Building Better Business
Three composites companies share details of how quality programs help them reduce waste, increase productivity, save money, improve employee morale and more. By Terin Bufford and Susan Keen Flynn

Do You Have What It Takes to Be an Aerospace Ace?
It takes a lot of time and effort to become a supplier for aerospace leaders like Boeing and Airbus. But it’s well worth the effort according to partner companies, who share advice with industry peers. By Jamie Hartford

Turning Bottles into Bridges
Bridge beams made from recycled plastics. Racecars incorporating reclaimed carbon fibers. With a focus on green solutions, applications abound for recycled composite materials. By Darin Painter

Online Exclusives
Composites are everywhere. So is Composites Manufacturing magazine. Visit compositesmanufacturingblog.com for exclusive content, including Q&As with industry leaders, new product round-ups and up-to-date news.

More on Aerospace
What company is tops in the aerospace industry? Click on the “aero” tab for a list of the Top 5 Aerospace Companies by Sales.

Q&A Interviews
Check out our Q&A with Richard Cubeta, owner of SolidCast Polymer Technology. He talks about the economic benefits of using recycled composite material and how his firm converts that material into manhole pipes, segmental tunnels and other products.
A Last Hurrah

This is my last column as your ACMA president. It has been a wonderful two-year experience and one I will never forget. Your board of directors has worked hard, and many changes have taken place. It has been an honor to lead this board, and I thank each member for their hard work, time and monetary commitment.

I especially want to thank Monty Felix, immediate past president of ACMA and CEO of Alaglas Pools, for his guidance and direction. He has been a true inspiration to me. It’s hard to believe that Monty will be leaving the board after nine years. We will miss him and his wisdom.

Also, I would like to thank the ACMA staff. We truly have a great staff that works hard every day for us and the industry as a whole. There have been challenges along the way as each of ACMA’s eight committees worked diligently to gain recognition for composites and grow the industry. Dedicated ACMA staff members are the ones behind the scenes moving our industry forward with little recognition.

Finally, and perhaps most importantly, thank YOU for being an ACMA member and supporting our industry: We are a much louder – and more persuasive – voice together than we are alone. I look forward to working with incoming ACMA president, Jay Merrell of Norplex-Micarta. Look for many new and exciting things to come, such as the first ACMA/SAMPE show in the fall of 2014. It will truly be the largest composites show in the United States. The composites industry is on a path for growth as sustainability, energy efficiency and security become more important than ever.

One last bit of advice before I retire my gavel: Did you know some states will pay for up to 50 percent of your expenses to travel to an international trade show? I contacted our state Business Development Commission about the Oregon Trade Promotion Program, funded in part by the Small Business Administration. We qualified! The program also will help us set up business meetings in the countries we visit, assist with some of the research legwork and help fund marketing materials for the show.

Many other states offer this program to promote product exportation. ACMA’s COMPOSITES 2013 was on the list of shows that qualified for assistance as were AWEA Windpower Conference & Exhibition and Composites Europe 2013. I was really surprised to see what opportunities may be out there for marketing.

In conclusion, it has been an honor to lead the ACMA board, which represents a great organization. It’s an experience I will never forget.

Thank you!

Lori Luchak
Miles Fiberglass & Composites, ACMA President
lluchak@milesfiberglass.com
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Add Digital Marketing to the Mix

By Todd Hockenberry

Successful marketing drives revenue growth using a mix of traditional and digital strategies. Traditional marketing channels include trade shows, magazine advertising, direct mail and outbound calling. These are sound techniques, but to reach your business goals you should also develop a series of tactics that utilize digital platforms.

The key to any marketing strategy is the extent to which you can identify and define your ideal client. Once identified, you can then tailor your marketing efforts to reach them where and when they seek a solution. The last step is to provide information convincing customers that you can deliver a valuable solution. There are many different ways to provide that information (traditionally, digitally or face to face with salespeople), but the method of delivery doesn’t change the goal.

The key area of overlap between inbound digital marketing and traditional marketing is content. Think of content as the fuel used to power a website. Search engines like fresh, relevant content such as blogs, updated site pages or social media publishing. Generally speaking, the more focused the content, the better your ranking on search engines.

But content is only the beginning of the process. Most companies put up a false barrier between the marketing department’s use of content, the sales team and the buying process. Put yourself in the buyer’s shoes. The proliferation of information (content) means that buyers now control the buying process: They can self-educate and regulate how often salespeople influence the process. Salespeople can no longer add value just by communicating specifications and features. Buyers expect to get this information from your digital marketing.

A recent study by the Earnest Agency, an advertising agency, showed that 90 percent of B2B buyers searched online for information about a product or company prior to engaging with a salesperson. Another Earnest Agency survey showed that for purchases over $10,000, 70 percent of buyers read at least four pieces of content before they make a decision. Prospects are researching your company before you even know about their need or opportunity. So you need to put out content that your prospects can find, be won over by and engage with.

Content is simply information that prospects are interested in consuming. Examples include white papers, blog posts, demonstration videos, webinars, surveys, checklists, photos, testimonials, case studies, ROI analyses and technical updates. The key to connecting digital marketing and traditional marketing is to map the content to the appropriate stage in the buying cycle.

OK great, but how do companies in the composites world connect a digital content strategy with their traditional marketing? And, most importantly, how do they do it so that it drives revenue?

You need good digital messaging, which is clear and crisp, because website visitors make decisions quickly. If they aren’t sold by your messaging they bounce off your site. Digital messaging also needs to be concise and focused on specific value. This requirement should inform your traditional marketing as well. Avoid marketing speak and clichés, and stick to measurable statements that get right to the heart of the value you create for customers.

One of the greatest things about good content is that it can be used in a variety of ways. If you create great content for your digital strategy it is easy to use that same content in traditional marketing. Take copies of your online case studies to trade shows. Submit your technical blog posts to trade journals for publication. Give your sales team the latest digital content, and train them to apply it to the sales process. If content matches the buyer’s process then blog posts, web pages and case studies become powerful communication tools for the sales team.

Feedback from traditional marketing events can feed the content engine and pull service and sales into your digital marketing strategy. For example, trade shows are great places to learn what issues are foremost in prospects’ minds and can become powerful subjects for fresh digital content. By connecting new regulations, breaking industry news and technical developments to your particular area of focus you position your company as one to watch and connect with when your prospects are in need.

To put it simply, a basic strategy for adding digital marketing to your traditional marketing has five steps: create focused content, publish and promote that content, map the content to target prospects’ buying cycles, integrate content into sales processes and encourage ongoing customer engagement.

Todd Hockenberry is a frequent contributor to Composites Manufacturing magazine and the president and CEO of Top Line Results. Visit www.top-line-results.com/acma.
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Composites Create Sound Structures

Music lovers flocked to Stanford University January 11-13, 2013, to attend sold-out performances celebrating the grand opening of Bing Concert Hall. The hall’s 842 seats encircle the 3,200-square-foot stage, creating an intimate environment for both the audience and performers. Acoustic panels on the walls and ceiling, made from fiberglass reinforced polymer (FRP) on top of steel-reinforced concrete, provide optimal sound in the hall and add a dramatic backdrop to performances.

Ennead Architects designed the hall with input from Nagata Acoustics, an acoustical consulting firm. Kreysler & Associates, American Canyon, Calif., assisted in the design and provided the acoustic panels.

“There were two major design factors we had to face: the acoustics requirements and the ease of construction,” says Greg Clawson, project manager for Ennead Architects. Bill Kreysler, president of Kreysler & Associates, and his team developed a series of eight wall panels resembling sails that measured approximately 50 square feet each. They also provided a 127-foot cloud structure for the ceiling made of 80 individual panels.

“When we looked at the design it was obvious that the best material to use would be fiberglass reinforced polymer,” says Kreysler, chair of ACMA’s Architectural Division – one of 12 Composites Growth Initiative (CGI) committees. Fiberglass was strong enough to create sharp edges and complex shapes, allowing tight fitting joints with the precise density needed. Though FRP met most of the requirements, it was too light for the acoustic panels. They need to be heavy enough to efficiently reflect sound. “The heavier the reflecting material is, the wider the frequency range can be reflected from the surface,” says Dr. Yasuhsa Toyota, president and founder of Nagata Acoustics America. This enhances sound in the hall.

To add weight, Kreysler & Associates cast reinforced concrete onto the back side of the molded single skin FRP panels. Once the concrete cured, the pre-assembled space frame was lowered onto the back and anchored into place, and only then were the panels removed from the mold, assuring they would be reassembled accurately during installation.

The resin used in the application also played a critical role. It was imperative to select a resin that would help the composite material pass two tests used in the construction industry: A flame spread test determines a material’s tendency to burn rapidly and spread flames, and a smoke density test establishes...
how much smoke is produced. CCP Composites provided a solution: Its NORsODYNEN™ H 81269 TF flame retardant polyester laminating resin does not produce smoke. The resin was a perfect choice for fabricating the FRP panels.

This innovative application may not have been possible without changes to the International Building Code (IBC) that came about with the support of ACMA’s Architectural Division and Fire Committee, association staff and an outside consultant. They spent more than two-and-a-half years at a cost of $70,000 donated by ACMA member companies to include FRP composites into the IBC and provide test requirements and regulations that were added to the 26th chapter of the 2009 edition of the IBC under section 2612. It is titled “Fiber Reinforced Polymer” and “Fiberglass Reinforced Polymer.”

“For my company, right now and for the next two years, I can guarantee that at least 75 percent of our work would not have been possible without this code change,” says Kreysler.

According to Clawson, the FRP material not only fulfilled the project’s design requirements, but also allowed for speedy installation. “It took a little over a year to design and finish the exterior of the hall, yet it took less than 10 months to complete the interior,” he says. Using composites helped accomplish all of the acoustic and architectural requirements in a creative way. And for this creativity, Kreysler and Associates received the Award for Composites Excellence (ACE) for Most Creative Application at COMPOSITES 2013 in Orlando, Fla.
Composites Set Sail

A race around the world and a race against time inspired 20 skippers to embark on a chance at the ultimate title. The Vendée Globe is the only single-handed, non-stop, round-the-world yacht race and is regarded as a critical test of individual endurance. Founded in 1989 by Philippe Jeantot, a French deep sea diver, the race takes place every four years. The skippers set sail on November 12, 2012, from Les Sables-d’Olonne, France, and finished at the same location.

The International Monohull Open Class Association (IMOCA) administers the “Open 60” class of sailboats competing in the Vendée Globe race. This class of high-performance racing yachts is “open” – meaning it does not represent fixed boat designs – and consists of 60-foot monohulls. The IMOCA defines and updates the class rules and helped coordinate the Vendée Globe race.

High-performance sailing yachts, used in challenging environments, are engineered to be stronger, faster and lighter. To meet these standards, boats are now largely constructed from composite materials, which offer significant advantages in terms of weight, strength and adaptability. The top three finishers of the Vendée Globe, profiled here, used composite materials throughout their yacht designs, as did most of the other competing yachts.

**Skippers:** François Gabart and Armel Le Cléac’h  
**Boats:** Macif (1st place) and Banque Populaire (2nd place)

François Gabart’s Macif is one of the most recent monohulls in the IMOCA fleet. It was built to be fast, reliable and solid. Gabart, 29, entered this race for the first time and became the youngest skipper to win the Vendée Globe. He finished in 78 days, breaking the previous record of 84 days.

Armel Le Cléac’h, 35, and his Banque Populaire came in just three hours behind Gabart, making this the closest finish in race history. Both yachts incorporated composites from the same firm, Hexcel Composites Ltd. Hexcel supplied its trademarked HexPly prepreg to CDK Technologies of France, which built the yachts. “Each yacht was made of 120 C carbon fiber prepreg from Hexcel and combined with a honeycomb structure,” says Michel Ollivier, operations manager at CDK Technologies. According to Ollivier, you can’t have a racing boat of this caliber without integrating composite materials.

“For over 30 years, we have supplied carbon fiber prepregs, honeycombs and adhesives to boat builders and all of the racing boats have hull, deck, keel, mast and rigging built in carbon fiber composites these days,” says Rachel Owens, communications manager at Hexcel Composites.

**Skipper:** Alex Thomson  
**Boat:** Hugo Boss (3rd place)

Taking third place in the Vendée Globe, Alex Thomson, 38, set a new non-stop round the world record for a solo British sailor. He finished the race in 80 days, breaking the previous record by nearly eight days.

Everything on Hugo Boss is made of composites except for the keel. “Sails, mast, boom, rudder, hull, bulkheads, deck, etc. Nearly everything is a composite structure. That’s why Alex Thomson Racing asked us to support them as a technical partner – before, during and after the race,” says Isa-Kristin Braun, head of marketing and public relations at Caterham Composites.

Caterham Composites faced challenges with materials, budgets and time constraints when it created the sliding coach roof for the Hugo Boss. The company aimed to protect Thomson from the intense weather expected during the Vendée Globe race and help him perform to his full potential. “The weather I faced gave me ample opportunity to push the adjustments that we made to the coach roof to the limit and I’m pleased to say it’s excellent,” says Thomson.

According to Braun, Caterham Composites used readily-available carbon fiber materials in various forms for the outer part of the coach roof. “We used a virtual development process with two-stage composite optimization, implemented with Altair Engineering’s HyperWorks software suite. For the core of the product, we chose foam and Nomex,” says Braun.

Once the race began, harsh conditions took a toll on several skippers. Of the 20 yachts involved in the race, only 10 finished. Nine individuals...
dropped out of the race due to collisions, electrical issues and damages. One skipper was disqualified for receiving assistance. The nature of the Vendée Globe itself was the biggest challenge for each sailor. It’s not just the 80 days at sea that’s difficult: It’s the years of preparation and the work it takes to get the boat on the starting line in the best condition.

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 “marine” tab.
Austin, Texas, is a vibrant city with more than 825,600 residents, up 25 percent since 2000. The downtown district buzzes with activity. Retailers, art galleries, restaurants, businesses and condos create excitement – and a lot of wastewater.

Last fall, Austin completed one of its most complex infrastructure projects, a 3.9-mile wastewater tunnel. The tunnel, which moves liquid sewage to treatment plants, will facilitate residential and business growth downtown. An important offshoot of the project was an accompanying odor control system.

ECS Environmental Solutions in Belton, Texas, supplied the odor control equipment, which included more than 1,000 feet of fiberglass ductwork and accessories such as field joint kits, flexible connectors, control and back-draft dampers and bolt gaskets. ECS also provided two fiberglass exhaust fans rated at 40,000 cubic feet per minute (CFM).

“The magnitude of this bio-filter project made it unique,” says Jeff Jones, president of ECS. His company manufactured ductwork in five different sizes, ranging from 72 inches to 12 inches in diameter. Approximately half of it was buried below ground and had to be H-20 wheel loaded so it could withstand thousands of pounds of high-density traffic driving over the site.

The above-ground ductwork is suspended by concrete supports. Fiberglass was an ideal material for this ductwork because of its light weight. “Supports are an expensive piece of the construction puzzle,” says Jones. “With specially-designed FRP ductwork, the contractor could extend the support spacing. That was beneficial to the client because it reduced costs.”

All of the ductwork was manufactured at ECS’ 100,000-square-foot facility. The round ductwork was filament wound using a computerized winder. Direct filament strands were pulled through a resin bath, saturated, then applied on top of a corrosion barrier at a pre-determined angle. The complex fittings and joints were manufactured using hand lay-up. ECS provided alternating layers of 1.5-ounce chopped strand mat and 24-ounce woven roving to the parts until the designated thickness or laminate sequence was achieved. Each separate layer was saturated with resin by hand.

The internal surfaces of every component feature a 100-mil corrosion barrier that was applied by hand lay-up. Because the ductwork is exposed to sunlight, a gelcoat with UV inhibitors was applied to the exterior.

ECS used AOC’s Vipel® K022, a corrosive-resistant vinyl ester resin. “The K022 resin was the best choice for this project,” says Jones. “Some of the gases in the air stream are corrosive – hydrogen sulfide and ammonia. There’s also sulfuric acid. Pipes built with this resin are inert to what goes in them: They will not corrode.”

The project contractor noted many advantages of the fiberglass ductwork. “Components could be fabricated entirely out of FRP due to its versatility,” says Cary Broschat, project leader from Quest Civil Constructors Texas, LLC. “ECS fabricated complicated shapes and pieces – reducers, bends, square and round duct with transitions between both shapes – with relative ease.” He says the corrosion-resistant material
The Contractor Talks Composites

Quest Civil Constructors Texas, LLC served as the contractor on Austin’s downtown wastewater tunnel project, which included installation of an odor control system with fiberglass ductwork supplied by ECS Environmental Solutions. Cary Broschat, project leader from Quest who has worked with FRP on several occasions, offered these views on composites.

Touting the Benefits:
“Composites can be much more costly than other materials. But taking into account the ease of installation and corrosion resistance, using composites results in a very competitive – and often cheaper – installed cost. Composites are also typically much more durable and have a longer lifetime with less associated maintenance cost than traditional materials.”

Making a Plug for Partnering:
“Composites suppliers should work closely with owners and engineers to make the full scope of available products and technologies known and get these products on the standard product lists with municipalities. There are some very cool products out there that offer huge advantages over traditional materials. But these products can only be used if owners and engineers know about them and understand their advantages.”

also eliminated the need for secondary corrosion protection.
ECS prefabricated and sub-assembled the duct system at its facility, then shipped it 60 miles south to Austin. The company sent a field crew of five employees to the construction site to handle all the field layup for Quest. The contractor trimmed the ductwork and placed it in supports, then ECS connected the pipes with field joints.
“We installed most of the duct using field-wrapped joints in lieu of flanged connections,” says Broschat. “Not only was this a cost savings, but the field-wrapped joints were quick and easy to install and allowed for minor gaps between the joints of the pipe to be completely sealed.” He adds that using ECS to perform the field wrapping saved time and money because of the crew’s skill and experience.
Installation of the odor control system was completed in January.

Susan Keen Flynn is managing editor of Composites Manufacturing magazine. Email comments to sflynn@keenconcepts.net.

For more stories like this, visit compositesmanufacturingblog.com and click on the “infrastructure” tab.

Educating End Users
The Corrosion Control Division (CCD) of ACMA launched an educational website for end users at corrosionresistant.org. It touts the benefits of FRP composites, provides extensive resources, includes case studies and much more. Check out the website and direct your customers and prospects there to help grow the industry.
Turning the Tables on the Rec Market

Sometimes innovation leads companies in unexpected directions. Just ask Eric Ball, vice president of product development at Orenco. Ball and his team didn’t set out to design a table tennis table. In fact, they didn’t set out to make a recreation product at all. Orenco is best known for wastewater products. However, one innovation led to another and Orenco will introduce its unique fiberglass table tennis tables later this year.

The new FiberGraphic™ tables are built using closed mold vacuum infusion, which allows for robust, embedded graphics. Although there are a few fiberglass pingpong tables on the market, Ball says that these are hand built using more traditional chopper gun fiberglass dispensing systems. None feature embedded graphics.

The technology to build the FiberGraphic tables was an offshoot of ongoing research and development into fiberglass products with embedded images, especially the architectural fiberglass panels now offered by Orenco’s Motif Design Tools division. Like the panels, the tables are built using a vacuum infusion process in which the fiberglass and the core material are laid-up as dry goods, sealed under a nylon bagging film, and then infused with a specialized polyester resin from Reichold that includes multiple proprietary formulations.

The resulting table is nearly 100 percent composite. “So there is absolutely nothing to rust or corrode,” explains Ball. This means that, unlike traditional wood tables, FiberGraphic tables can be used outdoors. At 150 to 200 pounds, they also are much easier to move than outdoor concrete table tennis tables, which can weigh 2,000 pounds.

Perhaps most importantly, the vacuum infusion process enables the tables to feature custom graphics. The graphics, which can include photos, logos, names and other images, are printed on large sheets of fabric and embedded in the table when it is infused. Ball thinks the collegiate market is ready for this kind of product and envisions pingpong tables featuring team or school logos on college campuses across the United States – for use in gyms, workout rooms and other athletic facilities. The University of Oregon has already requested custom benches for its six indoor tennis courts.

Like Motif Design Tools’ architectural panels, the pingpong tables can be built with embedded organic or inorganic materials such as grass, leaves, sand, rocks, seashells or, as Ball puts it, “just about anything that will fit within the thickness of the laminate we are making.” This includes wood veneers such as cherry and oak.

So how does a wastewater company move into the recreational market? Initially, Orenco developed decorative fiberglass manhole covers for water systems with embedded images of grass, rock or bark mulch to match landscaping. Next the company embedded images and materials into custom architectural panels under Motif Design tools. Then Ball and fellow tennis and table tennis enthusiasts decided to use the technology to build a pingpong table. “The whole thing is really in its infancy,” notes Ball. But he’s betting that sports enthusiasts will share his excitement about the custom tables.

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For more stories like this, visit compositesmanufacturingblog.com and click on the “Sports & Rec” tab.
Composites firms use business improvement processes to implement small changes that make a big difference.

By Terin Bufford and Susan Keen Flynn

Quality is everyone’s responsibility. That simple, yet insightful quote is attributed to W. Edwards Deming – statistician, educator, consultant and a founding father of the business process improvement movement. Deming began advocating for quality-control methods in manufacturing in the 1930s. Many of his ideas live on today.

Companies seeking to reduce waste, increase productivity and streamline operations often employ a business improvement method – and there are a lot of them. Six Sigma, Lean manufacturing, Kaizen. Total quality management. Perhaps the best way to understand how quality programs work is to examine them at work. Here are three mini case studies of the business improvement journey taken by composites companies from coast-to-coast.
Wayne Hampton, president of Waco Composites, spent eight years as a total quality management facilitator in Japan. So when the Texas manufacturing company opened in 1996, he knew exactly what kind of quality program he wanted to implement. “I like the Japanese concept of Kaizen,” says Hampton. “To me, it makes sense in every area of our lives, not just for a company. We can continually improve.”

Hampton developed a ½-inch thick manual of processes and procedures for Waco Composites that included Kaizen principles. One of those principles encourages all employees to regularly come up with small improvement suggestions. Waco Composites calls it their “Better Ways Program.” If an employee notices a better way to do something, he or she submits it to the plant engineer. The plant engineer then reviews the idea with the operations manager and Hampton. The best ideas are put into practice, and employees who suggest them are rewarded with gift cards.

Lots of employee suggestions have been utilized. During the company’s last ISO audit, it was commended for 18 continual improvements made in the past year. One idea related to waste generated from the company’s hydraulic presses. “When you press things in hydraulic presses using resin systems, you get a lot of squeeze out,” says Hampton. An employee suggested installing gutters on the presses to catch the excess resin. Now the squeezed-out resin travels down the gutters, empties into buckets and is recycled for use in future production.

Waco Composites’ original quality program became obsolete when business grew. Hampton was compelled to revise the program after a 2007 visit from a prospect, a multi-billion dollar company that manufactures vehicles for the U.S. Army and Marines. The visitors liked what they saw on a company tour, but told Hampton his employees at Waco Composites regularly suggest ideas to improve product quality and enhance plant safety. For instance, following one employee’s recommendation the company purchased mechanical vacuum lifters so workers in the water-jet cutting department don’t have to manually lift heavy panels.
quality program was not up to par. “I told them, ‘Before you leave the parking lot I will be on the phone with a consultant and we will undergo preparation for ISO 9001 certification,’” recalls Hampton. The following week, a consultant from Chicago was at Waco Composites helping the company prepare for certification and rewriting its quality manual.

Waco Composites became ISO 9001: 2008 registered in 2009. Kaizen principles help the company remain efficient. “Part of Kaizen is acknowledging that you haven’t reached the top,” says Hampton. “The bottom line is we can always get better in sales, in production, in environmental sensitivity – in every dimension of our business.”

Employees are kept in the loop through daily, monthly and “near misses” meetings. Each day the operations manager, production manager, shipping manager and programmer of the water-jet cutting equipment discuss any potential issues. During monthly luncheon meetings, the entire staff receives Kaizen training related to some aspect of the business. In March, the company covered production floor safety when carrying heavy loads. “Near misses” meetings are called when a problem nearly occurred, but didn’t. “We make sure the problem doesn’t ‘almost happen’ again,” says Hampton.

The quality program at Waco Composites stays on track with the help of outside consultants. One contractor conducts weekly walk-through audits of the plant and tells Hampton if he sees any hazards, such as containers missing the proper identification labels. “We are willing to be corrected,” says Hampton. “That’s part of continual improvement.”

Last year, Waco Composites hired a consultant to complete a waste analysis study. The consultant spent three months learning the company’s processes, evaluating where there was waste and how much it cost, and recommending how to reduce waste. Waco Composites discovered it threw away approximately $250,000 in wasted product annually and paid $25,000 to have it hauled away. The company worked with its suppliers to reduce waste. For example, it asked for custom size rolls of woven roving fiberglass material so less waste is generated when it’s cut.

“Our mantra these days is increased efficiencies,” says Hampton. “Things are tight everywhere, and we can’t afford waste. We’ve caused all our suppliers to get efficient with us.” Creating efficiencies, earning ISO certification and relying on Kaizen principles has benefitted Waco Composites. Hampton says the company has new business opportunities in Europe and Asia. “It’s opened up the whole world to us,” he says.

An Introduction to Kaizen
The Kaizen management philosophy was created in Japan following World War II. The word translates to “change for the better.” Toyota is one of the well-known leaders in the Kaizen movement.

What Is Kaizen?
Kaizen strives for continual improvement by asking every employee – from the receptionist to the CEO – to find small ways to make improvements within the processes and systems of a company. By consistently making little changes, companies can increase productivity, reduce waste, enhance safety, improve customer service, etc.

Followers of Kaizen often refer to the “Five S,” a systematic approach to create efficiencies. Each “s” stands for a Japanese word, translated here:
• Seiri – sort out
• Seton – organize
• Seiso – shine the workplace, or keep it clean
• Seiketsu – standardize
• Shitsuke – self-discipline

You may also hear people talk about Kaizen events: Employees gather together, map a process, find ways to improve the process and ensure buy-in from everyone involved.

Where Can I Learn More?
Try the following for more information on Kaizen:

kaizen-training.com – Kaizen Training is a for-hire consultancy. However, the website offers lots of free information, including articles, a blog, tools and weekly tips.

“Kaizen: The Key to Japan’s Competitive Success” – This book by Masaaki Imai discusses 16 management practices and contains 15 corporate case studies.

thleanlibrary.com – A compilation of resources, this website includes “Quick Start Guides.” These guides feature articles organized by how detailed they are – from “I only want the basics” to “I need to get down to the nuts and bolts” of each quality process.
Many companies are challenged with trying to find the best way to create value for customers. Best Bath Systems Inc. decided to reevaluate its operating processes to efficiently maximize customer value and minimize wastes. The company implemented lean manufacturing in 2000 to help.

Jay Multanen, project manager, and his team at Best Bath became intrigued with lean manufacturing after noticing the momentum it was gaining throughout industry. “After hearing about all of the success with several companies, including Toyota and our friends that are members of ACMA, our curiosity sparked us to pay attention,” says Multanen.

The main goal of lean manufacturing is to maximize customer value by responding to the customer’s demands as quickly as possible without creating wastes in the process. “There are several types of wastes and it is my duty to watch and evaluate my team to determine if we are producing wastes,” says Multanen. According to Taiichi Ohno, a Japanese businessman known as one of the founding fathers of lean manufacturing, the seven wastes are defined as follows:

- **Over production** – production ahead of demand
- **Over processing** – the act of doing extra, non-value adding steps
- **Motion** – people or equipment moving more than is required
- **Transport** – moving products that are not actually required to perform the processing
- **Waiting** – time wasted while waiting for the next production step
- **Defects** – extra effort involved in fixing and checking for defects
- **Inventory** – all products, work in progress and finished products that have not been processed

Best Bath Systems determines wastes using Ohno circles – a circle or a spot on the production floor where managers stand to observe and document any obvious wastes, thereby revealing where the production system has failed. An example of waste caught by the company involves Best Bath’s universal WaterStopper kit, which includes both small and large end caps. It is designed to go with both shower models the company manufactures, but not all clients require the whole kit. The shipping...
“Whenever we identify a waste, I go through a process... to find the root of the problem.”

Jay Multanen, Project Manager
Best Bath Systems Inc.,
Caldwell, Idaho

manager realized the company was sending out the kit to a particular customer, rather than shipping the specific piece it required.

“So we were wasting that material,” says Multanen. “Whenever we identify a waste, I go through a process... to find the root of the problem.” The customer ordered the universal kit because the salesperson didn’t realize the company only needed one part. “The root cause here was that we need to do a better job training our salespeople about our products.”

Employee involvement is a critical component in lean manufacturing. Best Bath Systems uses “lean walk-arounds” to ensure employees are on the same page. Each department has a whiteboard – called a scoreboard within the company – to chart measurables, write ideas for cutting down on additional steps and display overall improvements. “These charts are out in the open for everyone to see,” says Multanen. “Once a week each department comes together to discuss the various issues they might have seen within their department or within other departments.” Then employees brainstorm ideas to make their jobs easier, thus improving morale and fostering teamwork.

Once a month the company president does a walk-around to discuss the departmental challenges listed on the scoreboards. “It is my job to facilitate the discussions and to use the information gathered in these scoreboards to determine if our plan is effective,” says Multanen. “If it’s not, we need to reevaluate and make changes to the plan.”

Due to responses received from the scoreboards, Best Bath Systems made one big change to its production process. It consolidated parts assembly using a flow process (making one product at a time) instead of a batch process (making as many as you can). The latter produced a lot of waste. “What we had to do was give employees the right tools to build the right parts, one at a time,” says Multanen. “And that actually helped remove a lot of wastes that are common with batching, such as waiting, over-processing, motion and inventory.” The flow process also allows the company to track how much time is spent manufacturing a certain product so it can continue to improve in the future. The core of lean is grounded in the concept of continuous product and process improvement.

The company created an employee training program called Best Bath Systems University (BBSU) that includes several courses. One is on lean manufacturing. “We focus on lean principles in training so that all employees are using the same vocabulary and talking about the same issues,” says Multanen. Other BBSU courses cover marketing, sales, leadership and development as well as the Certified Composites Technician (CCT) program.

Multanen praises his employees' commitment to lean manufacturing. “Building employee involvement has been instrumental to the overall success of the company,” he says. “Everything we’ve done with lean has essentially come from the employees.”

An Introduction to Lean Manufacturing

The basic principles behind lean manufacturing can be traced back 100 years to Henry Ford: He combined interchangeable parts with standard work and moving conveyance to create what he called “flow production.” After World War II, Toyota carefully considered flow production and devised a system to provide continuity in process flow as well as a variety of product offerings. The seminal thought processes behind modern-day lean manufacturing were described in the 1990 book “The Machine That Changed the World” by James P. Womack, Daniel Roos and Daniel T. Jones. Aside from Toyota, other large companies that rely on lean manufacturing include Nike and Boeing.

What Is Lean?

Lean manufacturing, also simply called lean, is a production practice that focuses on maximizing customer value while minimizing wastes. The underlying theme of lean is to preserve value with less work.

The lean manufacturing practice follows five principles:
1. Identify customers and specify value
2. Map the value stream
3. Create flow by eliminating waste
4. Understand what the customer demands, then respond
5. Pursue perfection

Where Can I Learn More?

Here are two online tools that provide information about the lean process:

lean.org – The Lean Enterprise Institute Inc., founded by James P. Womack in 1997, is a nonprofit education, publishing, research and conference organization. The website includes a Knowledge Center with resources divided by market sector (such as manufacturing) and job functions.

leanmanufacturingtools.org – This website provides brief summaries of various lean tools and techniques.
Earlier this year, General Composites Inc. (GCI) began manufacturing a composite barrel for recreational or tactical uses for a customer. Because GCI already makes a similar barrel, the company assumed production of this one would run smoothly. It didn’t. So three employees formed a Kaizen group to identify what was going wrong and how to fix it.

The employees examined all of the production steps, discovered a glitch in layup and made an adjustment. Within one week, the production line significantly improved its first pass yield – the percentage of products that don’t require rework or are “good on the first pass.” The new barrel’s first pass yield jumped from 45 percent to 90 percent. “That’s amazing for a new product,” says Kenda James, quality manager for GCI. And much of the credit goes to the company’s focus on business improvement processes.

General Composites put in place a cohesive quality improvement program in 2010, when it became ISO 9001:2008 certified. Rather than select one quality process, the company uses a mix of methodologies. These include Kaizen, lean manufacturing, total quality management and Six Sigma. “When it comes to quality, one size does not fit all,” says James, who has 30 years of experience in quality programs and leads the initiative at GCI. “If you can keep the program in sync with what’s actually happening on the shop floor, it’s a richer experience for everybody.”

During the past year, GCI has held approximately four training sessions a month to teach overarching concepts of continuous improvement to its production staff. The training typically features a short PowerPoint presentation (15 minutes or less), followed by a group exercise or homework assignment. After one training session, employees completed a spaghetti diagram – a flow chart tracking the path of a part through manufacturing.

Spaghetti diagrams are designed to expose inefficient workflow layouts. Because GCI makes lots of products – and some employees wear lots of hats – the company suspected it would discover inefficiencies. Employees used a matrix calculator to count how many actual steps they took moving through the plant to complete each product. The person with the most steps received a signed photo of the CEO holding a bowl of spaghetti.

But the funny gift wasn’t the real benefit. Analyzing workflow allowed GCI to reconfigure two of its production lines – or cells as they are called in lean manufacturing – to run more smoothly. One of the work cells manufactures X-ray plates. The production team was scattered throughout the plant, so members selected a little-used room where everyone could work, drew a layout of how the cell should be structured and submitted it to the production manager. He agreed to the plan.

Another quality initiative put into action at GCI was an electronic batch traveler system (e-BT) to track materials and work-in-progress. Operators use tablet computers and handheld scanners to enter data including product codes, batch numbers, pass rates, defects, etc. “It saves a huge amount of time collecting and processing data.
“When it comes to quality, one size does not fit all. If you can keep the program in sync with what’s actually happening on the shop floor, it’s a richer experience for everybody.”

Kenda James, Quality Manager
GCi, Willsboro, N.Y.

for analysis,” says James. “In addition, it provides us standard costs for manufacturing processes. We can use the data to better price jobs.” GCi tested e-BT in December, implemented it on one line in February and rolled it out to another in March.

Several of GCi’s quality projects strive to correct issues. But the company wanted to aim higher and institute preventive measures or, as James refers to them, “the little things that are nice to have that you don’t usually get to, but make a long-term impact.” So GCi now conducts Quarterly Preventive Action Reviews both in the plant and in corporate offices. Some ideas generated by employees and used by the company include the following:

- **Trello Boards** – GCi uses this online collaboration tool to coordinate internal projects and communicate with customers.
- **Mentor Training** – The company began assigning mentors for on-the-job training and skills qualifications. “Training is better documented and more relevant,” says James.
- **Mold Evaluation** – GCi initiated a program to evaluate mold life cycles and defects to better understand the life expectancy of molds and when to invest in making new molds.

Whether it’s Kaizen on a product line or tracking operations with data the Six Sigma way, all of GCi’s quality initiatives have one commonality – continuous improvement. “That’s the name of the game,” says James. “The minute you think you’re set, you’re in trouble. There’s always something to improve. And you want it that way.”

An Introduction to Six Sigma
Developed in 1985 by Motorola, Six Sigma utilizes a set of process improvement tools to improve output. Since its inception, many Fortune 500 firms have adopted Six Sigma, most notably General Electric and Honeywell.

**What Is Six Sigma?**
Six Sigma is a disciplined, data-driven approach that helps companies deliver near-perfect products and services. It can be applied to any manufacturing or business processes. The main premise behind Six Sigma contends that if a company can measure defects in its processes, then it can systematically figure out how to eradicate them.

At the core of the Six Sigma methodology is the DMAIC model, an acronym that stands for:
- Define opportunity
- Measure performance
- Analyze opportunity
- Improve performance
- Control performance

**Where Can I Learn More?**
Most online resources also peddle products or consulting services, but you can still gain valuable information from many of them. Kenda James, quality manager at General Composites Inc., recommends these links:

- [isixsigma.com](http://isixsigma.com) – The website for this B2B media business includes articles, blogs, tools and a resource forum.
- [oneworldlearning.net](http://oneworldlearning.net) – The “resources” tab links to articles with basic information on Six Sigma, trends, DMAIC and more.
- [processexcellencenetwork.com/six-sigma-quality](http://processexcellencenetwork.com/six-sigma-quality) – This online global community for process professionals features information on various quality programs, including Six Sigma.

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Delve Deeper into Quality
Kenda James of General Composites Inc. will host an ACMA webinar on adopting a sustainable quality process on May 29, 2013, at 2 p.m. EST. For more information or to register, visit [acmanet.org/webinars](http://acmanet.org/webinars).
Composites manufacturers that serve the aerospace market are flying high. Original equipment manufacturers (OEMs) are ramping up production to replace the world’s aging fleets with more fuel-efficient aircraft, and they’re increasingly incorporating lightweight composites into their designs.

Composites were first used in military aircraft four decades ago. Today the materials are used in everything from rotor blades to lavatories in aircraft including commercial jets and helicopters. Boeing’s 787 Dreamliner, which debuted in 2007, was the first major airliner to feature an airframe constructed primarily of composite materials. The jet, which is 20 percent more fuel efficient than the previous model, is 80 percent composite by volume.

Other aerospace companies are following suit. The market for aerospace composites grew by double digits last year, according to a recent report from research firm Composite Insights. Visiongain, another market research firm, valued the industry as high as $10.3 billion in 2012 and predicts growth will continue during the next decade.

This is a golden opportunity for composites manufacturers, as getting in with large aerospace companies offers a number of perks. “A key benefit from working in the aerospace industry is the stability in demand and the possibility to carefully plan the business over extended time periods – not only months, but even years,” says Kees Reijnen, sales director at Zurich-based Gurit, a supplier to Airbus for more than 20 years. Gurit provides materials used in the interior of all Airbus models and in the secondary structure parts of the A320 and A330 series. The company also has worked with several of Boeing’s tier-1 suppliers for more than a decade, providing materials used in high-temperature sections of the air ducts in the 747 and 787 aircraft.

Quantum Composites has teamed with major aerospace OEMs in North America and Europe since 1991, providing discontinuous carbon and glass fiber molding compounds used in non-flight-critical secondary and tertiary parts. Its relationship with big aerospace manufacturers has helped the supplier win other business, says Steve Brown, a sales representative with the Bay City, Mich.-based company. “There’s definitely a cachet that comes with working with these large OEMs,” he says.

But that prestige comes with a price. While major aerospace companies offer opportunities, they also have stringent requirements, tough demands and plenty of red tape. It isn’t easy to win – and keep – their business. Here’s how you can.
Before You Bid

If you want to work with an aerospace manufacturer, the first step is to find out what certifications they require.

“There are quality systems you have to meet before you can even get a chance to bid,” says Edward Stan, marketing director for Tacoma, Wash.-based General Plastics Manufacturing Company, which has sold to Boeing, its subsidiaries and its tier-1 suppliers for 50 years. The manufacturer’s high-strength, lightweight, flame-resistant composite core materials; self-skinning flexible foams; rigid foam tooling board; and edge closeout seals for honeycomb structures are used in flight deck and cabin interior components including walls and ceilings, overhead storage bins, partitions and lavatories.

AS9100, the quality management standard for the aerospace industry, is a good place to start. “Typically, AS9100 is the minimum,” Brown says. “If you didn’t have AS9100, you wouldn’t even be under consideration.”

For the supply of parts and assemblies, accreditation to Nadcap is normally required, says Brown. Nadcap is an industry-managed program that grants accreditation for special processes used in the aerospace and military industries, including the manufacture of composite materials. Other standards that aerospace companies might want to see include ISO 9001 and MIL-I-45208A for defense jobs. Each company may also have its own standards, such as Boeing’s D6-82479, that suppliers are required to meet.

Once they’ve achieved the proper certifications, suppliers still can’t sit back on their heels. Ongoing audits are conducted to ensure they continue to meet the standards.

Such audits take place “on short notice at any point in time and at a frequency defined by the customer,” Gurit’s Reijnen says, though he adds that consistent supply, quality and adherence to deadlines can prompt OEMs to reduce the frequency of audits over time.

Airbus and Boeing tier-1 suppliers have been auditing at frequencies ranging from twice a year to once every three years or more, Reijnen says. ISO audits take place every three years, and Boeing audits quarterly for rate readiness, according to Stan.

In addition to quality system certifications, composite material suppliers must also prove that their products are up to snuff through material specification tests. Suitability of the materials must also be proven for each application in accordance with aircraft certification requirements, says Eric Thiebault, Airbus’ vice president of procurement for composites and paints.

Specification can be costly. A simple evaluation of material properties can cost more than $20,000 and a complete design database more than $500,000, estimates Matt Douglas, product manager for Quantum Composites. Moreover, specifications must be repeated following any significant changes in manufacturing location, machinery or raw materials. “If a raw material is discontinued, qualifying a substitute can be very involved,” Douglas says.

Winning the Contract

Jumping through the hoops required to bid for a large aerospace OEM’s business is a formidable task, but it doesn’t guarantee a contract. To actually ink a deal, composites suppliers need a value proposition.

“We are looking for innovative suppliers able to propose advanced materials allowing Airbus aircraft to be competitive, but also reliable suppliers able to master the quality of their production,” says Thiebault.

Service is also a factor that can help seal the deal. Gurit has succeeded thanks to its technical application and product innovation support, Reijnen says. For example, when working with prepreg materials, untrained staff at aerospace companies may produce poor parts, yield high scrap rates and work inefficiently, he says. To reduce such problems, Gurit trains customers when working with new designs, machinery or staff.

“At a Chinese customer not previously experienced in processing prepreg, Gurit technical support allowed good parts to be produced almost from the start and without any ongoing support within a week’s time,” Reijnen says.

The company also works with customers on cost out and product modifications to enable automated processing without requiring new qualification of materials. “Gurit managed for an aerospace carbon UD tape product to make a change to a lower cost grade of carbon fiber and to change the product properties with regard to tack and resin flow to the extent that an automated tape-laying process at the customer became reality without costly requalification needs,” Reijnen says.
Brown says he believes Quantum Composites continues to win aerospace contracts on the basis of quality. He also adds that Quantum’s material cures quickly and lends itself to automated processing. “You can mold a part in 10 to 15 minutes as opposed to making a few per day by hand layup or autoclave,” he says. “Our value proposition is not only cost but the ability to rapidly increase production.”

Small companies can get a foot in the door by focusing on specific materials for smaller applications, Airbus’ Thiebault says. “For instance, the interior area is less stringent than the structural one in terms of certification and [is] probably easier to start with.”

Innovation also is important. Airbus asks suppliers how they are preparing for the future through investments and research and development programs.

Keeping the Business

Winning a contract with major aerospace OEMs can be time-consuming, labor-intensive and costly. For composites manufacturers to achieve a return on their investments, they need to stay in it for the long haul.

The key to a lasting relationship with an aerospace manufacturer, Reijnen says, is “not giving the customer any reason to change: good delivery record, technical application support, ongoing competitive pricing [and] support in product innovation within the framework of existing product qualifications.”

Meeting deadlines is especially important, but it’s also imperative that suppliers can increase production as needed and be prepared to fill short-flow orders. “If Boeing wanted to triple its production tomorrow, we could scale up pretty rapidly to meet their needs,” says General Plastics’ Stan.

Major aerospace companies are large, complex organizations with many departments. “To establish a relationship with each group takes a long time,” says Quantum’s Douglas. “Coordination becomes a challenge.”

To help ensure that its relations with Boeing go smoothly, General Plastics has a dedicated account manager who sits in on planning meetings with the company. “You have to make sure your planning is in sync with Boeing’s planning,” Stan says. “Our goal is to meet their needs.”

When the time comes to renew contracts, which for General Plastics and Boeing happens every three to four years, Stan says it pays to be straightforward. “Both parties have to come to the table with mutual respect,” he says. The end result has to be a win for them and a win for us; if it’s not, it won’t work.

Long development cycles for aircraft can mean it might be seven to 10 years from the time a supplier establishes a relationship with the OEM until the final product goes online. “It’s certainly not a quick payback business model,” says Quantum’s Brown. “It will be costly and take a long time, and you better have some other source of revenue or else have very deep pockets.”

But in the end, establishing a solid relationship with an aerospace OEM can mean a steady and lucrative source of business for composites suppliers.

Jamie Hartford is a freelance writer based in Los Angeles. Email comments to jhartford@gmail.com.

Quantum Composites manufactures sheets of Lytex®, left, which are molded into hundreds of parts on airplanes including fairings, access panels, brackets, clamps, engine closeouts and more.

Below, Karl Ramos and Carol Coley of General Plastics inspect a closeout seal for gap management.
Composites firms with “green” products and services are doing their part to help the planet, but they wouldn’t be doing their jobs if those solutions didn’t also solve problems for their clients.

Logan County, Ohio, had a big one – its simple-span vehicular bridge over an area called Onion Ditch was declared obsolete by the Federal Highway Administration (FHWA). The bridge needed to be replaced, and county officials met to consider options.

The county’s dilemma was critical: the bridge is important to residents of West Liberty, Ohio, and maintaining safe infrastructure is important to county engineers. That kind of dilemma is widespread. In 2011, the FHWA reported 143,889 U.S. bridges as either structurally deficient or functionally obsolete. Across the country, local officials and state departments of transportation are trying to figure out how to handle a big problem with their shrinking budgets.

The Logan County Engineer’s Office needed money and a partner with high-quality, long-lasting materials. It received the first, thanks to the FHWA’s Innovative Bridge Research and Deployment Program, which makes funding available to state departments of transportation. It found the second, thanks to a conversation with an innovative composites company.

AXION International Inc., an 11-person firm based in New Providence, N.J., specializes in providing a green cure for the nation’s crumbling infrastructure. It produces Struxture, a line of lightweight but heavy-duty structural beams made from recycled plastic, and Ecotrax, a similar line for railroad tie applications. The firm’s patented process (see “How One Company Does It” below), developed in conjunction with scientists at Rutgers University, transforms recycled consumer and industrial plastics into structural products that replace traditional materials made from wood, steel or concrete.

Launched in 2007, AXION developed a process to make a building material from discarded laundry detergent containers and milk cartons that is strong enough to supplant steel and concrete. The material is a plastic polymer – essentially a mix of shredded heavy plastics and a bit of fiberglass.

“People around the world are demanding clean, non-toxic alternative building supplies and methods,” says Steve Silverman, CEO of AXION. “Our solutions are formulated using up to 100 percent recycled plastic and no chemical additives. Compared to traditional building materials like wood, steel or concrete, they’re extremely cost-competitive, feature longer life cycles and lower maintenance costs. They won’t rust, splinter, crumble, rot, absorb moisture or leach toxic chemicals into the environment.” Also, because the products are lightweight, they’re easier and safer to install than traditional materials, he says.

Logan County recognized the value of a durable bridge with a longer life cycle and less maintenance, and

### How One Company Does It

Here’s how AXION International’s recycled composite products are made:

1. **Raw Material**
   - Bales of No. 2 plastic (detergent bottles, milk jugs and the like) and industrial-grade plastics (scrapped car bumpers) arrive at the AXION plant for processing.

2. **Snowflakes**
   - The plastics are put through a heavy-duty shredder and turned into “snowflakes.” AXION says each pound of an I-beam it manufactures uses the equivalent of eight plastic bottles.

3. **Fiberglass**
   - The flakes are combined with fiberglass and fed into a manifold, where the mix is heated (but not melted) and readied for molding into I-beams.

4. **Extrusion**
   - The softened polymer is extruded, pressed into shape and then cooled.

5. **Assembly**
   - The beams are assembled into lightweight but strong bridges. And they’re sturdy: An AXION structure at North Carolina’s Fort Bragg supports tanks weighing 60 tons.
awarded the project to AXION. Today, the Onion Ditch Bridge is all plastic, from abutments to guardrail, and made from 100 percent recycled structural composite material, says William Jordan, director of business development for AXION. The bridge, measuring just over 25 feet in length, is an integral-abutment bridge that translates thermal expansion of the structural thermoplastic material into rotation at 12-inch round pile groups at each abutment, he says.

The bridge is exactly what Logan County needed, says Scott Coleman, the county’s engineer. “This structure brings together long-lasting recycled plastic materials and the nostalgic look of timber construction,” making it appealing to both public officials and the community.

“Sustainability Can Be Exciting”

Demand is growing for materials made from recycled composites, says Dr. Sophie Cozien-Cazuc, FibreCycle project manager at Umeco, a UK-based provider of advanced composite materials to defense, wind energy, automotive and recreation clients. (FibreCycle is a UK-funded research project that aims to develop materials based on carbon fibers recovered from waste streams.)

Cozien-Cazuc says Umeco’s technologies and services are driven by customer demands. For one recent application, recycled composites were literally in the driver’s seat.

The Lola Group and Drayson Racing Technologies approached Umeco to develop an all-electric prototype racecar that would demonstrate the potential of sustainable technologies. Umeco collaborated with the University of Warwick and ELG Carbon Fibre Ltd. on a green solution. Carbon fibers from out-of-life MTM®49 epoxy prepreg were reclaimed by ELG and then re-impregnated with Umeco’s toughened epoxy resin. The collaborators performed a series of tests to determine the mechanical and impact properties of the material, comparing performance to the original virgin prepregs. Tests showed minimal loss of strength and similar fiber stiffness.

In addition to recycled carbon fibers and resin the racecar also includes flax fibers, which have similar mechanical properties to glass fibers, but with much lower weight and environmental impact, Cozien-Cazuc says. Flax fibers also have extremely good vibration damping and insulating characteristics, she says. “The use of renewable flax composites in green vehicles provides a nice synergy and, with this eco racecar, we’ve shown that flax can even be used in high-performance, cutting-edge applications.”

Today, the Lola-Drayson B12/69EV racecar is one of the world’s most innovative “cleantech” motorsport projects. The 850-horsepower vehicle now participates in the FIA Formula E World Championship Series.

“Umeco is mindful of the impact that its operations have on the environment and is keen to promote the application of recycled composites and sustainable bio-composites,” says Cozien-Cazuc. “Accordingly, we actively engage with organizations seeking to develop cost-effective solutions aimed at reclaiming raw materials from our prepregs. Sustainability can be exciting.”

Darin Painter is a freelance writer based in Cleveland. Email comments to darin@writingmatters.com.
Since its adoption in 1983, the OSHA Hazard Communication Standard (HCS) has required manufacturers and importers of substances (typically chemicals and mixtures) to:

- review the available scientific literature to determine the potential health or physical hazards that may result from the use of the substances and
- communicate to their customers, in the form of labels and safety data sheets (SDS), the hazard information as well as recommendations for protection against the hazards.

The customers (who OSHA calls employers) are to:

- have written hazard communications programs,
- make available to employees the labels and safety data sheets provided by the manufacturer or importer and place appropriate warning labels on intermediate processing and storage containers and
- formally train employees on hazards of, and appropriate protective measures for, substances found in the workplace.

Because of the health or physical hazards potentially associated with their use, many of the raw materials used by composites manufacturers have long been provided with hazard warning labels and SDS. For example, under the HCS, suppliers of unsaturated polyester resin provide their composites manufacturing customers with labels and SDS warning of the potential for fire and mild temporary nervous system effects that may result from use of the materials and recommending safeguards such as elimination of open flames or sparks and use of protective eyewear and gloves.

Molded composite products have typically been considered articles, which are exempt from the HCS. OSHA’s March 26, 2012, revision to the HCS, however, made several changes that are believed to affect the applicability of the standard to molded composite parts. As a result, many composites manufacturers may be required to provide their customers with labels and SDS warning of a hazard that may result from normal use of molded composite products.

Combustible Dust

A number of industrial explosions and fires have been attributed to combustible dust explosions, including several that resulted in worker fatalities and serious injuries. While some industries such as grain processing and wood milling have long been known to involve combustible dust hazards, many of the recent combustible dust incidents have been in industries such as metals and polymer processing where such hazards were not expected to be present.

In response to a growing awareness of the potential for combustible dust to contribute to a fire or explosion hazard, in 2007 OSHA instituted its Combustible Dust National Emphasis Program (NEP). Under the NEP, composites manufacturers and other industries known to generate or process combustible dusts are targeted for inspections.

While OSHA and the National Fire Protection Association (NFPA) standard allow an employer to test dusts to determine their degree of explosivity and then tailor the control approaches, ACMA has observed that the composites industry dusts that have been tested have exceeded the explosivity criteria and should therefore be considered sufficiently hazardous to require full application of the standard. This includes dusts from grinding composite laminate with as little as 25 percent organic content.

The NFPA standard 654, considered by OSHA to be the primary consensus standard for control of combustible dust in composites processing operations, is a lengthy and complicated document. Under the NEP, however, OSHA enforcement staff is known to have cited composites manufacturers for three primary types of violations:

- Failure to employ a documented housekeeping program to prevent the buildup of dangerous quantities of dust, including on rafters and other elevated surfaces;
- Failure to locate dust collection equipment either outside of the plant or away from areas where workers are typically present, so that an explosion or fire would be less likely to cause injuries; and
- Failure to employ dust collection equipment, including fans and cyclones as well as portable vacuum cleaners, that is specifically listed for combustible dust.

Of course, the customers of many composites manufacturers also subject the molded composites products to the same dust-generating activities. This makes these customers also subject to the NEP and now makes the composites manufacturers supplying...
the molded products responsible for informing their customers about the combustible dust hazard.

OSHA's Revised Hazard Communications Standard

Many customers of composites manufacturers grind, drill, sand, cut or otherwise mechanically work molded composite products, generating combustible dusts. OSHA staff maintains that agency policy has long required suppliers of products normally subject to downstream processing that creates a recognized hazard to comply with the HCS and inform customers and their employees about the hazard, irrespective of the articles exemption. (“OSHA’s [HCS] ... requires the provision of information to downstream customers when known processing approaches will result in a hazard.” Preamble to OSHA 2012 HCS Final Rule, 58FR17705.) However, many manufacturers have assumed that they qualified for the articles exemption and have not provided labels or SDS with their molded products. OSHA is not known to have enforced its claimed policy in this matter.

In any case, OSHA’s 2012 revised HCS clarifies that the article’s exemption does not apply if normal downstream processing may create a recognized hazard. Specifically, suppliers of products such as molded composites items are not exempt from the HCS if normal downstream processing may create a combustible dust hazard.

The 2012 HCS defines an article as:

... a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical ... and does not pose a physical hazard or health risk to employees. 49CFR1910.1200(c), emphasis added.

Hazardous chemical is defined as:

... any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

Since combustible dust is now a hazardous chemical under the HCS, composites molders must comply with the requirements applicable to chemical manufacturers, if their downstream customers grind, sand, drill, cut or otherwise mechanically work the product and generate dust.

The 2012 HCS requires chemical manufacturers, importers and distributors (including composites manufacturers whose customers generate combustible dust) to comply with the revised standards by June 1, 2015. Employers must train workers on the new label elements and SDS format by Dec. 31, 2013, and fully update workplace hazard identifications, labels and warnings by June 1, 2016.

Hazard Classification

Manufacturers and importers of classified substances, including products not exempted as articles because normal downstream processing generates combustible dust, must “consider the full range of available scientific literature and other evidence” and determine if any of the HCS hazard classifications apply. A literature review may not be needed to classify the hazards of molded composite products, since OSHA has concluded that combustible dust satisfies the criteria for the hazard classifications “flammable solid” and “explosive.” (“Combustible dust is addressed under the broad definition as both a flammable solid and an explosive hazard.” Preamble to OSHA 2012 HCS Final Rule, 58FR17705.) The grinding of composite parts even with relatively high inorganic content (75 percent) generates dusts that exceed the explosivity criteria when tested.

While the HCS would technically not apply to suppliers of molded composite products if their customers did not produce combustible dust in “more than very small quantities,” in practice the process of showing that a quantity of combustible dust is not sufficient to create a hazard is very complicated. It would require suppliers of composite products to define with relative certainty many aspects of their customers’ dust generating operations, housekeeping practices, etc. Some composites manufacturers attempting to establish the hazardous quantity for their dust found that the demonstration was not worth the effort and decided to comply with the HCS if their customers were known to produce any quantity of dust by mechanically working the molded composite product.

John Schweitzer is senior director of government affairs for ACMA. Email comments to jschweitzer@acmanet.org.

For More Information

Detailed information on combustible dusts and OSHA’s Hazard Communication Standard is available at the following websites:

Combustible Dust National Emphasis: osha.gov/dsg/combustibledust/enforcement.html

Effective dates for the Hazard Communication Standard: osha.gov/dsg/hazcom/effectivedates.html

Sample labels and safety data sheets based on OSHA’s combustible dust guidance: acmanet.org/regulatory-compliance/workers-regulatory.
Why Now Is the Time to Be a Part of ACMA

Why should your company join ACMA or renew its membership now? Now more than ever, ACMA is having a bigger impact on your company’s bottom line – and the composites industry as a whole. Here are just a handful of reasons that membership in your association is so important:

- ACMA is leading a major coalition to reform how agencies such as the National Toxicology Program assess risk for chemicals and substances like styrene.
- Companies that come to our Composites Build America National Lobby Day in Washington, D.C., May 22-23, 2013, will have access to panels of speakers from federal agencies including the Departments of Defense, Transportation and Energy and gain insights into new markets for the industry.
- ACMA is working with a consortium and the federal government to increase the amount of composites in cars and trucks.
- We are partnering with SAMPE to launch the largest and most comprehensive composites show in North America, which will be held in Orlando in the fall of 2014.

Like many of our member companies, ACMA has used Kaizen to streamline our organization and become even more effective in serving your company. (See story on quality processes, including Kaizen, on p. 13.) This is not the time to sit on the sidelines; it is the time to get in the game. Visit our new website at acmanet.org to learn more about all the exciting opportunities that ACMA is creating for companies like yours.

Tom Dobbins, CAE
ACMA Chief Staff Executive

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This year’s event will feature a new program, the Federal Market Growth Symposium. Federal agency representatives and key Congressional staff will discuss opportunities to expand the use of composites in defense, land and water infrastructure, energy production and distribution, and automotive transportation and trucking.

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Transition to Sustainable Quality: Getting it Right the First Time
Kendra James, Quality Manager, General Composites, Inc.

WEDNESDAY, JUNE 5
Products Liability Litigation: How to Reduce Your Company’s Exposure
Steven Henry, JD, MSM, Smith Moore Leatherwood LLP

WEDNESDAY, JUNE 12
Utilizing Recycled Fiberglass for Affordable Green Composite Technology
Rich Cubeta, President & CEO SolidCast Polymer Technology

COMING SOON!
Understanding Your True Costs:
Production Cost Estimator Program - MEMBERS ONLY
Douglas Caudle, President, Piedmont Fiberglass, ACMA Board of Directors
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CM by the Numbers
Our writers unearthed these fascinating figures while researching articles for this issue of *Composites Manufacturing*.

**100-mil**
ECS Environmental Solutions supplied more than 1,000 feet of fiberglass ductwork for an odor control system. All internal surfaces had a 100-mil corrosion barrier. Read the article on page 10 for more details on the project.

**112,365 square feet**
Stanford University’s new 112,365-square-foot Bing Concert Hall features a center stage offering 360° views of musical events. Kreysler & Associates fabricated FRP acoustic panels, described on page 6, that help provide unparalleled sound.

**3 benches**
Orenco supplied a tennis club in Roseburg, Oregon, with three custom FiberGraphic™ sports benches. Discover how the manufacturer began embedding graphics into benches and table tennis tables on page 12.

**18.28 meters**
The Macif racing yacht, measuring 18.28 meters in length, won the Vendée Globe round-the-world sailing race earlier this year. Turn to page 8 to see how the Macif – and other top finishers – used composites to be competitive.

**18**
When Waco Composites was last audited for its ISO 9001: 2008 accreditation, the manufacturer was credited for making 18 continual improvements since the previous audit. On page 13, the company reveals how implementing Kaizen allows it to make incremental improvements.

AXION International makes railroad ties from recycled polyethylene and fiberglass. They are constructed of 100 percent recycled materials. Learn about other applications for recycled composites on page 23.