have a visual reminder of the importance of safety. A couple years ago, the company placed a large whiteboard with the outline of a body at the entrance to the plant. When an injury occurs, the corresponding body part is colored in – yellow for a first-aid injury and red for a recordable one. A chart next to the body details the injury and date it happened. “When someone walks in and sees that an assembly guy got a splinter in his hand while trimming an automotive side panel, I hope they get to their work area, think about that guy and make safer decisions,” says Lawson.

Fortunately, Lawson is not the company’s sole mouthpiece for safety. CSC, like MFG’s other entities, has a safety team. The six team members, who represent various shifts and departments, promote safety on the floor and encourage safe behaviors. For example, they remind co-workers to wear earplugs and safety glasses. When team members witness an employee taking extra precautions, they hand out a neon green T-shirt – designed by the safety team – that reads “I got caught” on the front and “Doing something safe” on the back.

Safety is so important to MFG that the company renamed its 5S lean manufacturing program to 6S: It added “safety” to the other pillars (sort, set in order, shine, standardize and sustain). “Safety isn’t a sign on the wall or a monthly talk,” says Lawson. “It’s a living part of the workplace culture.”

| Company Name: Miles Fiberglass & Composites | Headquarters: Happy Valley, Ore. |
| Business Focus: A manufacturer of composite and fiberglass products for the transportation, wind and industrial tank markets |
| Employees: 48 |
| Plant Size: Two facilities totaling 75,000 square feet |

Lori Luchak-Olund, CCT, president of Miles Fiberglass & Composites (MFC) and immediate past president of ACMA, grew up in the composites industry. MFC is a family-owned and operated business that has spent nearly 50 years providing fiberglass and composite components for numerous markets. “Our employees contribute much to the success of the company,” says Luchak-Olund.

MFC offers 32 different training programs, most lasting up to nine weeks, to its administrative, management and technical staff. “Our management training programs focus on leadership, business strategies and high-level business functions,” says Luchak-Olund. Since MFC is a family business, the company conducts numerous succession planning programs, identifying internal candidates to fill key leadership positions. The company has also conducted training on lean manufacturing, business modeling and production for its management team.

Administrative and management programs are typically conducted in conjunction with Clackamas Community College, both at the college and at MFC. Classes include English as a Second Language programs, basic math and production 101.

The latter was a customized class built around the production of a fiberglass shower. The instructor relied on a flow chart to visually display the production path.
of the shower, from the time MFC takes the order until the truck driver delivers the shower. “The class showed how connected everyone is to the process and covered technical and quality issues,” says Luchak-Olund.

MFC’s signature training program for production staff revolves around the Certified Composites Technician (CCT) program, mainly the Wind Blade Repair (CCT-WBR) course. “This CCT certification was developed at Clackamas by MFC and is offered through ACMA,” says Luchak-Olund. MFC offers courses in all nine CCT certifications to employees after one year of employment and has had a very successful passing rate: Two-thirds of the manufacturer’s employees are certified.

Approximately 25 to 30 percent of MFC’s employees underwent training in 2012. So far, 15 to 20 percent of employees have attended a training course in 2013. Educating employees helps ensure consistency among job functions, which in turn eliminates errors and allows the company to manufacture quality products. “It is important to standardize how a job is performed so that you can guarantee that it is done the most efficient way every time,” says Luchak-Olund.

Since MFC increased the number of training programs it offers, Luchak-Olund has seen a steady rise in production quality. “I believe we now have a better product because we can track the problem areas and correct them at the source,” she says. For example, the company found cracking in the gel coat surface of a shower part and realized a worker was pulling the part from the mold incorrectly. MFC provided that employee additional training.

Product consistency is key to business success, and Luchak-Olund says standardized training programs help breed consistency. But simply offering courses isn’t enough. “Be sure to conduct follow-up checks – or ‘crucial check points’ as we call them,” she says. “That way you can verify that your employees are still doing what they’ve been taught.”

Offering training programs on a variety of topics also enables MFC to cross-train employees. According to Dan Bellanger, CCT instructor at MFC, cross-trained employees gather skills outside the usual parameters, thus becoming greater assets to the company. “If the work flow changes, we’re free to move people around instead of having to lay off and hire people,” says Luchak-Olund.

Employee training is an effective way to increase customer satisfaction as well as employee morale. Nearly half of the staff has been employed at MFC for more than 20 years. And the opinions of employees are vitally important to the company.

As part of its lean manufacturing training, MFC’s management team implemented a suggestion box, which is opened monthly. If a suggestion is carried out, that employee is rewarded with money or a gift card. “We also post a photo of the suggestions before and after and give that employee additional acknowledgement,” says Luchak-Olund. “I think the acknowledgement is just as good as the incentive or the gift. It creates an atmosphere where people are thinking, ‘How can I do this better and improve what I’m working on?’”

And that, ultimately, is the goal of employee training.

Employees from Miles Fiberglass & Composites gather for a Certified Composites Technician (CCT) course.
In 2013, Beetle Plastics LLC created a technical paper educating prospects about fiberglass tanks and pipes. Unlike previous technical papers that focused on the products themselves, this one highlighted the corrosion-resistant benefits. Since January, more than 100 people have downloaded the document.

“We only knew a few of these people prior to them finding and downloading the technical paper,” says Matthew Mettry, co-director of the senior management team at Beetle Plastics, Ardmore, Okla. Nearly a year ago, the company was struggling to increase web traffic and generate new customers. That’s changed thanks to a revamped marketing strategy, including online content like the technical paper.

Beetle Plastics is a subsidiary of Midwest Towers Inc., a manufacturer of evaporative water cooling towers. For years, it supplied components for cooling towers sold by its parent company. But in 2012, Larry Brown, president of Beetle Plastics, decided to expand the company’s customer base. To reach new clients, it could no longer rely solely on a traditional marketing approach including attending trade shows, visiting customers and creating product lists.

So Beetle Plastics purchased a marketing portal with HubSpot, an Internet marketing service company. HubSpot’s software platform features tools designed to help companies attract leads online and convert them into customers. The manufacturer also hired Top Line Results, a marketing firm in Orlando, Fla., to oversee its inbound marketing strategies. With inbound marketing, companies attract the attention of customers using blogs, podcasts, social media marketing, e-newsletters and other content-rich platforms.

“Adding the inbound strategy has allowed us to review and assess how we are marketing and selling to our customers,” says Mettry. The HubSpot software generates a report that displays analytics for all of Beetle Plastics’ inbound marketing efforts. For example, the report can find out which channels – websites, search engines, social media outlets, etc. – are bringing customers to its landing pages.

Inbound marketing has become essential. Prospects go online to research potential vendors: They visit websites, read blogs and do other research to learn about suppliers. Before a company can make the initial contact,
Marketing: A Trio of Tips

Matthew Mettry, co-director of the senior management team at Beetle Plastics LLC, offers this advice to execute a successful marketing strategy:

1. **Write from the customer’s perspective.** Beetle Plastics has changed its content to show that it “thinks like the customer.” The company’s blog posts now focus on customers’ needs instead of listing Beetle Plastics’ products and services so the content is viewed as educational not promotional.

2. **Increase SEO efforts.** Part of the reason why Beetle Plastics’ inbound marketing is so successful is due to its search engine optimization (SEO) efforts. Having multiple social media outlets, keyword tracking and compelling blog content are the most effective ways to increase a company’s visibility in search engines.

3. **Link your social media outlets.** All of Beetle Plastics’ social media platforms are integrated through HubSpot. This allows the company to gather statistics, such as click through activity. Based on those statistics, Beetle Plastics tailors its content toward prospects.

prospects have already gathered information and made an impression about the company. Because of this, Beetle Plastics took a proactive approach to increase its overall presence. “We can no longer list our products and services and go search for people we know need them. In the Google age, that doesn’t work,” says Mettry. “We share our case studies, technical papers and brochures with customers through blogs, email and social media.”

Beetle Plastics currently has more than 100 blog subscribers and 2,000 contacts that receive blogs and other content updates. For example, instead of simply posting an online catalog that lists the features of a fiberglass tank, the company wrote a blog post explaining how FRP tanks solve problems associated with storing and transporting hydrochloric acid.

Most of the blogs and case studies are written by sales representatives at Beetle Plastics. Each post includes keywords linked to other content on the website. For instance, a blog post that discusses corrosion-resistant tanks and vessels has keyword phrases linking the reader to a product page for chemical storage tanks.

The company also established two monthly email campaigns. One is sent to all contacts informing them of new online content, and the other is emailed to people who request additional information. The monthly emails highlight blog posts, new offers, upcoming events and other items of interest. There’s been an increase in engagement, open rates and number of subscribers since the start of the campaigns.

In addition, Beetle Plastics relies on social media including Facebook, Twitter, LinkedIn, Google+ and YouTube. The company’s main focus for these outlets is to monitor the keywords and traffic as well as publish content. Beetle Plastics hopes to build a community of contractors and engineers, its main prospects.

After implementing an inbound marketing strategy, Beetle Plastics’ website traffic increased by more than 20 percent, generating more than 50 new leads. The company also landed a new fiberglass pipe client in South America. “Our company’s inbound marketing and web presence were extremely instrumental in establishing our expertise and starting this relationship,” says Mettry.

Although Beetle Plastics credits most of its recent success to inbound marketing, a hint of outbound marketing – cold calling and exhibiting at trade shows – also helped to expand the company’s customer base. Integrating both inbound and outbound marketing strategies leverages the strengths and eliminates the weaknesses of each marketing approach. Today the company is reaching more engineers, design firms and end users of fiberglass products.

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Terin Bufford is communications coordinator at ACMA. Susan Keen Flynn is managing editor of Composites Manufacturing magazine. Email comments to tbufford@acmanet.org and sflynn@keenconcepts.net.
Advanced composites manufacturers have historically had to overcome the key challenges of long qualification times and high costs associated with new technology or material use in military vehicles or equipment. Even though the market can be challenging to enter, when designs offer substantial cost, time and weight savings, opportunities exist in the military market.

Here’s a look at two recent developments that build upon a decades-long tradition of composites technology in the military.

The Latest Generation of Fighter Jets

The first widespread use of composites in military fixed-wing aircraft – as well as the first structural use of advanced composites – were on fourth generation fighter aircraft. According to Don Kinard, an F-35 engineer at Lockheed Martin, the F-16 from Lockheed Martin was one of the first advanced fighters to use composites on the empennage in the mid-1970s. During the next several decades, structural composites grew to comprise five to 12 percent of the weight of aircraft in fourth generation fighters. Today’s leading-edge fifth generation fighters take advantage of developments in advanced materials to comprise even more composites.

The F-35 Lightning II Program – also called the Joint Strike Fighter Program (JSF) – is the core of the Department of Defense’s (DOD) next-generation aircraft weapon system for the Air Force, Navy and Marines. Lockheed Martin won the contract to develop the F-35s, which feature three variants: the F-35A for conventional takeoff and landing, the F-35B for short takeoff and vertical landing (STOVL) and the F-35C carrier variant.

The F-35B is the first operational supersonic stealth fighter designed for short takeoff and vertical landing. It is 50.5 feet long and has a wing span of 35 feet. Kinard estimates that composites now account for as much as 25 to 30 percent of the aircraft’s weight. It uses a combination of graphite, glass epoxy and bismaleimide (BMI) composites mostly for exterior doors and skins.

Kinard explains that military customers for JSF aircraft are interested in performance and affordability improvements. Cost-and-weight trade studies drive composite usage, so the most affordable material is used for each particular application.

Carbon fiber and ceramic fiber composites also are finding their way into military jet engines. Ted Lynch, executive vice president of SAMPE, says the DOD is the largest single user of aircraft fuel, so it’s extremely interested in any technology that reduces...
fuel usage. Lynch says JSF engines now feature carbon fiber composites, replacing titanium in certain areas. Composite components such as fan blades and eventually turbine sections could help engines become more efficient.

New Designs for Small Combatant Craft

In 2009, Structural Composites Inc., West Melbourne, Fla., began developing an advanced lightweight hull and deck for small combatant craft using inexpensive composite materials. Scott Lewit, president of the company, says the non-inflatable boat it helped design is the first to use advanced combatant technologies and single-skin construction.

Rigid hull inflatables are one type of small combatant craft widely used throughout the Navy, with one or more on every ship. They patrol waters, protect forces and harbors, carry demolition teams to sites to dive for mines or other threats, and transport people and equipment. Special forces use them for search and seizure anti-terrorism operations.

According to Lewit, a much lighter non-inflatable design allows for combined uses and reduces the number of specialty boats a ship has to carry. “Being lighter and more capable means it can perform more missions and hold more people,” he says.

Lewit’s company partnered with Lockheed Martin, the Brunswick Corporation and Zodiac Marine to develop five new technologies under the U.S. government’s Small Business Innovation Research grants:

- Sandwich-free construction without a core or heavy stringers
- Low section single-skin framing
- Membrane thin laminate panels
- Suspended cockpit
- New resin coating technology called “shark skin” whose strain to failure changes, allowing the coating to change from brittle to elastomeric

The result is a new boat design that uses standard two-pound density marine foam urethane and glass fibers instead of high-density expensive core materials. These are very inexpensive materials whose density restricts their use as a core and are instead used to form shapers that hold the framing in place and support compression boards that keep the frame from buckling. The design allows the frames to carry the load by having enough glass on them.

Instead of using stringers to connect the deck and hull, the boat’s structure is formed from a grid of preformed composites. Its design looks like an air frame construction, with the deck de-coupled from and suspended on the hull bottom.

The boat is designed so when it hits a wave, the hull and deck respond independently. Since they’re not coupled, the boat absorbs the shock energy and uses the deflection of the hull-to-deck cavity to reduce the lock...
loads. The design mitigates shock and solves what Lewit says is a big problem: “Sixty percent of boat operators report lost time due to wave impact injuries. There are broken bones, back problems and occasional fatalities. The idea of protecting the guys they’re carrying and the driver and mitigating shock is important.”

Lewit’s team implemented the new technologies in two boats for the Naval Combatant Craft Division: an 8.5-meter working demonstration craft named the 850B and an 11-meter prototype that is currently undergoing tests. Both versions rely on composite materials to significantly reduce hull and deck weight. The 850B is 40 percent lighter and the 11-meter is 30 percent lighter than typical rigid inflatables used by the Navy.

Removing significant weight from the structure allows for much higher-powered propulsion. To demonstrate this, the 850B was outfitted with twin 185Hp Optimax outboard engines modified to use jet fuel. Jet fuel was used not for speed, but because the Navy would prefer to use fuel that is readily available. All Navy ships carry diesel and aircraft fuel, and gas engines pose dangerous fire hazards.

Configured this way, the 850B weighed 3,600 pounds – much lighter than the Navy’s typical 7-meter rigid hull inflatable, which weighs 4,600 pounds. The 850B also comes in significantly under the weight limit (5,500 pounds) for cranes on Navy ships that lift small combatant craft into and out of the water. “It’s hard to change the crane,” says Lewit. “Better to change the boat.”

The lightweight 850B also offers much higher fuel efficiency. “With the weight and fuel savings, it can support an additional 6,500-pound payload,” says Lewit.

In addition, the new laminate design and framed construction is repairable and easier to maintain than a rigid inflatable, says Lewit. The design focuses failures onto the frame. The craft’s first failure mode – if, for example, it runs aground on rocks – is designed so the bottom will deflect and the frame’s sidewall will buckle outward, bending the glass. “The glass can take quite a bit of bending before it cracks. When it does, it is easy to see where the crack happened on the frame and repair it by grinding and patching,” says Lewit.

From elite fighter jets in the sky to small, but indispensable craft in the sea, the military turns to composites for cutting-edge technologies.

Debbie Sniderman is an engineer and CEO of VI Ventures LLC, an engineering consulting company. Email comments to info@vivllc.com.

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From Small Components to Large Structures

Navy ships are relying more heavily on composites, from small components to large structures. Military fleets now use smaller components such as deck drain inserts, electrical boxes, pumps and stanchions. These complex structural parts offer important money- and time-saving benefits when compared to steel or other materials. They can be used in places where fire dangers are high, such as ventilation ducts in engine rooms, since they can be fire-hardened. They are easier to repair or replace, have longer lifetimes and can have lower acquisition and/or life-cycle costs, especially when produced in large quantities.

Composites also are cropping up for the first time in larger marine structures, where they demonstrate significant benefits to military customers. Composite deckhouse structures provide lower infrared signatures. Submarine cover plates offer acquisition cost savings when compared to steel. Composite fairwaters allow divers to perform maintenance in place instead of requiring docking.
The advanced composites market – focused mainly on aerospace and other high-tolerance, low-production rate applications – is often seen as part of a completely different world from the open-molding fiberglass reinforced polymer (FRP) industry. But insight from key members of ACMA’s High Performance Council suggests otherwise: They say that advanced materials used in the aerospace industry are now trickling down into competitive consumer markets – and are essential to the growth of the FRP industry.

In its recently published report “Growth Opportunities in Global Composites Industry 2013-2018,” market research firm Lucintel, Las Colinas, Texas, predicts that the advanced material market will grow faster than any other market in the global composites industry during the next few years. Advanced composite materials offer a way to diversify and improve on existing U.S. consumer products, such as boats and sporting goods that typically use e-glass or vinyl esters.

Here are three ways that high performance composite materials currently impact material usage in the U.S. composites industry:

1. **Carbon fiber is giving the marine industry a boost.**
   Matthew Bodoff, U.S. national sales manager at Gurit, has been working in the composites industry since the 1990s. According to Bodoff, the most notable change to the FRP industry during the past few decades has been the acceptance and use of carbon fiber in traditional fiberglass markets, such as the U.S. marine industry.
   "Aerospace companies like Airbus are ramping up, and that’s really driving the growth for advanced materials," says Bodoff, a member of the High Performance Council. "With more carbon fiber available in the marketplace, boat manufacturers, which are traditionally open molded fiberglass, are switching to carbon fiber.” He notes that carbon fiber sales have “grown exponentially” during the past decade. Statistics from publisher Smithers Apex support Bodoff’s observations, predicting that the global carbon fiber reinforced plastics market will grow at a rate of 16 percent annually during the next three years.
   One prominent example of the carbon fiber trickle down from aerospace to marine is the use of high performance materials on all the yachts in the America’s Cup. Crew members of Oracle Team USA completed one of the greatest come-back wins in sports history, sailing at record speeds in the AC72 catamaran. The yacht featured a 135-foot wingsail made from a carbon fiber skeleton comprising a cored nose cone and main spar. You can bet the design was influence by aerospace: Tom Speers, head of wing design at Oracle Team USA, previously worked for Boeing as an aerospace engineer. In addition to the
wingsail, the yacht also included carbon fiber rods and hulls.

Not only is carbon fiber a champion in the yacht racing market, but it’s becoming a popular material among amateur boaters, too. “On the recreational side, boat builders are looking for ways to differentiate their product,” says Bodoff. “There’s a large market of good quality used boats that hinders the sale of new boats. The only way to make used boats less valuable is to improve the design on the new boats – and one way is through weight savings. Customers want to go further on a gallon of gas, and carbon fiber offers a solution.”

2. New fabrics are slimming down sporting goods.

In 2011, composite supplier Saertex partnered with Bombardier Aircraft to supply advanced non-crimp fabric for use in its CSeries upper wing skin, lower wing skin and front and rear wing spars. At the time non-crimp fabrics – unwoven material made from layers of fiber laid down on top of each other at different angles – were relatively new in the aerospace industry. The experiment was a success, and other aerospace companies started using non-crimp fabrics.

For example, last March Airbus showcased the same advanced fabrics on the maiden voyage of its A350 XWB. The twin-engine jetliner used carbon non-crimp fabric in nonstructural components of the airplane such as the window frames, center wing boxes, keel beams and floor panels. Today these same advanced fabrics are being used to reduce fabric in structural components for sports equipment.

Trey Sawtelle, co-president of non-crimp fabric supplier VectorPly in Phenix City, Ala., and a member of ACMA’s board of directors and the High Performance Council, has been working extensively with competitive U.S. ski and snowboard manufacturers during the past few years. He’s noticed that the use of multi-axial fabrics has been particularly beneficial to the sports market. “The increased use of carbon fiber in these competitive sports applications has been the holy grail for that industry,” he says. “You can go as strong and as light as you want using advanced fabrics.”

Modern engineered fabrics are capable of reducing the amount of fiber in nonessential areas. This has been a crucial change for ski manufacturers. “Not long ago, we were making snow skis, which are long and narrow, using woven rovings or chopped strand mats. These didn’t allow the builder to optimize the product,” says Sawtelle. “You don’t need a chopped strand mat or a 90 degree [fabric] to build a long, thin ski; really you just need a fiber and a zero degree fabric. With a non-crimp fabric you can design a strictly unidirectional [fabric]. So you take out unnecessary weight, but you still meet the mechanical specification for that part.”

3. Advanced materials are being tailored to specific products.

When Sawtelle started working in the composites industry, the market was primarily filled with woven roving fabrics. “I’ve noticed significant growth for advanced fabrics in the past five years,” says Sawtelle. “This has changed how we’ve been able to overcome woven roving fabrics for end-use applications.”

Thanks to material research, advanced fabrics are becoming stronger and more customizable based on product-specific needs. “As a result of increased regulations in the aerospace market, we can now be much more specific on where we lay the aerial weight of our fabrics,” says Sawtelle. “Say you have a zero degree, a sixty degree and a minus sixty degree, you can create a triaxial specific to the requirement of the end-use product from a mechanical property standpoint. This has changed everything and has truly allowed us to design anything with any material that our customers might need.” Sawtelle says manufacturers can now create thinner, more aesthetically appealing composite parts geared toward the end-use product.

Mike Bracey, vice president of sales at BGF Industries in Greensboro, N.C., which recently partnered with Innegra Technologies LLC to produce advanced fabrics, says advanced fabrics can be used in OEM products. “Thanks to material research, you can now make a product that has several layers of fabric to help you reach a specific goal,” he says. “You can use a triaxial to make it stronger and more durable, or you can use a biaxial to make it lighter.”

The AC72 catamarans created specifically for the 2013 America’s Cup, such as the one used by the winning Oracle Team USA, measure 72 x 26 feet and weigh 13,000 pounds. They are light and fast thanks to advanced composite components, such as the wingsail and hulls.
for water sports, agrees that customizable products are the future for the advanced material market. “Slowly but surely engineers are moving away from traditional metals in favor of composites that can do exactly what they need,” says Bracey, a member of the High Performance Council. “With the new fabrics on the market – for example, bi-directional, unidirectional, multi-axial – end users are getting more bang for their buck with composites than they ever have before.”

But fabrics aren’t the only materials working their way from aerospace to other industries and being adapted to meet specific requirements. Resins such as phenolic resins, which are traditionally used in high-temperature aerospace or ballistic products, are being modified with lower molecular weights to be used outside of autoclave machines. This has opened up the possibility of using phenolic resins in corrosion-resistant products. One high-profile example of this is the recent use of phenolic resin in the water pipes under the fountains of the National September 11 Memorial and Museum at New York’s World Trade Center. There are approximately 4,300 lineal feet of large-diameter piping, comprising an inner layer of glass-reinforced vinyl ester and an outer layer of approximately 60 percent glass-reinforced phenolic.

**Advancing the FRP Industry**

For most of the FRP composites industry, the use of high performance materials has been considered a luxury reserved for aerospace companies. But rising demand for advanced materials suggests that more companies are interested in using advanced fibers: The total demand for carbon fiber alone is expected to increase from 52,560 tons in 2013 to 102,460 tons in 2020, according to Composites Forecasts and Consulting LLC.

“As high-end materials have become more commercialized, the value translation of those materials is much more transparent,” says Sawtelle. “Manufacturing processes have changed, material production has increased, therefore overall pricing has come down on advanced materials, and it’s made them much more relevant to everyday applications.”

Angie McPherson is a freelance writer based in Washington, D.C. Email comments to mcphersonangie@gmail.com.

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**Help Shape the High Performance Market**

If you are interested in working on legislative, regulatory and educational issues related to high-performance composites, consider joining the High Performance Council (HPC). For more information on the HPC and other Composites Growth Initiatives, visit acmanet.org/cgi-committees.

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By John Schweitzer

ACMA recently called on industry members to contact OSHA regarding the proposed silica standard that will increase costs for many composites companies without providing workers any health benefits. Information about the rule and guidance for writing to OSHA are available at acmanet.org/silica.

At the heart of the issue is OSHA’s failure in its preliminary economic analysis (PEA) to consider the use of silica containing materials by composites manufacturers, except for one highly atypical manufacturer of “engineered stone.” As a result, the proposed control requirements may not provide sufficient protection for composites industry workers nor be technically or economically feasible.

Many composite raw materials and molded composite products contain crystalline silica. According to OSHA, prolonged inhalation to respirable crystalline silica at high concentrations may lead to the development of disabling and sometimes fatal lung diseases, including silicosis and lung cancer.

Sand and quartz are comprised primarily of crystalline silica. Calcium carbonate, gypsum, dolomite, mica and other materials used in the production of cast polymer, engineered stone, tub/showers, molding compound and many other composite products contain crystalline silica at lower levels.

OSHA’s Proposed Regulation

Under the OSHA proposal, employers would be required to conduct an initial assessment of occupational exposure to silica. If 8-hour average exposures exceeded an action level of 25 µg/m³ (micrograms per cubic meter of air), the employer would be required to implement a periodic monitoring program.

For workplaces where 8-hour average exposures exceed a revised permissible exposure limit (PEL) of 50 µg/m³, employers would be required to install engineering controls and adopt work practices to reduce exposures to the extent possible. Job rotation would not be permissible as a technique to reduce silica exposures.

If exposures still exceeded the PEL after installation of engineering controls and adoption of work practices, personal protective equipment (PPE) could be used to meet the PEL. Employers must establish procedures to prevent unauthorized employees from entering areas where they might be exposed to silica in excess of the PEL. Regular medical monitoring of employees would be required.

ACMA is working with OSHA to assess composites industry workplace exposure and control options. Exposure limits and other OSHA information about crystalline silica can be found at osha.gov/dsg/topics/silicacrystalline. For updates and analysis, turn to CM Online at compositesmanufacturingblog.com and click the “Government Affairs” tab.

John Schweitzer is vice president of government affairs for ACMA. Email comments to jschweitzer@acmanet.org.
There’s a good news/bad news scenario currently playing out in our industry. The bad news is that composites make up only one percent of the materials market. The good news is that if we get to two percent, we’ve doubled our market share!

So what can we learn from our competition? We know we have a better product in many cases. Then what do they have? From my perspective, other segments of the materials market – steel, aluminum and concrete, for example – are much more cohesive, starting with stronger support for their trade associations. Companies don’t simply belong to trade associations: They actively participate! Read ACMA Chairman of the Board Jay Merrell’s column on page 2 for more on that subject.

Companies in traditional materials industries also maintain market share by staying connected, often through industry publications. Right now you are reading the flagship publication of the composites industry. This issue is loaded with business advice, examples of composites innovations, the latest on military applications and more. To ensure you continue receiving such top-notch editorial, please make sure you renew your subscription at acmanet.org/subscribe-to-composites-manufacturing-magazine or simply return the card inserted in this issue of CM magazine. Consider getting CM in a convenient digital format. If you don’t renew, you may miss out on some great nuggets of information that could help you increase market share.

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just drop off a copy of CM magazine the next time you visit. What better way to remind them of composites – and the value your company provides – than to have them get a steady stream of information from your trade association.

There is no magic formula for growing our industry, only a series of small steps. The first one is to connect the whole industry together.

Tom Dobbins, CAE
ACMA President

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For more information or to sign up for the email, please contact Andrew Huber at ahuber@acmanet.org. Not a member? Contact Paul Hirsh at phirsh@acmanet.org to learn more about the many benefits of joining ACMA.

Join Forces with the Entire Industry at CAMX

This is the time many of you would be preparing for ACMA’s early spring COMPOSITES show. But not this year! Instead, you are – or should be – eagerly awaiting next fall, when CAMX, The Composites and Advanced Materials Expo, takes place for the first time. Join engineers, researchers, manufacturers, suppliers, service providers and end users in all market segments Oct. 13-16, 2014, at the Orange County Convention Center in Orlando, Fla.

SAMPE and ACMA, co-producers of CAMX, are placing their brands, expertise and success behind the show, which takes the place of the SAMPE Convention and ACMA’s COMPOSITES.

Leaders of both organizations recognized that changes in the industry called for one true industry event. This new event – CAMX – provides educational programs and networking opportunities for sharing product innovations and establishing key industry contacts. You’ll still find the best of COMPOSITES at CAMX – a large exhibit hall, education sessions, technical papers, ACE Awards, product displays and manufacturing demonstrations, plus plenty of networking during the ACMA Awards Lunch and receptions.
ACMA realizes that many of you still want to connect with peers, customers and friends next spring, so be on the lookout for information on new ACMA events. For more information, visit theCAMX.com or contact Heather Rhoderick, ACMA’s vice president of events and education, at hrhoderick@acmanet.org. Interested exhibitors should contact Sean Nodland at snodland@acmanet.org.

What You Need to Know About Conflict Minerals
“Conflict minerals” mined in conditions of armed conflict, particularly in the Democratic Republic of Congo (DRC) in central Africa, are likely to become very important for many composites manufacturers. That’s because Congress decided to cut off funding for warring factions in Africa by requiring publicly traded companies to disclose the use of four metals – tin, tantalum, tungsten and gold (also called “3TG”) and derivative compounds. Mining of 3TG funds an ongoing conflict there.

What does that mean to your company? Find out during ACMA’s Policy Spotlight LIVE: Conflict Minerals Update. This members-only webinar on November 19 at 11 a.m. will be led by John Schweitzer, vice president of government affairs for ACMA. To register, go to acmanet.org/meetings. Members also can access resources on conflict minerals by visiting acmanet.org/regulatory-compliance/conflict-minerals.

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www.acmanet.org/cct
One of London’s most recognizable icons is the red double-decker bus, called the Routemaster. Introduced in 1956, the buses ran throughout the capital city until 2005. Today a new double-decker bus, reminiscent of the Routemaster, carries passengers throughout London thanks to an initiative dubbed the “New Bus for London” (NBfL).

The NBfL buses are nearly 36.7 feet long and can carry up to 87 passengers. They use advanced composites to achieve weight savings while structurally supporting the hybrid powertrain and meeting aggressive fuel efficiency targets. The manufacturer of the bus, Wrightbus, selected Gurit to design and supply composite parts for the rear end of the bus exterior. This includes a dome section at the top (highlighted in yellow), two panels on the back (highlighted in blue) and the hop-on, hop-off platform (not shown).

These composite parts were laminated with Gurit’s glass SPRINT™ ST 70FR, a fire-retardant structural matrix, and larger, flat areas were stiffened with minimal additional weight using Corecell™ M-Foam. Bus technicians have been trained to repair parts damaged during collisions with Gurit’s SP 110 high-strength epoxy laminating system.