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About the Cover: Photo credit: Rob Hoekstra, www.reflexion-architecture.eu
A Final, Familiar Message – Get Involved!

Well, this is it. My last column as ACMA Chair! In the next issue of Composites Manufacturing magazine, you’ll begin hearing from the association’s next chairman, Jeff Craney of Crane Composites. I know he will have lots of great insight to share.

To begin my last column, I’d like to thank the entire association for the opportunity to serve. As I have mentioned many times – probably in every column – ACMA is driven by our members and what they bring to the table. Each of us has a very strong desire to advance our industry. I am so thankful for the quality and quantity of volunteer support for our initiatives, projects, committees, publications, programs and shows. Without this strong volunteer spirit, our association would not be as great as it is today.

Now I ask that we make this association even stronger by getting more companies to join and more members involved. If you’re an ACMA member who is unsure how to get the most out of your membership, call any staff member. They can help you derive benefits for yourself and your company, as well as enhance the industry.

I need to add a special thank you to my fellow ACMA Board of Directors, who, through their terrific support, have made this job very easy. These members of the board are folks that I have relied upon for the last two years, and they have become my friends.

The other thing that ACMA has going for it is its small but mighty staff of professionals. This group, led by Tom Dobbins, runs circles around other association staffs. They contribute to the success of our association – and industry – with hard work and insight. They push the ACMA brand further and wider every day, and I appreciate that!

Speaking of pushing, this issue of Composites Manufacturing will cover several topics that help push the industry to new heights. One of those is composites education. We have had a long run of success in employee training with our Certified Composites Technician (CCT) program, and it continues to evolve. But two-year and four-year colleges are also impacting the industry by training the next generation of composites professionals. We will all benefit from a larger pool of trained, experienced and certified individuals. Check out the article covering three innovative education programs on page 16.

In closing, I want to say it has truly been an honor to serve as your chairman. My parting message is a familiar one: Recruit more members and volunteers, participate more in your association, and I’ll see you at CAMX in Dallas in October!

Jay Merrell
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Creating an Inspection Plan

While composites inspection takes place after parts are manufactured, the plans for such inspections are developed based on work completed well before the piece or product is fabricated. Inspection is a multi-faceted process that typically starts with the engineering drawing. It takes into consideration what the designer determines is most important – the surface plane, mating surfaces, hole location, attachment points, material performance and so on.

Inspection techniques range in difficulty according to the method. Some of the more common techniques include visual, measurement, destructive testing and non-destructive testing. Each of these techniques require skilled inspectors. Without proper inspections, you risk shipping substandard or non-conforming products to the final customer.

No matter what method is ultimately used, the path to creating an inspection plan is similar and relates to an effective quality system. ACMA's Certified Composites Technician (CCT) program notes four basic elements of an effective quality system: expectation, specification, verification and progression. Following this model, the first step toward creating an inspection plan is to define the product. What is it? What is it used for? Next, establish the necessary specifications to provide the customer with an acceptable product. Those specifications include visual, aesthetic and physical requirements.

In this column, the word “method” will refer to the procedure or way an inspection is accomplished, while “technique” will refer to the ability or skill required to complete the inspection. In creating an inspection plan, the methods of evaluating the product and process must be defined first, then the various techniques can be established. From
my experience assisting companies in establishing quality systems, it's more difficult to determine what needs to be inspected than how to inspect it.

Once you've defined the product and established specifications, then it's time to choose inspection methods and techniques – as well as members of your team that can handle the inspection or be properly trained to do so. Let's take a very simplistic look at what is needed to select inspection methods and techniques to verify compliance and provide for continual improvement – the verification and progression parts of an effective quality system. Keep in mind that the main purpose of inspection is to determine whether the components and/or the product conform to the specifications as provided. Once the product has been defined and the specifications established, the manufacturing process must be charted. This is a step-by-step diagram including all necessary steps, from receipt of raw materials through manufacturing to final packaging and product shipment.

Once all of the individual steps have been charted, then “what if” scenarios must be considered. What if it’s the wrong material? What if the process goes wrong? What if it doesn't conform to expectations? You want to identify all the possible failure modes that could occur during the fabrication of the composite part and rank them in importance. In other words, rank them by the seriousness of the failure or defect of the part or process as compared to the expectation for that part or process.

The final step in determining what inspection methods and techniques are required is to graphically chart the information above, identifying the step-by-step process, failure points, degree of seriousness of the failure for the final part, inspection method for each part/process and the corrective action for identified failure.

There are two basic types of the defect measurement or identification – variable and attribute. Variable defects are those that can be measured, such as thickness, weight, width, length and physical strengths. Attributes are observations that are either present or not present, conforming or non-conforming. For example, if the specification for a part states that it must have gray primer, that's classified as an attribute. The part either has or does not have gray primer. However, if the specification states that the part must have 3 to 5 mils of dry film gray primer, it would be classified as a variable. The primer must be measured to ensure conformity. These differences are important as the method and the technique for verification are established.

Any inspection plan must take into account the diverse market distribution for composite products. Inspection methods and techniques will vary according to the product and its intended use. A composite door that is used on a military armored vehicle will have very different critical characteristics than a door for a Class 8 truck. A nacelle that becomes part of an aircraft will have very different requirements than one used in the construction of a wind turbine assembly.

The inspection plan will identify the method or manner in which a specific inspection will be performed. If it is based on variable criteria, the method could define a test procedure or a method of measurement. Let's take the example of the armored vehicle door panel: It will have certain ballistic requirements that will specify some destructive testing verification. By contrast, a door for a Class 8 truck more likely will have a minimum and a maximum thickness requirement. In that case, the method would detail where and how the part thickness would be measured and what measurement tool would be used. The technique would detail the training required for proper use and repeatability of the measurement.

Creation of an inspection plan should be well thought out and completed far in advance of manufacturing the part, even though the inspection itself occurs after fabrication. By planning ahead, you ensure that the part meets the customer's needs.

The guest columnist for this issue's "Best Practices" column is Larry Cox, former director of education for ACMA. He is principle of Structurlite Composites Consultants, which provides curriculum development and training in composites education as well as development of tactical and strategic plans for businesses. Email comments to lcox1225@gmail.com.

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**Acetone**
Better water equals better fish. That’s the thinking behind a 24-meter diameter fish farming system developed by AgriMarine Holdings, a company based in Vancouver, British Columbia, that specializes in fish farming and developing sustainable aquaculture technologies. The company has proof that the idea works, with its 3,000-cubic-meter tank yielding significantly higher salmon output per volume than conventional fish farming environments, says AgriMarine CEO Sean Wilton.

The company’s approach depends upon using a material that is tough enough to withstand the pounding of waves and immersion in salt water. What’s needed is the right combination of fatigue and corrosion resistance, which led AgriMarine to a specific choice – composites. The AgriMarine System™ floating semi-closed containment tank is made from GFRP.

Wilton notes that salt water aquaculture, such as the raising of salmon, is traditionally done in a net enclosing a parcel of ocean. The water the fish swim in reflects whatever drifts in from the surrounding sea. Thus, the temperature and oxygen level fluctuate, as do the pathogen, parasite and contaminant loads. “You’re basically at the whims of nature,” says Wilton. “What is inside your net is identical to what is outside your net for the most part.”

The AgriMarine tank mitigates these issues by isolating fish from the surrounding water. The water that goes into the tank is pumped up from the depths of the sea, thereby enabling more control of the environment. The temperature of the water inside the tank can be optimized, as can the water’s oxygen concentration. Together, these factors enable fish to grow faster, cutting the time required to raise a crop, says Wilton. In addition, water-borne surface contaminants – natural or man-made – don’t reach the fish. Controlled and constant circulation of water provides optimal oxygen mixing and distribution. The fish swim at a planned speed, with the exercise producing highly desirable firm flesh.

Wilton notes that fish farming tanks have been considered before, but the idea was not pursued due to concerns about scale and cost. However, the ability to spread the expense over the lifetime of the tank changes that equation, with better feed efficiency and lower cost to treat parasites also improving the economics. Pulling off this idea, though, requires a large tank with some special material properties. The enclosure has to float in the water and so is subject to wave action, which causes the structure to bend and flex. The tank also is exposed to corrosive salt water. AgriMarine investigated and tried various materials, including rubberized fabric, aluminum and floating concrete. However, these were too expensive, too weak, corroded too quickly or exhibited all of these failings.
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“Reinforced plastic composites had the best combination of cost, corrosion resistance, fatigue resistance and ruggedness that were required for a long service life in a harsh marine environment,” Wilton says. To fabricate the tanks, AgriMarine partners with Janicki Industries of Sedro-Wooley, Wash., which designs and builds large-scale, high-precision composite tooling and parts. AgriMarine already had a tank design when it teamed with Janicki to make it manufacturable. Because the tank is 80 feet wide, it’s too large to feasibly ship. “We had to take their conceptual design and break it up into components with flanges to aid assembly,” says Andy Bridge, vice president of industrial sales for Janicki Industries. “The bottom of this thing is like slices of a pie. We had to design these pieces so they could all be easily manufactured and nest into shipping containers to keep transportation costs low.”

Part of the design work involved looking for commonality of shapes. Fewer shapes means that less tooling is involved, which helps lower costs. The completed tank features 48 total sections fabricated with six tools. The pieces are made via vacuum infusion using an epoxy vinyl ester resin specifically selected for its corrosion resistance.

Another important component of the tank is its steel bolt connectors. Because the tank is made and shipped in pieces, there has to be some way to fasten everything together. This seemingly simple requirement is complicated by the fact that the inside of the tank needs to be smooth, which means the connector heads have to be countersunk so they are flush with the inside.

After fabrication, the tank pieces are transported to remote sites. There, workers assemble the pieces on skids, then slide the completed tank into the sea. Water is pumped in, and the tank sinks until its upper lip rides about two feet above the ocean.

Thanks to hard work by all of the partners on the project, the tank is a success: Wilton says that the observed and measured physical properties of the latest tank version match predictions in terms of deflection, buoyancy and other parameters. AgriMarine exported two tanks to Norway in early 2015. Other tanks will soon be deployed elsewhere because, says Wilton, economics favor this type of fish farming. “The fish output is significantly higher,” he says. “It definitely is worth it.”

Hank Hogan is a freelance writer based in Albuquerque, N.M. Email comments to hank@hankhogan.com. For more stories like this, visit CompositesManufacturingMagazine.com and check out the Marine articles under the “Market Segments” tab.
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In 2012, CERN researchers discovered a particle consistent with the Higgs boson—nicknamed the “God Particle”—and scientists celebrated a historical moment in physics. Now, composites have entered the story, as research on the Higgs boson, extra dimensions and dark matter at CERN (the European Council for Nuclear Research) restarts after a two-year hiatus. During that time, improvements were made on the laboratory’s particle accelerator, the Large Hadron Collider (LHC). The LHC, the world’s largest and most powerful particle accelerator, has received CFRP upgrades in its ATLAS detector, one of two general-purpose detectors within the LHC.

At 151 x 82 x 82 feet, the 7,000-ton ATLAS detector is the largest volume particle detector ever constructed. It sits 328 feet below ground near the main CERN site, close to the small town of Meyrin, Switzerland. The LHC yielded the first discovery of a particle consistent with the Higgs boson, a particle that gives all matter mass and can explain why some particles have mass despite properties that should require them to be massless.

If it’s been a while since you’ve taken a course in physics, you may be wondering what are particle accelerators and detectors? In simple terms, a particle accelerator is a machine that accelerates particles to extremely high velocities using electric or electromagnetic fields. The LHC at CERN is in a subset of accelerators known as colliders. As the name suggests, particles within these accelerators crash or collide together. When that occurs, detectors such as the ATLAS detector then gather information about the particles, including their speed, mass and charge. Such collisions allow scientists to study the subatomic world and the laws governing it.

Over the past two years, the LHC was upgraded to accommodate higher collision energies. As part of the upgrade, CERN contacted Teufelberger Service GmbH, a manufacturer based in Wels, Austria, for a specific component at the center of the ATLAS detector. The lightweight CFRP piece is a 5-meter high-tenacity carbon fiber support structure with an epoxy resin system selected for its radiation resistant properties. Toray supplied the carbon fiber.

The CFRP component supports both a specialized subdetector and the beam tube where the particles are moving, and must hold the detector elements in place. The original component was made from aluminum because of its light weight. However, aluminum did not provide all of the necessary properties. “The aluminum...
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allowed for a little deflection, or shifting, of this pipe during the experiment, which is not ideal," says Herwig Kirchberger, head of the composite business unit at Teufelberger. "But the most severe issue was that the aluminum structure was contaminated with radioactive particles, and this was the main reason for CERN’s switch to carbon fiber." Kirchberger explains that carbon fiber’s lower mass absorbs less radiation.

Safe transmission of loads between the CFRP structures and the metal parts it supports at the ends of the tube also called for special reinforcements. Kirchberger notes the adhesive could degrade over time from exposure to high radiation levels, so CERN chose Teufelberger’s T-IGEL® system to connect the aluminum flanges and the CFRP pipe structure.

Some of CERN’s standards were a challenge to meet. “CERN really had an eye on the laminate quality. They were looking for a very low corrosion level,” Kirchberger explains. “Getting the corrosion levels down to below one percent was one of the biggest challenges.” Kirchberger also says CERN had very tight geometry specifications.

The structure was manufactured using wet filament winding. While the steel mandrel proved useful for the inner dimensions, having no tooling for the outside surface made it problematic to manufacture the structure to meet the geometric requirements. Ultimately, Teufelberger succeeded in meeting CERN’s stringent requirements.

Experiments with the LHC resumed in April. Now, according to CERN, the energy of particle collisions will be 62.5 percent higher per beam. Higher energy allows physicists to search for new particles and to check previously untestable theories. Among other improvements, the time separating the bunches of protons in the accelerator has been halved to 25 nanoseconds, meaning the LHC can deliver more particles per unit time, as well as more collisions, to the experiments. Kirchberger is excited that CFRP plays a small, but important role in the groundbreaking scientific research done at CERN.

Mary Beck is the communications coordinator at ACMA. Email comments to mbeck@acmanet.org.
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The eyes of Deryck Graham, managing director of Quickboats in Cottesloe, Australia, light up when he describes two people pulling his Quickboats foldable watercraft out of their car and putting it together in about one minute before placing it in a river. That’s the potential he anticipated when he developed an advanced composites-based foldable boat for the adventure watercraft market.

“Lightweight boats and inflatables are not new in the marine industry, but a rigid foldable boat is,” says Graham. “We are changing the way people own and use a boat by freeing them from the challenges of storing and transporting. Most importantly, we enable them to access difficult-to-get-to locations such as dams, gorges, rivers and isolated beaches."

The 132-pound, 12-foot boat is sold in 11 pieces, which are stored in two canvas bags, one for the hull and the other for the seats, transom, nose and other components. The boat assembles with a series of “quick-click” connects. Its design is made possible with advanced composite materials. “We wanted the boat to click together and be light enough for two senior citizens to walk it to the lake, but strong and rigid enough to be a competent boat on the water,” says Graham. The boat has a 5-foot, 6-inch beam – about the same as a bigger 14-foot boat – and can hold four adults. Affordability for the outdoor adventurer goes with the territory, so the boat is priced at $4,000.

Quickboats has sold nearly 450 foldable boats, mostly for the adventure watercraft market.

Top sheet coating on the wear areas, such as the gunnel rail and keel, are made from a combination of thermoplastic polyurethane (TPU) and acrylonitrile butadiene styrene (ABS). “So here we’re no longer using a mold to produce a boat,” notes Graham. The flat panels are pre-stressed to give the structure the needed rigidity without having to increase the weight of the panel by increasing the thickness of the core or the skin.

The patented hinge design – what makes it a foldable boat – is accomplished with the use of FRP flanges which are bonded to Kevlar® fiber strips embedded with...
epoxy resin at the edges of each panel. This enables the hull of the boat to fold in on itself for storage in its canvas bag, which can be hung on a garage wall. The geometry of each of the flat panels is narrower at the bow and wider at the stern to form the hull. The foredeck “nose,” a passenger bench, a captain’s bench and the transom pop in place to provide the horizontal and box structures that hold the boat open and keep it rigid. A motor of up to 10-horsepower is mounted on the transom.

Also patented is the design of the transom and associated triangular torsional bracing that addresses the need to absorb engine thrust. “The thrust created by the motor has to have an opposing force, but the transom alone will not do it,” says Graham. “By including composite-based poles to reinforce the transom, the thrust dissipates through the poles onto the captain’s seat and then onto the hull side panels, creating a triangular structure.” The boat’s transom and hinge are just two of several mature patents and patents pending in Australia, New Zealand, North America and Europe.

As of mid-March, Quickboats had sold close to 450 foldable boats. The vast majority were for adventure watercraft, with a few used as tenders for sailboats. The company partners with distributors in Taiwan and are currently in discussions with other groups for distribution to North Asia, the Americas and Europe. Quickboats also has had inquiries from government and military organizations that see the foldable boat as a potential first response emergency water vehicle for flood rescues and rescues in hard-to-access dams or canyons. “You can put 30 Quickboats in a 40-foot container complete with engines and safety gear and send it into a disaster area where, in the past, one or two boats at a time have been deployed,” says Graham.

“Frequently, inflatables have been used in these situations but they pose the risk of puncture, particularly where there has been destruction. Rescue is a completely different application than the adventure market, but we are more than willing to serve it.”

Patrice Aylward is a communications consultant based in Cleveland. Email comments to paylward@aol.com.

The GFRP boat features 11 pieces, which snap together when users are ready to hit the water.

For more stories like this, visit CompositesManufacturingMagazine.com and check out the Sports & Recreation articles under the “Market Segments” tab.
If you ask owners or managers of composites companies to name their top business challenges, you’ll likely hear this among the answers: “I just can’t find enough skilled, educated employees!” Yet an online search for “composite technology programs in college” yields more than 1.8 million hits. So why do businesses have such a hard time finding solid employees?

There’s a fundamental disconnect between industry and academia, says Steve Von Vogt, executive director of the Maine Composites Alliance, a group of more than 60 composites companies. “Education needs industry input to be relevant. Industry needs enlightened science and training to lift the level of technical competency and competitiveness,” he says. “But too often, academic institutions and industry are terribly misaligned.”

When the two come together in a symbiotic relationship, the results are impressive. There’s more than one way to forge a successful partnership between industry and academia, as the following examples from three composites education programs show.

Sharing Assets Benefits College and Companies

When students leave the Composite Science and Manufacturing Program at Southern Maine Community College (SMCC) in South Portland, Maine, they hit the ground running. Andy Schoenberg, department chair for the program, recalls the difference a handful of recent graduates made at a local composites company. The company, which typically handles small orders, landed a high-volume project. “When they manufactured the first order, they had a 50 percent reject rate,” says Schoenberg. One former student told Schoenberg he was afraid of losing his job, even though he had ideas on how to improve the process based on what he learned at SMCC. Schoenberg encouraged the graduate to show initiative at his new company. “So he created standard operating procedures, wrote the chemical mix logs and put together the necessary structure and paperwork,” says Schoenberg. “They went from a 50 percent reject rate to zero.”

SMCC’s Composite Science and Manufacturing Program just finished its fourth academic year. Approximately 30 students are enrolled in the program, which confers an associate in applied science degree upon graduation. Students follow two paths — a straight associate’s degree or a pre-engineering path allowing...
them to move into the bachelor’s degree program at University of Massachusetts Lowell. All students leave SMCC able to:

- Use common processes to develop, manufacture and repair composite materials.
- Understand the properties of materials and material selection.
- Apply quality systems to composite manufacturing and product testing.
- Explain the underlying scientific principles relevant to composites.

The aim is to train students who are ready to enter the workforce. SMCC ensures its graduates are prepared in collaboration with the Maine Composites Alliance, which teamed with the community college to found SMCC’s Composite Science and Manufacturing Program. Members of the alliance have helped develop curriculum, supplied equipment and served as adjunct professors.

The real gem at SMCC – and one that would not exist without the help of industry – is its Composites Engineering Research Laboratory (CERL). “We probably have the most advanced composite research lab in any community college in the nation,” boasts Schoenberg. “And all of the advanced analytical equipment is owned by the Maine Composites Alliance or its affiliated partners.” That equipment ranges from a dynamic mechanical analyzer to parallel plate rheometers and a thermal analysis bench.

SMCC students work in the CERL, which provides testing and development services to regional composites companies. The lab is adept at “short-cycle problem-solving for industry,” says Schoenberg. “While most academic institutions do long-term theoretical research, our entire lab is based on the industry timetable,” says Schoenberg. “If I can’t get a company their data within one quarter, they won’t be able to use it.”

In three years, the CERL has completed projects with 35 companies. It recently helped a large fiberglass manufacturer with a customer in the wind industry that had problems with turbines. The manufacturer was unsure whether the issues rose from the materials or the fabrication process. Team members at the CERL discovered variables in the vacuum infusion process and made suggestions to the manufacturer.

“There is a critical need for a characterizing, prototyping and product development lab,” says Von Vogt. “It has to be industry-driven and focus on real problems and product development. The icing on the cake is to locate it at a highly-focused training facility with bright students available to intern at companies and solve industry problems as part of their academic training.” Von Vogt says CERL is successful because companies and SMCC “execute as true partners, each bringing some assets to the table.”

Less than 10 students graduate from the Composite Science and Manufacturing Program each year. SMCC hopes to attract
Charles Tur, right, from Magnum Venus Plastech trains Maitland Peet, a faculty member from Peninsula College, on a donated silicone bag making unit.

more students, and the opening of an 80-person dormitory in the fall may help. The success record of its graduates should sway prospects, too. One former student is a senior engineer at Bath Iron Works working on a DDG 1000 destroyer. Another is in California helping with advanced composites projects for an aerospace company. All seven students in the class of 2015 had jobs lined up prior to graduation. “Some of our students will be engineering technicians, some will go on to get an engineering degree and others will be really solid operators – the guy on the floor you know can do the job,” says Schoenberg. “But in all cases, they are raising the foundational knowledge base within the industry.”

Joining Forces Creates Strength in Numbers

If one community college can make a difference training the next generation of composites professionals, imagine the impact of several schools banded together. That’s what happened in the state of Washington a little more than two years ago, when 10 community and technical colleges with composites and advanced materials programs formed the Composites Washington Training Consortium (CWTC).

“The primary goal is to increase our workforce capabilities in Washington,” says Darren Greeno, dean of professional technical education at Bellingham Technical College, a member of the CWTC located in the Pacific Northwest. While each of the schools builds curriculum to serve the needs of businesses within their districts, there is common ground. “So many skills cross over, so there’s no reason we can’t work collaboratively to have a common baseline or core curriculum,” says Greeno.

Two big market segments in the state – aerospace and marine – led the push for the consortium. The Center of Excellence for Aerospace & Advanced Manufacturing and the Northwest Center of Excellence for Marine Manufacturing & Technology spearheaded the effort to formalize the group. “We wanted to provide an efficient and structured platform to develop and share composites curriculum in an open source format,” says Mary Kaye Bredeson, executive director of the Center of Excellence for Aerospace & Advanced Manufacturing.

The CWTC engages in several activities to strengthen education across its state. It facilitates communication between companies and colleges, creates a platform to develop and share curriculum, organizes professional development for instructors and industry, and represents Washington at significant conferences and trade shows. The focus spans sectors, including aerospace, marine, automotive, recreation, energy and infrastructure.

The consortium recognizes that the training needs for such diverse market segments are vast, as are the requirements for employers ranging from behemoths like Boeing to mom-and-pop manufacturers. That’s why the schools within the CWTC offer operator, technician and engineering pathways. Here are examples of three educational routes:

- **Short-term technical certificates** – South Seattle College offers a composites aviation certificate. The 11-week program prepares entry-level technicians to fabricate, assemble and repair composite materials on aircraft.
- **Short-term stackable certificates** – At Peninsula College, students can stack technical certificates. For instance, they may earn certificates in composites entry level manufacturing and CNC machining and programming, then apply those toward requirements for an associate in applied science degree.
- **A “2 x 3” engineering pathway** – Students at Bellingham Technical College can earn an associate in applied science degree by taking classes in core academic subjects, engineering and composites. After two years, students can transfer to a four-year university and complete an engineering program in three years – hence the “2 x 3” designation.

Industry partners are helping the CWTC standardize courses among its schools. The Center of Excellence for Aerospace & Advanced Manufacturing is currently facilitating a workshop to compare classes among the colleges and create common course numbering, which will help students move from a program at one college to another with ease and assure potential employers that graduates meet specific standards.

Companies help in other ways, too. They often supply equipment and training. For example, Greeno says Magnum Venus Plastech donated more than $60,000 in equipment and sent a representative to instruct faculty on silicone bag molding. Angeles Composite Technologies donated more than $70,000 in prepreg materials to Peninsula College last year. “These types of contributions and collaborative efforts are what keep colleges on pace because technologies change so quickly,” says Greeno.

Staying abreast of industry advancements attracts students. The number of students entering composites and advanced materials programs at each CWTC college annually varies from 10 to 60. Some schools have waiting lists, such as Clover Leaf Technical College’s Material Science – Composites program. That’s not a surprise considering most graduates transition into well-paying jobs with manufacturers or suppliers.

Greeno sites one graduate of Spokane Community College (SCC) as a great example of how the right training can change lives. Frustrated with a dead-end job in the fast food industry,
the student enrolled in the composites program at SCC. While there, he learned how to test parts and perform quality control on a coordinate measuring machine. After graduation, he was hired as the head coordinate measuring machine operator for a major supplier of composites parts in the Northwest. “These kinds of career opportunities are phenomenal!” says Greeno.

The CWTC also benefits companies by streamlining the hunt for skilled workers. "It provides employers the ability to connect with 10 community and technical colleges offering composites training as a whole rather than having to visit each individually across the state of Washington," says Bredeson. One great tool offered on the Center of Excellence for Aerospace & Advanced Manufacturing’s website allows companies to find recent graduates from community and technical colleges. It displays program descriptions, skill sets gained by students, course dates and the anticipated number of graduates for each program. (Check out the website at coeaerospace.com/recent-program-graduates and click on the “composites” cluster.)

As the composites industry grows, the need for educated employees also will continue to increase. “Instantly filling that demand or creating training programs to fill that demand is challenging because these are really expensive programs to run,” says Greeno. “It’s difficult for colleges to just jump into composites. That’s where I need to commend our industry partners in Washington state for their collaborative efforts as well as our state government for funding that allows colleges in our consortium to build out programs. Now it’s our job to make sure they are sustainable.”

A Coming Together of the ‘Town and Gown’

This May, Winona State University (WSU) hits a milestone: Thirty-two students will graduate from the public university in Winona, Minn., as part of its 25th class in the Composite Materials Engineering (CME) program. WSU is one of only a handful of accredited undergraduate programs in the United States that offer a bachelor of science degree in composite materials engineering.

“The program is a blend of mechanical, chemical and materials engineering,” says Fariborz Parsi, Ph.D., professor and chair of the Department of Composite Materials Engineering. “I know there are composites courses at other schools, usually on the mechanics of composites. But we offer both theory and hands-on courses. When students graduate from our program, they have designed, manufactured and tested composites.”

More than 460 students have graduated from the program since 1991 and pursued a variety of careers. Some work for large corporations such as the Ford Motor Co., Boeing, Northrup Grumman and Motorola. Many work for composite manufacturers and suppliers. And others have found a way to integrate their favorite pastimes into careers, going to work for companies including TREK Bicycles and Callaway Golf Company.

Graduates who work throughout the United States and as far away as the United Arab Emirates can thank local composites companies for partnering with WSU to create the CME program. In the mid-1980s, area businesses were in dire need of talented engineers. A group of companies approached the university about building a testing center on campus. In 1987, WSU opened the Composite Materials Technology Center (COMTEC), a student-staffed laboratory that provides design and analysis, material characterization, testing and prototyping for local companies.

Around the same time, WSU conducted a national industry workplace survey. “It indicated a need for people who are better educated in composites rather than just craftsmen, who are certainly always needed,” says Parsi. “But companies wanted people educated in the science of materials as well.” The results of the survey spurred WSU, community businesses and the state legislature to team up and create the first bachelor’s degree program in composites materials engineering accredited by the Accreditation Board for Engineering and Technology. WSU offers nearly 30 courses in composite materials engineering, covering materials, polymer processing, rheology,
Understanding the Science Behind the Applications

A shared concern among many industry companies is that they can’t find enough qualified employees, particularly skilled composite technicians to fabricate, assemble and repair parts. But colleges caution companies not to focus solely on shop floor activities when searching for employees: The science behind the materials and processes matter, too.

“We don’t do enough science in composites,” says Fariborz Parsi, Ph.D., professor and chair of the Department of Composite Materials Engineering at Winona State University. “If we want to increase the volume of composites, we need to be more intelligent about how we use the materials and optimize their properties.” He adds that by better understanding the materials and processing parameters, companies could reduce their scrap rate and make composites less expensive. That’s why laboratory courses, such as ones on the properties of materials and manufacturing, are so important, says Parsi.

Andy Schoenberg agrees. As the department chair of Southern Maine Community College’s Composite Science and Manufacturing Program, he teaches four advanced science courses. In labs, students use scientific principles to solve industry-related problems. For instance, students in an advanced polymers class are redeveloping the basis of marine chemistries for polyester unsaturated resins to solve print-through problems and issues with toxicity in some of the additives.

“We teach about polymers and materials because too often employees don’t have a clue,” says Schoenberg. “They take verbatim from a salesperson how a material will behave, but when they put it in the field it doesn’t work.” Employees who are well-educated in the science behind the materials can troubleshoot problems.

finite element analysis, manufacturing systems analysis, advanced microscopy, thermal analysis, mechanical characterization and more. In a course on composites manufacturing, students do hand layup, pultrusion, filament winding, extrusion, injection molding and compression molding.

One of the university’s signature classes is a two-semester design course. “In one year, students go through the cycle from conceiving an idea to building a product,” says Parsi. Last year, student teams built products ranging from an ice auger to a portable solar-charging device. (You can see videos of projects from 2008-2014 on YouTube by searching “WinonaUComposites.”)

Students also get hands-on training in the COMTEC organization, where they see real-world problems faced by industry companies. “We have a lot of interaction with the companies in town,” says Parsi. “We’re not here by ourselves trying to teach only out of the books.”

Getting practical experience before graduating is particularly important in today’s business environment, adds Parsi. “Companies are looking for employees who can make a difference right away. Nobody has the resources to do extensive training,” he says. “Our students don’t learn everything in four years, but they can walk into a company and make a difference. They have the right mentality and background.”

One alumnus who proves Parsi’s point is Charles Weber, who graduated from the CME program in 1999. Afterward, Weber joined Composite Product Inc. in Winona as an applications design engineer. He quickly rose through the ranks, becoming president of the company in 2004. In 2011, Weber left the company to work full time at Kaber, a design and prototyping firm in Onalaska, Wis., that he started several years earlier. In four short years, Kaber has added four employees and moved into a larger location.

As company owner, Weber appreciates the value of well-educated students with practical skills. “Between the lab work and onsite testing lab at COMTEC, students at WSU get a great opportunity to go beyond classroom theory,” he says. “As an employer, I can say this makes a critical difference.”

That’s the ultimate goal for all colleges and companies – to make a difference. Working hand-in-hand seems the best way to reach that goal.

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

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Interest in composites is building in the architecture market.

By Mary Beck
Jim Williams, a 37-year veteran in the composites industry and sales manager at MFG Molded Fiber Glass Companies, has observed a creative upsurge recently in one market segment: Architects are creating more and more outside-the-box designs that push the boundaries of what can be built. To Williams, other composites professionals and an increasing number of architects, it’s clear that composites are a great material choice.

What makes composites so capable? When it comes to decorative work on the exterior of a building, staying lightweight is key to minimize installation costs and framing requirements. Composite structures are also strong and weatherproof. And perhaps the greatest advantage is molding freedom, which opens up numerous possibilities for the structure’s shape.

Molding freedom is a big selling point for Mike Dobronos, president of Architectural Fiberglass in Cleveland. The company is best known for its decorative work. “With traditional materials, you can’t bend something two or three different ways,” says Dobronos. “It’s difficult to make a ball, for instance, out of metal, whereas out of fiberglass you can do it readily.”

Architectural Fiberglass manufactures dome roofs, religious ornaments, cornices and custom pieces for a variety of buildings. Recently, the company completed a project for the security area in the Wichita Dwight D. Eisenhower National Airport in Kansas. The FRP honeycomb-patterned ceiling fixtures are purely decorative, giving the room character, says Steve Dobronos, sales manager at Architectural Fiberglass. The fixtures use Ashland’s MODAR® modified acrylic fire-retardant resins to meet low smoke requirements for interior fixtures.

Whether decorative or structural – or a combination of both – composites are pushing the limits of what’s possible within the architecture market.

Unique Challenges and Results

While architects like to push the boundaries of design, Paul McMullan understands why some may be uneasy about trying unfamiliar materials. “[Architects] want to create a radical design, but they don’t want to take unnecessary risks because that’s their reputation at stake,” says McMullan, composites business director at Scott & Fyfe in Fife, Scotland. But as more architects learn about composites and their benefits, visionaries are taking the materials to new heights. Scott & Fyfe provided reinforcement materials for two recent projects in The Netherlands that highlight the potential for composites.

The first project, the Hilton Schiphol at the Amsterdam Airport Schiphol, uses 10,000 square meters of interlocking composite panels of different shapes. The second, the Stadskantoor Utrecht (SKU) building, represents the largest use of composite materials in a building façade, totaling 20,000 square meters, McMullan says. In both cases, architects chose composites over competing aluminum, plastic and glass materials.

Most of the GFRP tiles on both buildings were produced using vacuum infusion to achieve curved shapes and a heavily consolidated laminate about 3 to 4 millimeters thick. Vacuum infusion was also ideal for the highly filled, high-viscosity resin system required. The reinforcement material, Scott & Fyfe’s Polymat Hi-Flow Max, was specifically chosen for its compatibility with these resin systems. The stitch-bonded reinforcement consists of a thermoplastic core sandwiched between two layers of chopped strand fiberglass.

McMullan says formulating a resin system with the right level of additives to meet fire standards presented the greatest challenge on both projects. “The fire performance was achieved by adding aluminum trihydrates to the polyester resin,” McMullan explains. “But by nature when you add that, you increase the viscosity which makes it difficult to process.” The team tinkered with the balance of the reinforcement materials and resin to meet both requirements. The intumescent gel coat system used also added fire resistant properties to the panels.

Finding the right resin can be difficult for many architecture projects. There are some limitations to how much GFRP you can put on an exterior of a building, says Mike Dobronos. “Metal is a non-combustible product, while composites are fire retardant,” he elaborates. “Non-combustible resins exist, but are hard to work with, so not many [manufacturers] want to use them.”

Both Mike and Steve Dobronos note that just about every major resin company has chemists at work to formulate a better non-combustible resin.

One recent project in the U.S. – 170 Amsterdam in New York City, opened in March 2015, GFRP was crucial to achieve the design and structural integrity of the X-shaped exterior columns.
Expanding Education for Architects

Though knowledge of composite materials isn’t as widespread as the industry would like, more schools are taking steps to teach architecture students about all of their material and design options. Rick Pauer, marketing manager at Polyn Composites USA Inc., recently visited one of the latest schools to offer composites education for architects, the Illinois Institute of Technology (IIT) in Chicago. He became interested in the school’s program after he heard about the FIBERwave PAVILION, a carbon fiber reinforced polymer structure created by IIT students that shifts and morphs when variably tensioned.

Now, a group of 10 students led by Alphonso Peluso, associate professor at IIT’s School of Architecture, is working on a new project: They are creating CFRP slabs that will be combined to form a 4.5 x 9-foot wall structure. Pauer attended the teams’ midterm presentations on their work and offered feedback.

“For the most part, the challenges were all related to fabrication,” Pauer says. “The techniques that they were given were resin-rich, so there were a lot of air bubbles in the composite, and we walked through how to fix that.” He also gave a presentation to the students about different architecture applications for composites, so they could see the materials’ capabilities.

This is the fourth time Pauer has visited a class of architecture students. He says the ITT students seemed excited about using composites and were impressed by the applications he showed them. “They’re used to working with wood, concrete and steel, and this really fits into the free-flow concept that they’re looking to create out of easier materials to work with,” he says.

To support Peluso’s students, Pauer has coordinated with Vectorply and Composites One to provide scrap materials.

The industry can also lead education efforts for architecture school grads. Pauer is working with members of ACMA’s Architectural Division to introduce more students and established architects to composites. Their goal is to create a teaching module so anyone in the Architectural Division can kick start the educational process, which could potentially be applied to the architecture industry’s continuing education credit requirements. Lunch-and-learns with local architects – a strategy Steve Dobronos plans to incorporate with Architectural Fiberglass – are another way to get architects involved with composites.

City – combines decorative work with practical building support. Owned by Equity Residential, 170 Amsterdam is a 20-story apartment building with 8,500 square feet of retail on the ground floor. MFG worked with Rider Construction Inc. and Handel Architects to build a unique structure that eliminated most of the interior columns from the apartments. Instead, tilted X-shaped exterior columns replace the perimeter columns of the structure, and there are very few intermediate columns.

Williams says Rider’s president was sold on GFRP because it’s lightweight and has structural integrity. As an added bonus, GFRP was the simplest material to use. Unlike other U.S. cities, New York requires the deck concrete to be poured at the same time the columns are set. This initially proved challenging: “The exterior columns are angled, and we had to design so they could be stripped and removed after the concrete set,” Williams says. Steel was an option, but so heavy that it would have required special equipment to put in place, thereby making it cost prohibitive. GFRP was the best choice.

The exterior columns are made from chopped strand fiberglass mat with a gel-coated surface. They feature at least two pieces bolted together to make the column, with no other materials incorporated into the laminate. “With chopped strand mat, we were able to obtain a better glass-to-resin ratio that allowed us to have more physical strength while keeping costs down,” says Williams.

Building Awareness

One of the biggest hurdles to expanding the use of composites in architecture is creating awareness. Many architects aren’t as educated about – or even aware of – composite materials as they are for competing materials like steel or aluminum. This can make bidding on a project more difficult, but not impossible. There are other reasons why some architects may shy away from composites, beyond lack of knowledge. “When we talk to an architect, we need to sell them on the strengths we can build into a form,” Williams says. “Because it is fiber reinforced plastic, they
correlate that with something that is fragile.” He believes that once architects understand the strength and versatility of GFRP, they’ll see there’s “no competition.”

McMullan, on the other hand, understands how other materials can be competitive. “The fire performance criteria is always perceived as a bit of an obstacle for composites,” he says. While most metals are flame-resistant, composites are flame-retardant. But he is still confident. “We’ve proven that [fire] standards can be achieved, and architects need to know. We need to de-risk it and show that it is a reliable technology.”

Even so, many architects are still willing to work with and learn about GFRP. Steve Dobronos says many of Architectural Fiberglass’ sales stem from an architect calling and asking what GFRP can do for them. “They say, ‘Hey, can you make this out of fiberglass?’ And in most cases, yes we can,” says Dobronos. “We try to educate them from there.”

Dobronos also has a few go-to examples to share if an architect is not immediately convinced by GFRP’s properties, including decorative pieces in Las Vegas and Disney World. “Most of that is made out of fiberglass because they’re willing to spend the money and have a good product,” he says. “They don’t want to go back there and replace it every year. They don’t even have the opportunity to replace it because the place is always so packed!” He also references previous projects his company has worked on, other pieces that have been on buildings for more than 50 years and GFRP boats that haven’t rusted or corroded after years on the water.

A Strong Outlook

High-profile projects are helping bring composites closer to the forefront of the architecture market, and industry manufacturers are feeling upbeat. “Everyone I spoke to [for the Hilton and SKU] projects has been really amazed by the design and its uniqueness and what’s been possible,” McMullan says. “I think that confidence is going to spread. The challenge is to educate and train architects in what’s possible so when they consider their next project, composites is at least on an equal platform as traditional materials in the design stage.”

Mike Dobronos says when it comes to GFRP, “99 percent of the time, we can do it better and with less expense [than metals].” He’s finding that architects agree: “We do more business every year,” he says. “More people are aware of composites.” Ultimately, that rise in awareness – coupled with advances in composite technology – should lead to growing sales in the architecture market.

Mary Beck is the communications coordinator at ACMA. Email comments to mbeck@acmanet.org.

Join ACMA at AIA!

ACMA will host the second annual Composites Pavilion at the 2015 American Institute of Architects show May 14-16, 2015. Come visit the pavilion in rows 15-19 near the entrance of the exhibit hall. You can also attend session FR313: “Composites: Fiber Reinforced Polymers and the IBC” from 3:30-4:30 p.m. Friday, May 15 in room B302.
What do ambulance transport cots and high-tech drones have in common? Some of their parts may have been manufactured from sheet molding compounds.

SMCs are thermoset, semi-finished composites that combine chopped strands of fibers, traditionally glass, with various types of resins. Produced in sheets between 1 mm and 3 mm thick, SMC is a highly versatile, dimensionally stable material. It’s often used in the automotive industry to compression mold everything from Class A body panels to semi-structural components. But cars and trucks aren’t the only applications benefitting from SMC’s fast cycle times, corrosion resistance, durability and moldability.

Citadel Plastics produces SMC parts for ambulance transport cots for Ferno, a supplier of medical equipment. The cots incorporate independently operated motorized legs to raise and lower them, which in turn reduces the strain on emergency medical technicians caused by lifting heavy patients. SMC provides the cot legs structural integrity and encloses the moving mechanism. Rapid Composites uses a hybrid SMC, combining higher tow carbon fibers and glass fibers, for production of an amphibious, tricopter/quad configurable drone called the Bullray. It weighs just 4.4 kilograms and can be molded in less than 10 minutes to its net shape.

Major markets

Because a one-piece SMC part can often replace a multi-piece metal assembly, the material is sought after in many markets. Perhaps the most talked about is automotive.

OEMS rely on SMC as a lightweight replacement for steel and aluminum, producing large parts such as exterior body panels and underbody shields as well as smaller items like electric vehicle battery box enclosures.

While SMC is often associated with Class A surfaces that
provide cars aesthetic appeal, it’s also used on heavy duty vehicles. Caterpillar has been incorporating SMC valve covers in its heavy construction equipment since 1988. The range of applications has grown to include hoods and doors on motor graders, medium wheel loaders, paving equipment and hydraulic excavators. In addition, Caterpillar engine guards, transmission covers and roofs also are compression molded with SMC.

“SMC offers benefits to Caterpillar such as weight reduction, consolidation of parts and corrosion resistance,” says John Unser, CCT, engineering specialist, research and development for composites/adhesives/plastics. “The biggest driver is lower cost for the same or better performance than steel.” One example of this is transmission covers. Caterpillar replaced a 9 mm thick steel plate with a compression molded SMC part and saved 25 to 40 percent on production costs.

However, since Caterpillar produces thousands of parts per year rather than millions, like automakers, the company can’t always justify the tooling costs required for SMC. So it relies on SMC for higher volume products. Still, Unser predicts SMC usage will continue to grow at Caterpillar: “The focus is on [becoming the] lowest cost producer. The conversion of metal to composites will help us achieve this goal.”

In building markets, SMC has become a material of choice for HVAC system housings. Previously, this application used sheet metal. “It’s hard to replace sheet metal because it’s so low cost, but other benefits that plastic provides are corrosion resistance and the ability to consolidate parts,” says Peter Emrich, senior vice president of technology, Molded Fiber Glass Companies. SMC compounds designed with insulation properties make excellent industrial switch gears and electrical insulators. “Change the plastic to conduct electricity and control how much it conducts, and you have materials that are electrostatically dissipative for holding circuit boards and that allow static electricity to drain off,” says Emrich. “But they are resistive enough so that if you ever had a direct short across the SMC you wouldn’t get a shock.”

**A Focus on Low Density SMC**

Today many compounders, resin producers and fiber suppliers are focusing on lower density SMC for the automotive market. Lighter parts help automakers reduce vehicle weight and meet mileage mandates. “In the year 2000, the average density of automotive SMC was pushing 1.9 gm/cc [grams per cubic centimeter],” says Emrich. “Now it’s in the 1.2 range – and there’s room to move yet.” With thermoplastics ranging from approximately .9 to 1.8, SMC can now compete with those materials. “Historically, the density of SMC would put it at a slight disadvantage in lightweighting applications, but now you don’t have that disadvantage,” says Emrich.

One common method for lightweighting in SMC is to replace calcium carbonate fillers with miniscule glass spheres. “In the early days, these spheres crushed easily,” says Terry O’Donovan, vice president of marketing and sales at Core Molding Technologies Inc. and chair of ACMA’s Automotive Composites Alliance. “If they’re designed to be hollow and take up space, they don’t do much good if they crush while processing.” The development of higher strength microspheres has allowed them to retain their spherical shape.

Continental Structural Plastics (CSP) incorporated glass microspheres into its new Tough Class A (TCA) Ultra Lite, a 1.2 specific gravity SMC formulation that weighs 35 percent of the density of a comparable metal part. Medical equipment supplier Ferno considered carbon fiber mat and unidirectional carbon fiber for the legs of its motorized INJX™ ambulance cot, but ultimately chose Quantum Composites’ AMC 8590 carbon fiber SMC because its variety of orientations provides the necessary strength in select areas.

**The use of SMC will spread as engineers learn more about designing with composites, rather than just substituting a metal part with the same configuration using SMC.**
less than the company’s standard SMC. “But there were shortcomings to that, including the microsphere’s strength, how well they would adhere to the resins and their sensitivity to humidity,” says Probir Guha, CSP’s vice president of advanced research and development. So CSP worked with AOC LLC on development of a new resin to resolve those issues.

“In the past, when we would try to go to lower specific gravity to reduce the weight, we would run into issues such as paintability, strength, stiffness or loss of surface quality,” says John Young, AOC technical services manager. Working with AOC, CSP was able to produce an SMC that meets Class A specifications and has the necessary mechanical properties and paintability requirements for automotive use.

Low density isn’t the only characteristic that automotive OEMs seek. Owens Corning’s customers requested rovings that would interact with epoxy resins to produce high-strength, high-modulus SMC. In response, the company developed ME1510, a glass fiber, multi-end roving for automotive structural applications. “We put an entirely new sizing chemistry around the glass to achieve improved performance,” says Monique Buch, Owens Corning’s global product platform leader for assembled rovings.

Using Carbon Fiber in SMC

Another approach to lightweighting SMC, replacing glass fibers with carbon, offers opportunity. “Carbon fiber is much stiffer than glass fiber, and many parts – particularly automotive panels – really need stiffness more than strength,” says O’Donovan. “Carbon fiber weighs less than glass, so it makes a somewhat lower density material. But the real advantage of carbon fiber in an SMC is its stiffness. You can get away with cross sections that might be 1.5 mm thick instead of 3 mm thick. That’s saving half the weight.”

But cost is an issue. “In a normal glass SMC, the glass and resins are, in a rough order of magnitude, equal contributors to the cost,” says O’Donovan. “But in carbon fiber SMCs, the carbon fiber is significantly more expensive than glass.” That limits widespread use.

Much of the carbon fiber produced today goes to the aerospace industry, which utilizes very high-grade, high-cost carbon fibers. SMC compounders are searching for ways to work with less expensive fibers. Magna Exteriors and Zoltek, for example, created a material called EpicBlend SMC EB CFS-Z, which combines sheet molding compound formulations with commercial carbon fiber. The companies say the material is less expensive than higher-grade SMC, while still maintaining the same performance characteristics.

Other advancements include hybrid solutions, such as the SMC used in the Bullray drone. “With hybrid SMCs, some of the glass fiber is replaced by carbon, but not all of it,” says O’Donovan. “So you have the strength, but at lower cost.” He adds that other companies are experimenting with putting recycled fibers into SMCs.

Rovings, Resins and More

Companies are always striving to produce SMC materials with new and improved properties. Johns Manville designed the Multistar 264 family of rovings specifically for use with multipurpose polyester resins. “It allows consistent glass loadings for improved fiber distribution, which is an advantage for the compounder,” says Philippe Bekaert, global market development leader of fibers for Johns Manville. One customer used another roving in the Multistar family to design a formulation that can be pigmented and colored to produce a Class A surface without any need for painting or other coating.

IDI has a line of Structural Thermoset Compounds™, available in both sheet and bulk formats, for high-performance applications. The molding compounds use specialized resins and higher levels of reinforcement to provide greater strength, lower coefficients of thermal expansion and better corrosion resistance. Larry Landis, director of technology and quality for IDI, says these compounds are well suited for the automotive market, oil and gas field equipment, sports equipment and agricultural applications.

In addition, IDI has developed new technology for pigmenting SMCs for outdoor applications, reducing discoloration and “fiber bloom” – damage to the fiber’s aesthetics from UV exposure. Applications for pigmented SMCs include outdoor equipment such as lawn mowers, recreational vehicles and multicolored steps and sidewalk units that adhere to the Americans with Disabilities Act.
Quantum Composites, part of Citadel Plastics, has produced an SMC with new bismaleimide resins that can withstand high heat. “It has a glass transition temperature above 350 degrees Celsius,” says Mike Gruskiewicz, vice president of technology for the U.S. region for Citadel Plastics. “That SMC could go into applications like fracking components for deep well oil and gas.”

Molders are involved in innovation, too, experimenting with ways to produce more complex parts with SMC. Some are incorporating features typically found in injection molding – like side cores – into compression molding tools. Other companies are even injection-molding large SMC parts, gaining the flexibility of the injection molding process with the strength supplied by SMC’s long glass fibers. “The people who can do that are making some unique products for their markets,” says Landis.

Mindful of the need for sustainability, Citadel Plastics has been testing renewable solutions for SMC components, such as resins derived from plant oils. “We are doing some work with a soy-derived filler that uses a waste stream from food production,” says Gruskiewicz. “That is a low-density filler that is renewable, light weight and is a value-added product eliminating something that is largely a waste stream.”

Many SMC producers are experimenting with substitutes for monomers like styrene. IDI makes wrappings and pipe coverings for building interiors from monomer-free SMC. Parts makers could use monomer-free SMC for vehicle interiors as well because it has none of the odors typically associated with VOCs.

**The Future of SMC**

There are obstacles that could slow down SMC’s further penetration into new and existing markets. The automotive industry, for example, might be reluctant to spend money on new SMC systems when it has already invested heavily in metal-based parts production. In addition, design engineers don’t always understand SMC’s properties, and traditional modeling programs may not be sophisticated enough to handle SMC’s anisotropic nature, where the X, Y and Z planes all have different properties. Even so, Gruskiewicz predicts the use of SMC will spread as engineers learn more about designing with composites, rather than just substituting a metal part with the same configuration using SMC. “When you design from the ground up using composites, you can come up with innovative solutions that are much more effective,” he says.

With technical innovations unlocking new capabilities, SMC offers growth potential. “Today we are running as much SMC product as we’ve ever run,” says Emrich. “That seems to be true at all SMC manufacturers. Everybody is busy.”

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CMA supports legislation increasing the likelihood that the Environmental Protection Agency (EPA) will conduct a risk assessment for styrene and possibly require controls for composites industry workplace exposures and plant emissions. The legislation would also allow the EPA to order the industry to conduct exposure studies and provide data to the EPA. And the EPA could collect "user fees" from the industry to pay for this regulatory program.

Why in the world would ACMA support such legislation? There's good reason, but first some background.

The legislation, introduced March 9 in the Senate with nine Republican and seven Democratic co-sponsors, is called the Frank L. Lautenberg Chemical Safety for the 21st Century Act, or CS-21. The bill aims to reform the EPA's program under the Toxic Substances Control Act (TSCA), which since 1976 has functioned adequately to regulate new chemicals, but has largely failed to fulfill its mandate to issue safety standards for styrene and the thousands of other existing chemicals to which Americans are potentially exposed at work or in their homes.

CS-21 would require the EPA to consider styrene to be a high priority chemical. Soon after the Act is enacted, the EPA would conduct a safety assessment and require any risk management measures needed to ensure uses of styrene meet a safety standard of "no unreasonable risk of harm to health or the environment under conditions of use." Composites industry workplaces and plant emissions are very likely to be conditions of use evaluated as part of a TSCA styrene review, and so in a few years, the composites industry could be faced with additional limits on styrene exposures and emissions.

So back to the original question: Why would ACMA support the legislation? Consider this:

• Styrene is already on the priority list for a TSCA assessment, and the EPA has promised to issue a styrene safety standard under its current program by 2018.
• Styrene will also be subject to a risk assessment and issuance of a safety standard under the EPA Office of Air's MACT Risk and Technology Review program.
• Styrene is on the priority list for issuance of updated workplace exposure limits by both Federal and California OSHA.
• The first of these programs to get to styrene will likely have a very significant influence on subsequent risk assessments.
• CS-21 would, for the first time, legislatively mandate science quality measures, and a reformed TSCA would be under close scrutiny by stakeholders and Congress.

Under a reformed TSCA, the EPA would have to conduct a very transparent assessment using published guidelines and employ a weight-of-evidence approach to hazard assessment. By no means do these legislative requirements guarantee a valid styrene assessment, but they make it much more likely styrene will receive a scientifically valid toxicity review under a reformed TSCA than under any of the other regulatory programs interested in this substance.

Working against science quality will be the aggressive deadlines
set by CS-21 for issuance of safety standards. The Act’s sponsors expect the EPA’s reformed TSCA program to conduct safety assessments and issue risk management requirements for 25 chemicals a year, once the program is fully implemented. Consider that the EPA’s IRIS program did not complete a risk assessment for even one substance during all of 2014.

Getting valid safety assessments out of a reformed TSCA program – so the composites industry is allowed to continue using styrene – will require aggressive and continuing attention by ACMA and other stakeholders and effective Congressional oversight. But the industry still has better odds here than under any of the other options.

John Schweitzer is ACMA’s vice president of government affairs. Email comments to jschweitzer@acmanet.org.
FIBERS Team Tours Ohio Plants

In March, ACMA hosted a tour by the FIBERS Technology Roadmapping team from U. Mass Lowell of composites manufacturers in the Ashtabula, Ohio, area. The purpose of the tour was to inform leading researchers of the needs of ACMA members. Companies visited included Chromaflo, Rochling Glastic, Enpress, Mar-Bal, Iten, Citadel, MFG, Continental Structural Plastics and Zehrco-Giancola.

Dr. Daniel Walczyk, a member of the FIBERS team from Rensselaer Polytechnic Institute (RPI), said, “Although I was familiar with engineered composites and glass composites, I never realized how big this segment is of the total market, the variety of useful parts made and the challenges facing these companies. It was a very enlightening and educational experience for me. With regards to roadmapping, it’s clear that engineered composites and glass composites must be emphasized as much as traditional advanced composites.”

Based on the success of this tour, ACMA will arrange additional tours in a different geographic locations to provide networking opportunities for ACMA members. If you would like to participate in a future tour featuring your composites manufacturing facility, please contact Dan Coughlin, ACMA’s Vice President of Composites Market Development, at dcoughlin@acmanet.org.

ACMA Visits New IACMI Institute

ACMA members visited Oak Ridge National Laboratory (ORNL) and the University of Tennessee (UT) on April 13. UT is leading the recently announced Institute for Advanced Composites Manufacturing Innovation (IACMI) with ORNL as a key partner. The tour included the new Tickle Engineering Building (named in honor...
of former ACMA Board chairman John Tickle) and its composite pedestrian bridge as well as other composites-related laboratories at UT. ACMA also toured ORNL’s Manufacturing Demonstration Facility, one of North America’s premiere additive manufacturing laboratories, in which multiple drivable cars have been 3-D printed, and the Carbon Fiber Technology Facility, the world’s most flexible, open-access semi-production scale carbon fiber processing facility.

ACMA Hosts National Policy Summit

ACMA’s National Policy Summit took place April 14-15, giving ACMA members the opportunity to join fellow industry leaders to meet directly with their representatives, Senate leadership and key White House advisors. Participants discussed a number of issues, including burdensome regulations, tax reform and expanding key markets. ACMA provides members with the opportunity to build strong relationships with government leaders who can move the needle on the issues that matter to our industry’s bottom line.

OSHA Grants HAZCOM Enforcement Forbearance

In response to advocacy by ACMA and other industry groups, OSHA posted enforcement guidance in February allowing formulators (chemical suppliers whose products are mixtures comprised at least in part of substances obtained from other companies) to avoid citations for failing to comply with the agency’s June 1, 2015, deadline for updating safety data sheets and labels provided for their chemical products. The guidance tells compliance officials at OSHA and state workplace safety agencies to allow

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chemical formulators up to an additional two years to come into full compliance with requirements for updated SDS and labels, provided the formulators have exercised “reasonable due diligence and good faith” to obtain updated hazard information from their suppliers but have not been able to obtain that information.

Find Products Easily with ACMA Buyer’s Guide!

Composite manufacturing professionals can cut through the clutter of traditional search engine results with the ACMA Buyer’s Guide. Easily accessible from the ACMA home page at acmanet.org, the Buyer’s Guide allows users to perform targeted searches for industry-related products and services using either a user-defined keyword search or an alphabetized directory search by product categories. Imagine blending a Google-style search engine with the Yellow Pages, and you have the ACMA Buyer’s Guide, the industry’s premiere online supplier directory.

Industry Calendar of Events

For more information regarding ACMA’s upcoming events and education, visit acmanet.org/meetings.

May 14-16
ACMA exhibits at the AIA Convention
Atlanta

May 18-21
ACMA presents and exhibits at AWEA WINDPOWER
Orlando, Fla.

May 18-21
ACMA exhibits at SAMPE Baltimore
Baltimore

June 7-11
ACMA presents and exhibits at the International Bridge Conference
Pittsburgh

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For more information on becoming a member of ACMA, email membership@acmanet.org or call 703-682-1665.

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Delivering a New Lightweight Truck

Volkswagen has left its mark on the vehicle lightweighting movement with the Transporter, a utility concept truck weighing just 3.5 tons. The truck also can be built as an all-electric vehicle. “The use of carbon fiber not only helps the vehicle become lighter, more efficient and environmentally friendly, but achieves great savings in diesel consumption and carbon dioxide emissions due to 40 percent more payload and up to 30 percent savings in shipments,” says Irem Cavusoglu, corporate communications manager at DowAksa, the carbon fiber supplier for the project.

The Transporter features a CFRP refrigeration structure and chassis behind the cab, including the monocoque, floor plate and box. The refrigerated cargo space gives the Transporter the added capability of carrying medical products as well as food products. DowAksa says the vehicle will enter series production within the next two years.

Front and Rear Walls
The skins are Lamilux GFRP composite skins made by Lavender Composites.

Cantrails
The cantrails are fabricated using pullwinding, a variant of pultrusion where fibers are introduced length-wise and cross-wise. All parts are reinforced with DowAksa’s standard-modulus A42 24K carbon fiber.

Chassis
The chassis, front wall, rear wall and the floor plate are vacuum infused. The vacuum thermal insulation enables the refrigeration unit on the vehicle to operate 60 percent more efficiently.

Side Walls and Roof
The enforcements in the side walls and roof are pultruded. The specially developed CFRP refrigeration technology not only provides a solution to carbon emissions, but also noise – two of the most critical issues in refrigerated transportation.
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