Features

On the Fast Track

Speed is the name of the game at many Winter Olympic venues, from downhill skiing to bobsledding. U.S. athletes hope that advances in high-performance materials, including carbon fiber, help shave crucial hundredths of a second off their competition times – and land them hard-earned medals.

By Susan Keen Flynn

State of the Industry

Global market research firm Lucintel shares key industry numbers and opportunities for 2014.

By Dr. Sanjay Mazumdar

Bio-Resin Market: Still Budding, But No Boom

The two leading U.S. crops are corn and soybeans. But not all produce ends up on the table: Some finds its way into composites. Resin suppliers share the latest developments in bio-resins.

By Darin Painter

CM Online Exclusive

Researchers at The Dow Chemical Company worked hand-in-hand with USA Luge to create state-of-the-art sleds for the 2014 Winter Olympics. CM Interviews talked to two of the researchers – Jay Tudor and Scott Burr – about the project and other cutting-edge research at Dow in an exclusive interview. Access the discussion online at compositesmanufacturingblog.com by clicking on the “CM Interviews” tab.

About the Cover:

Photo courtesy of The Dow Chemical Company.
Looking Ahead to a Prosperous 2014

Happy New Year to the readers of this fine magazine, either printed or electronic. Our hope is for a prosperous New Year for the composites industry. But as I have always been told, hope is not a very good strategy. We all have to work at making the industry successful. Sometimes that requires putting our shoulder to the wheel and pushing harder to make things happen. Other times we need to take a longer view and think about how we can improve our chances for success. That’s just what ACMA is doing.

At ACMA’s last board meeting in October, we placed all of our education-focused committees under the umbrella of a new Education Steering Committee. Those committees include the Certified Composites Technician (CCT®) Committee and subcommittees, the ACMA CAMX Technical Paper Subcommittee and the ACMA CAMX Education Session Subcommittee. We have retained all of the individual committees, but now we have a coordinated oversight strategy. The idea is to ensure that the association is making the most of our educational assets and using them in ways that benefit members. This, in turn, should help the composites industry prosper in 2014.

Another way we can improve our future is with additional training in new skills, technologies and processes. Why not consider enrolling in a CCT program this year? ACMA currently offers nine CCT designations and is looking to update current programs and develop new process programs in the coming years.

One of the most exciting developments for the New Year is that ACMA will roll out its online education portal – “ACMA Online: Education On Demand” – during the first quarter. The portal is a tool for enhancing the CCT experience with online learning and testing. It will also, in time, be used to distribute all of the association’s educational content: Members will be able to access webinars and technical papers. We are just beginning to unlock the potential of this online education portal.

This year also marks the debut of CAMX, The Composites and Advanced Materials Expo, which will be held Oct. 13-16, 2014, in Orlando, Fla. CAMX will be America’s go-to event for products, solutions, networking and advanced industry thinking for all market segments. I highly recommend that you visit the new show website at theCAMX.org regularly to see what’s new.

Finally, thanks to our members and ACMA’s Membership Committee the association continues to grow. We saw a 6 percent increase in new and rejoined members for the first quarter of fiscal 2013-2014. Many companies joined or rejoined as a result of members recruiting members. If you are a new member, welcome to ACMA! And for all of our long-time members, thank you for your continued support.

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Some of the most successful – and memorable – businesses are built on big ideas. Powerful ideas can create powerful results when they’re successfully implemented.

However, turning an abstract vision into reality can be a challenge for even the most dedicated executive. One of the easiest ways to create focus and execute effectively is to live in a 90-day world. By concentrating your attention into three-month periods, both you and your team can take the necessary small steps that add up to big results. You’ll also turn a potentially overwhelming, abstract concept into a much more manageable, concrete plan.

That’s not to say that you should abandon your yearly planning process or even your five- and 10-year plans. Both short- and long-term planning are crucial for directing your company’s future – and achieving your ultimate vision. However, in order to meet those long-term goals, you need to start executing in the short term, and that’s what a 90-day world is all about.

Here’s how working in a 90-day world might look in your business:

1. With your big idea locked down, gather your executive team for a yearly planning meeting. Where do you want the business to be in 12 months? Decide what you need to accomplish in the next year – and get specific with your ideas.

As you plan for the year ahead, consider how this coming year fits into the long-range vision for your company. Make sure your plans for the next 12 months set the stage for your long-term success while meeting your short-term goals. Additionally, because this will be
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your main high-level meeting for the year, take time during this meeting to flesh out all the details.

2. Next, you’ll narrow the scope of your planning during a series of four quarterly meetings throughout the year. In each meeting, you’ll look out at the next 90 days, no more and no less. You and your team should make a list of three to seven big priorities that need to get accomplished in the next 90 days in order to achieve the yearly plan you’ve decided on. We call these priorities “rocks.”

Put dates on each of these rocks and choose one person to own each. That person will be responsible for keeping that rock on track and reporting to you on both progress and challenges over the 90-day period.

3. Once you’ve established your rocks and their ownership, you and your team will build out the tasks necessary to accomplish these rocks. Put dates on these, too, to offer them the best chance of getting accomplished on time.

Depending on the size of your organization, this build-out may take place at the executive team level. In larger organizations, your leaders may take their rocks back to their team and build out the associated tasks in smaller groups.

4. To keep your rocks on course, review their progress in weekly executive team meetings. This is where the rubber meets the road. What’s getting accomplished? What issues are arising? What mid-course corrections are needed to assure success?

About two weeks before the 90 days are up, you’ll want to start looking ahead to the next 90 days. Take stock of where your current rocks stand, then set your new rocks and continue to move your company forward, quarter by quarter.

You’ll also want to check in with your company as a whole on a quarterly basis to report results on the rocks you set. By regularly reporting progress to the company as a whole, you’ll continue to establish the company-wide buy-in you’ll need to get large goals accomplished.

Breaking down your priorities into a 90-day world keeps you and your team from getting overwhelmed. Everyone’s to-do list will seem much more manageable. Focusing on your rocks also frees up your team to focus their efforts on what’s most important. This increased intensity toward achieving clear, meaningful goals is what will help you start to execute big ideas consistently – and gain traction in your marketplace.

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

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A team of 15 engineers are working in a remote New Mexico facility to take their knowledge about solar-powered vehicles to the next level – the upper atmosphere. Max Yaney, founder and chief technical officer at Titan Aerospace, established the company in 2012 with a unique vision to change the high altitude, long endurance market for aerial vehicles. His dream is to create a series of unmanned aircraft that function as satellites, but with a broader range of capabilities and at a lower cost. Titan Aerospace is presently designing and constructing the Solara 50, a solar-powered “atmosat” – or atmospheric satellite – that could potentially perform research tasks and serve as a communications platform at the edge of space. The company hopes that the Solara 50, which resembles a large drone, will be commercially available in 2016 or 2017.

The Solara 50 is large: It’s 15 meters (49 feet) long and features a wingspan of 50 meters (164 feet). It’s also fast – capable of cruising at 65 mph. The atmosat is projected to cruise at an altitude of 65,000 feet and remain there for up to five years. It could carry 250 pounds of equipment, such as telecommunications platforms, reconnaissance equipment, sensors and other payloads.

“The Solara is extremely light and strong and has a simple design with commercial off-the-shelf components, which allows us to operate effectively in this market,” says Ron Olsen, vice president of sales and marketing at Titan Aerospace. The airframe relies heavily on composites – mainly fiberglass, Kevlar and carbon fiber. While the company could not elaborate on proprietary information concerning composite usage, Olsen added that materials were chosen to meet the atmosat’s strength and weight requirements.

Production of the Solara 50 is possible thanks to Titan Aerospace’s autoclave installation last March. “With an autoclave, we are able to make parts under pressure using prepreg materials that are lighter and stronger than their wet-layup counterparts,” says Olsen. “This allows us to the push the envelope...
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Titan Aerospace anticipates the Solara 50 will be used for numerous applications, including disaster response.

developed the Helios prototype for NASA, but an air mishap in 2003 cut that program short. Boeing was making progress on the SolarEagle when the Defense Advanced Research Projects Agency (DARPA) scaled back its funding in 2012. However, the team at Titan Aerospace strongly believes that with the help of new technologies, advancements in composites and efficient solar cells this is the perfect time for the Solara vehicle to make its debut.

Titan Aerospace anticipates the Solara 50 will be used for numerous applications, including disaster response. With search and rescue functionalities, the aircraft could perform tasks that are currently limited to helicopters and manned aerial vehicles at a fraction of the cost, says Olsen. The Solara will be equipped with high-resolution, full-motion video cameras that can assist in locating survivors and monitor cleanup. Other applications may include coastal patrol, border patrol and communications. According to Olsen, the craft can replicate 100 cell towers in a 5,000 square mile radius – an ideal application for emerging countries.

In August, Titan Aerospace performed a flight test on a 1/5 scale Solara demonstrator. The demonstrator is still undergoing fatigue tests in the company’s facility. The company also has plans to create its next-generation atmosat – the Solara 60 with a 60-meter wingspan. It’s clear that this two-year-old firm is gaining a lot of attention and journeying into new territory. “We’re really plowing unplowed ground here,” says Olsen.

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

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Adding Life to Aging Bridges

The Maine Department of Transportation (DOT) is excited about a potential bridge repair technique that could save the state $50,000 per bridge. Engineers at the University of Maine created a retrofitting system that applies composite strips underneath deteriorating flat-slab concrete bridges, which could extend their lives up to 20 years. The DOT and university hope this system will provide a low-cost, long-lasting alternative to traditional repairs or bridge replacements.

The importance of fixing dilapidated bridges hit home in 2007, when the I-35 bridge in Minneapolis collapsed into the Mississippi River killing 13 people and injuring 145 others. Many state DOTs began to look carefully at the conditions of their own bridges. That year, the Maine DOT, along with the University of Maine and engineers from other organizations, created the Advanced Bridge Safety Initiative to determine ways to repair or replace deteriorating bridges.

“The main part of that initiative was to look at how we can use composites to strengthen some of our bridge structures,” says Dale Peabody, director of transportation research for the Maine DOT, who frequently works with the University of Maine’s Advanced Structures and Composites Center. Maine has more than 2,700 bridges: DOT officials estimate more than 450 of them are in poor condition or structurally deficient.

In 2011, Hannah Loring, a graduate student at the University of Maine, created a retrofitting system for aging concrete flat-slab bridges alongside her advisor Bill Davids, professor of civil and environmental engineering. The fiber-reinforced polymer (FRP) flexural retrofitting system – featuring carbon fiber and fiberglass hybrid strips – can increase the strength of a bridge by 30 percent.

The retrofitting system is an inexpensive option, according to Davids. A flat-slab concrete bridge could cost $420,000 to replace or $120,000 for deck repair. The university’s flexural retrofitting system would cost closer to $70,000. “Our goal is to provide a cheaper alternative for repairing bridges,” says Davids. The Maine DOT funds the university’s retrofitting project and works with the Advanced Structures and Composites Center to test, analyze and provide new technologies for retrofitting and construction.

At the heart of the system are FRP sheets manufactured by Kenway Corporation in Augusta, Maine. The university cuts the sheets into 4-inch-wide strips, while the length varies based on needs of each repair project. Jacob Marquis, senior project manager at Kenway, worked with Davids and Loring to design and produce FRP strips capable of achieving the necessary bolt-bearing capacity and required tensile strength. The strips consist of woven carbon fiber fabric core laminate layers sandwiched between unidirectional fiberglass outer laminate layers.

The team at the University of Maine opted for FRP because of its lightweight properties. This benefits construction workers, who lift the strips over their heads when applying them to the underside of bridges. “Although having a corrosion-resistant material is also a major benefit, the weight is the biggest advantage,” says Davids.

The FRP strips are attached to bridges using anchors. Pre-drilled holes are placed in the strips at the required spacing. The strips are then attached to the concrete under the bridge with an adhesive to hold them in place during anchor installation. At each anchor point, holes are drilled into the concrete then filled with epoxy, an anchor stud and a nut that is tightened on the strip once the epoxy has cured. “With this easy installation...
technique, we estimate a 12-foot-long beam can be retrofitted in an hour with a two-man crew,” says Davids.

With other FRP retrofit techniques, materials are adhesively bonded to concrete. However, field adhesion can be challenging due to environmental conditions such as prolonged exposure to moisture conditions. With mechanical fastening, holes are drilled directly into the concrete and could lead to corrosion of the internal steel reinforcement. “Mechanical fastening poses its own challenges but is a viable, more easily installed alternative in most cases,” says Davids.

The American Concrete Institute Committee 440.2R-08 “Guide for the Design and Construction for Externally Bonded FRP Systems for Strengthening Concrete Structures” gives specific guidelines for using adhesively-bonded FRP strengthening technologies. Unfortunately, there are no design guidelines for mechanically-fastened FRP systems. So Davids and his team relied on engineering principles and carefully examined test data at every step when designing this system. “We took measures to closely replicate field conditions in order to gain the most accurate data,” says Davids.

The retrofitted concrete beams underwent testing at the university’s Advanced Structures and Composites Center to determine load failure. Without the composite strips, the beams failed under 15,000 pounds of force. With the strips, that increased to under 22,000 pounds. In the field, that means heavier vehicles can cross the bridge, which is of great importance to the trucking industry.

Davids and his team use load rating guidelines from the American Association of State Highway and Transportation Office’s (AASHTO) “Manual for Bridge Evaluation” to help determine which bridges are good candidates for repair. “If a bridge is no more than 30 to 35 percent understrength and in good condition overall, it would be a perfect candidate for repair with this system,” says Davids. “There are still some fatigue resistance questions, but at a minimum we feel this system would extend the bridge life 20 additional years. And it’s possible that the life can be extended for much longer.”

Research and testing is ongoing for the FRP flexural retrofitting system. “This project has the potential to help us out greatly,” says Peabody. Davids agrees: “Considering that the Maine DOT has several hundred flat-slab concrete bridges in its inventory, this would be a worthwhile investment.”

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

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**Influencing Infrastructure**

Do you want to stay up-to-date on the infrastructure industry – or better yet, influence decision-makers? Join ACMA’s Transportation Structures Council, one of 12 specialty industry groups in the association’s Composites Growth Initiatives (CGIs). The council coordinates the development and promotion of composites technology materials and products used in the repair or replacement of transportation structures.

For more information, email Andrew Huber, manager of the CGI Committees, at ahuber@acmanet.org.
“More people have been in space than have been at half the ocean’s depth,” notes Stockton Rush, a scuba diver and CEO of OceanGate Inc., Everett, Wash. OceanGate hopes to change that with Cyclops, a deep diving manned submersible for commercial markets that will be more than 80 percent carbon fiber by weight. Due to be completed in 2016, the first version of Cyclops will be able to reach depths of 3,000 meters. A later version will submerge 6,000 meters.

The idea for Cyclops began five years ago when Rush tried in vain to rent a submersible to explore the Puget Sound. Such rentals didn’t exist. So Rush, who has a background in aerospace engineering, bought a partly completed sub and finished it himself. Later, he found out that there are only seven manned deep diving submersibles in the entire world – all owned by governments or universities. “That didn’t compute,” he says.

Rush decided to find out why there were so few. He concluded that existing deep diving submersibles have all been built individually to meet specific research needs, so they are too expensive and specialized for commercial markets. He believed submersibles could be commercialized – and using advanced materials could aid the endeavor.

Cyclops will be the first-ever manned deep diving submersible with a carbon fiber pressure vessel. The cylindrical pressure vessel – where passengers sit – is placed between two end caps: One will be made of titanium, and the other will feature a 180-degree glass viewing dome.

Existing deep diving manned submersibles rely on titanium for the pressure vessel, making them heavy and expensive. “As the sub gets heavier your ship gets bigger, which means more crew and more cost,” says Rush. “Every pound you put in your sub ends up increasing your total system and deployment cost.” The weight of titanium also requires the addition of syntactic foam for buoyancy, which makes these vehicles ‘fat’ and slow, he adds.

Carbon fiber offers several advantages. Rush says it is cheaper than titanium, has similar in-plane shear strength and is one-third the density. You also can orient the fibers to maximize their strength. This last benefit is particularly advantageous in a submersible. “In a pressure vessel, the loads are very well known. They’re all going to be straight into the center,” says Rush. “So you have axial and radial loads and you don’t get torsional loads of any significance. You know exactly what the water is going to do, which allows you to optimize how you put the fibers so that all their strength is in the direction of that load.”

Despite these advantages, Rush says there has been a hesitancy to use composites for pressure vessels because reliability and failure rates were not as well-known as steel and titanium. But he believes that the high-volume manufacturing and testing of composites that’s occurred in many industries – especially aerospace – have now alleviated this uncertainty.

Still, OceanGate faced challenges designing a carbon fiber cylinder. Matching the lineal displacement of composite with the glass end cap created issues. So did transitioning the end of the carbon fiber cylinder into the titanium portion, which has a different load pattern. The company spent a lot of time considering how to reduce the stress in joints where the cylinder and end caps come together.

Construction on the first carbon fiber pressure vessel is scheduled to start in March or April, though a manufacturer has not yet been chosen. One company in the running is Boeing, a preferred vendor for OceanGate. Whatever manufacturer is selected, Rush anticipates that the Cyclops will be built using individual fiber placement with a robotic arm to ensure predictability and uniformity of resin and fiber areas. Manufacturing will present challenges, too. For instance, the carbon fiber hull is seven inches thick, so it will require multiple cure cycles.

Rush is optimistic that such issues will be resolved and the Cyclops will garner commercial appeal thanks to its design: The hull will be larger than existing submersibles so it will be able to carry five passengers. The.

OceanGate’s Cyclops manned submersible, currently under development, could take passengers nearly two miles below the ocean’s surface.
Cyclops At-a-Glance

Here are a few quick facts about OceanGate’s Cyclops manned submersible:

- **Crew Members**: 5
- **Carbon Fiber Hull**: 17.8 centimeters thick
- **Maximum Operating Depth**: 3,000 meters
- **Weight**: 8,600 kilograms
- **Speed**: 3.5 knots
- **Payload**: 500 kilograms
- **Length**: 5.5 meters
- **Width**: 3.3 meters
- **Height**: 2.3 meters

five-foot wide, glass viewing dome will give passengers a 180-degree view – a marked departure from existing small view ports. Rush says these and other improvements make Cyclops well suited to numerous purposes, including inspection, repair and maintenance for the oil and gas industry; assaying and sampling of minerals for mining; and filming of documentaries.

Rush plans on being an early adopter, too. After missing out on that sub ride all those years ago, Rush will be a passenger on Cyclops’ first dive. “I wouldn’t give that up!”

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

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When athletes in the Winter Olympic Games in Sochi, Russia, take center stage February 7-23, so will composites. The Olympics will feature 15 disciplines in seven sports – biathlon, bobsled (which includes skeleton), curling, ice hockey, luge, skating and skiing. And critical apparatus for all the events will incorporate composite materials. Like the sports themselves, some of the composite applications are media darlings, such as skis and snowboards made from carbon fiber, Kevlar and fiberglass. Others are less heralded. Composite materials provide ankle support in skates for hockey players, short-track athletes and speed skaters. Handles in curling brooms are constructed from carbon fiber to make them stronger and lighter. Some athletes in the biathlon use rifles with barrels wrapped in carbon fiber to reduce weight. Olympic athletes often lead the charge to adopt new high-performance materials in their quest to shave hundredths of a second off their time in an event or safeguard themselves with protective equipment during crashes or collisions with competitors. The most significant material developments in this year’s Winter Olympics will likely be on display at the Sanki Sliding Center, site of the skeleton, bobsled and luge events. U.S. teams for all three disciplines hope to bring home medals thanks to sleek new sleds.

Customization of Skeleton Sleds

A few years ago Tuffy Latour, the coach of the U.S. skeleton team, contacted Hans deBot of deBotch Inc. to create a custom saddle for racer Katie Uhlaender. The carbon fiber and advanced composite parts manufacturer in Mooresville, N.C., had already produced an aerodynamic carbon fiber pod – the bottom portion of
the sled – for the team. Now Latour wanted a saddle, which is affixed to the pod and includes handles, fitted specifically for Uhlaender. (Athletes lie face down on the saddle when they ride down the frozen track.)

deBot worked with supplier BSCI to pour a splash of Uhlaender’s body. “We put her on our surface table in riding position and poured a urethane casting of her body from her chest to hips,” says deBot. “From that, we digitally scanned the splash, modeled it on the computer and cut a pattern and tool to build her saddle.” The carbon fiber saddle was affixed to the pod, which features steel runners on the bottom.

Uhlaender ran the sled at the 2012 World Championship in Lake Placid, N.Y., and won by less than two-tenths of a second. “That provided a lot of motivation in the coaches’ eyes to do more,” says deBot. In preparation for the Sochi Olympics, deBotech has created custom saddles for three men’s skeleton racers as well as a new one for Uhlaender.

Previously, sleds were constructed from wet laminated fiberglass. The new sleds, designed by ProtoStar Engineering and called the ProtoStar V5, are made from a mix of high-modulus and intermediate-modulus carbon fibers. “It’s all prepreg material, resin-optimized for strength-to-weight ratios and vacuum bag molded and autoclave cured,” says deBot. He says that autoclave curing yields the best surface quality and structural integrity.

“We probably have the most technologically-advanced, slickest bullets out there for our U.S. teams now,” says deBot.

**Weight Distribution in Bobsleds**

deBotech also worked on the Night Train 2 sled for the reigning Olympic champion four-man U.S. bobsled team. He calls the bobsled “a whole different animal” from the skeleton. “It has a lot going on because of the size difference and you’re hauling around four guys,” he says.

deBot got involved with bobsled when a driver of a four-man team approached him to build a sled for the 2002 Winter Olympics in Salt Lake City. “I jumped at the opportunity to support our country and take on a high-profile job,” recalls deBot. He admits he didn’t know anything about bobsled, but figured his experience with clients in NASCAR and other motorsports would guide him. deBot downloaded specifications on the sled’s length, width and minimum weight from the International Bobsleigh & Skeleton Federation.

Like the skeleton, previous bobsleds were made from wet laminated fiberglass. “American athletes were competing with sub-par sleds we were buying out of Europe,” says deBot. deBotech produced a sled made from carbon fiber, Kevlar and other high-modulus materials, but the four-man team did not qualify for the Olympics. However, the team did participate in a trial run in Salt Lake City that caught the attention of Bob Cuneo of Chassis Dynamics and Geoff Bodine, former NASCAR driver and owner of Bo-Dyn Sled Products.

Soon after, Cuneo, Bodine and deBot teamed up to build state-of-the-art bobsleds.

The body of the Night Train 2 is constructed completely from composite materials. “It’s built like the monocoque chassis of a race car,” says deBot. “It has very specific layup schedules in the initial cure of all the structural components.” The sled features carbon fibers, carbon/Kevlar® hybrids, high-modulus fibers, unidirectional tapes, Nomex® honeycomb core and more. This allows deBotech to address high-load areas of the sled locally without increasing the sled’s overall weight.

“Sleds have a minimum weight, but they don’t tell you where to put that weight,” says deBot. “If I can save an enormous amount of weight in the body and still be structurally sound and perform aerodynamically, then all the weight can go on the centerline at the bottom of the sled. That lowers the center of gravity tremendously and increases performance ten-fold.” And that’s an important advantage in a sport that “never lets up,” according to deBot. “You push off the top of the track and the sled is in the hands of highly-trained Olympic athletes and Sir Isaac Newton!”

**Stiffness in Luge Runners**

The former head coach of the U.S. national luge team, Wolfgang Schaedler, built sleds with a wood core and fiberglass wrap in his garage. “He was a very talented sled builder, but the inconsistency of the hand-built sleds manifested itself in several ways,” says Duncan Kennedy, a three-time Olympian in luge who now serves
Swept Away by Carbon Fiber

When curling debuted in the 1998 Winter Olympics in Nagano, Japan, most Americans were unfamiliar with the sport. TV viewers were intrigued watching athletes slide large stones down the ice toward a target. Since then, many people have been tempted to try the sport. Today, more than 130 curling clubs in 42 states are part of the United States Curling Association.

As interest has grown, so have options for equipment – particularly the brooms used to smooth the icy path to the target. “Not so long ago handles were made from wood,” says Megan Suslavich of Brooms Up Curling Supplies, Woodbury, Conn., an official sponsor of the U.S. curling team. “But as athletes advanced in Olympic competition, lighter brush handles were more attractive as they help the sweeper maintain endurance while sweeping.”

Today, broom handles are available in wood, fiberglass, a mix of fiberglass and carbon fiber and 100 percent carbon fiber. Olympians only use the latter says Lino Di Iorio, founder of BalancePlus Sliders Inc. in Barrie, Ontario, Canada. Di Iorio holds three patents on curling brush technology.

The handles on BalancePlus brooms are conical, rather than cylindrical: They graduate from a one-inch shaft at the top to an inch-and-an-eighth near the brush, which Di Iorio says allows athletes to exert more strength into the brushing stroke. His company produces carbon fiber handles for athletes one at a time using hand layup on a mandrel.

“Total carbon fiber handles are feather light, very strong and much easier to sweep with, especially when you’re playing a three-hour game,” says Di Iorio. “They definitely enhance performance.”

Dow has also begun work on new pods and bridges for the sleds. (Bridges attach the pod to the kuffens.) Both use a mix of materials, including Kevlar®, carbon fiber and fiberglass. “We select the mix to get the right balance of stiffness, flexibility and as much toughness as you can garner in something built to go fast and occasionally collide with an ice wall,” says Scott Burr, lead research and development manager at Dow Core R & D.

To create pods and bridges, Dow’s researchers moved into uncharted territory – low-volume manufacturing. So they used vacuum assisted resin transfer molding (VARTM). “This is a new capability for our group, and we’ve since been able to use it for other projects,” says Tudor. While he would not disclose any specifics, Tudor said VARTM is useful in making new materials and samples for customers.

Dow has provided eight sleds with new kuffens to USA Luge for the Olympics, mostly for singles competition though some double sleds have new components. Kennedy anticipates that at least one sled will feature a new pod, too.

“We’ve taken these elements of a sled that have been a staple for decades and worked with Dow to open the box up and try new ideas,” says Kennedy. “We’re running things on the track that no other country is – and haven’t even thought of. Hopefully we see positive results. But I guarantee we are pushing the envelope. And that’s exciting.”

Susan Keen Flynn is managing editor of Composites Manufacturing magazine. Email comments to sflynn@keenconcepts.net.
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ACMA and SAMPE have joined forces to produce a new super industry event that connects and advances all aspects of the composites and advanced materials communities. CAMX – The Composites and Advanced Materials Expo is taking place October 13-16, 2014 at the Orange County Convention Center in Orlando, Fl. CAMX will be America’s go-to event for products, solutions, networking and advanced industry thinking for all market segments.

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Plan Now to Attend - Registration and Housing Will Open in March.

For more information and to sign up for CAMX updates visit www.theCAMX.org.

Schedule At-A-Glance*

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To learn more about CAMX, visit www.theCAMX.org
ACMA and SAMPE, trusted leaders in the composites and advanced materials industry, have created a new super industry event - CAMX - The Composites and Advanced Materials Expo. CAMX is the one source for connecting and advancing all aspects of the world's Composites and Advanced Materials communities: R&D, engineering, manufacturing, service providers, and end-users. Exhibit in this new marketplace and attain maximum global exposure, opportunities to expand into new markets, and solidify your position in the industry.

CAMX is pleased to announce the call-for-abstracts for the ACMA and SAMPE produced portions of CAMX. High-quality technical papers featuring new research and applications on the topics below are requested.

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- 21st Century Wheels and Props
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- New Materials/Nanotechnology
- Process Advancements and Affordable Composites
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Abstract Deadline: February 7, 2014
State of the Industry

Key Numbers and Opportunities in 2014

By Dr. Sanjay Mazumdar
The U.S. composites industry is highly fragmented, comprising approximately 3,000 companies. These include suppliers of fiberglass, resin, core, adhesive and other materials to fabricators making bathtubs, utility poles, pipes, tanks, automotive parts, aerospace parts, sporting goods and more. Fiberglass and polyester resin are the dominant materials and represent approximately 58 percent of all materials sold (in terms of dollar value) in the composites industry. Cost of materials typically ranges from 25 to 50 percent of total composites product cost based on the type of application and process used.

In 2013, the composite materials market grew by 1.7 percent to reach $7 billion in value and 4.7 billion pounds in terms of annual shipment. The U.S. gross domestic product (GDP) grew by 2.4 percent in 2013, which will help the U.S. composites market restore confidence again amongst composites part fabricators.

In 2014, the key economic indicators and market dynamics suggest a growth of 5.8 percent. Demand in the U.S. composites market is expected to reach $10.3 billion by 2019, at a compound annual growth rate (CAGR) of 6.6 percent. Strong recovery in the transportation, aerospace and construction sectors is expected to drive this trend through 2019 and beyond as shown in Figure 1.

Now let’s take a closer look at some industry segments and innovations on the horizon.

Automotive
Auto sales were projected to reach 15.6 million vehicles in 2013, from 14.7 million vehicles in 2012. Growth in automotive demand is mainly driven by low interest rates, increasing consumer confidence and the increasing trend of replacing older cars. Composite materials are used in interior headliners, underbody systems, bumper beams and instrumental panels. The demand for composites in the U.S. automotive market grew by 8.8 percent in 2013. Increase in the use of composite materials in racing and high-performance vehicle components, such as chassis, hoods, wheels and roofs, is one of the driving factors for the increase in composites penetration in the automotive industry.

The Obama Administration’s Corporate Average Fuel Efficiency (CAFE) standards of 36.6 mpg by 2017 and 54.5 mpg by 2025 are likely to provide impetus to the usage of lightweight materials such as composites. To meet the CAFE standards, major OEMs have optimistic plans of reducing gross vehicle weight drastically in their future models. For instance, Daimler had set a target to reduce the gross vehicle weight by 10 percent in all of its new models by 2013. Similarly, GM and Ford set targets of weight reductions of 15 percent by 2016 and 250 to 750 pounds by 2020, respectively.

OEMs are turning to carbon fiber and other lightweight materials to reduce vehicle weight. Demand for carbon composites will significantly grow as major OEMs have entered into joint ventures with carbon fiber suppliers to have a secured raw material supply. Zoltek (now Toray) entered into strategic alliance with Magna International for the development of low-cost carbon fiber sheet molding compounds. Plasan Composites worked with Globe Machine Manufacturing Co. and Weber Manufacturing to develop a manufacturing process called “pressure press” to fabricate automotive composite parts in 17 minutes. The company is developing a resin transfer molding (RTM) process to fabricate parts in 10 minutes.

Another area in the automotive

In 2013, the composite materials market grew by 1.7 percent to reach $7 billion in value and 4.7 billion pounds in terms of annual shipment.
industry which recently attracted a lot of attention is the increased usage of compressed natural gas (CNG) tanks. Rising shale gas exploration in the United States is expected to result in a significant increase in the gas supply, which would boost the need for CNG tanks in the coming years. Demand for natural gas vehicles also is increasing, which will drive the composites tank market higher. Major Type IV CNG tank manufacturer Hexagon Lincoln had plans to expand manufacturing capacity to 80,000 units in 2013 and 160,000 units in 2014, from the capacity of 40,000 units in 2012.

Aerospace
Composite materials continue to gain market traction, and OEMs show strong confidence in composites technology. Demand for composite materials in the U.S. aerospace market grew by 10.2 percent in 2013. New aircraft programs such as Boeing’s 787, Airbus’ A380 and A350, Bombardier’s C Series and general aviation aircrafts such as Cirrus and Diamond are utilizing a significantly higher amount of composites than previous aircraft and thus driving composite materials’ growth. Boeing 787 had a huge order backlog – 884 aircraft – as of October 2013. To fulfill orders, Boeing planned to escalate production capacity of 787s to 10 aircraft per month by the end of 2013, 12 aircraft per month by 2016 and 14 aircraft per month by 2020. Airbus’ A350 XWB had an order backlog of 682 aircraft as of August 2013. A350 XWB is expected to launch in 2015 and have a production rate of 10 aircraft per month by late 2018.

Wind Energy
The Production Tax Credit has remained a key driver for wind energy development in the United States, but the uncertainty of extension led to a “boom and bust” cycle. In 2012, the market grew as renewable energy developers rushed to complete construction in time to qualify for the credit before its expected expiration at the end of the year. This huge increase affected the new wind energy capacity installation in 2013, as most of the planned projects had been completed in 2012. Approximately 3,000 MW of new wind energy capacity was installed by the end of 2013, a 77 percent decrease from 2012. Advanced materials are making headway in the wind market. GE started using carbon fiber in its two wind turbine models, GE 1.6-100 and GE 4.1-113. Major Brazilian blade manufacturer, Tecsis, is manufacturing wind blades for GE energy using large tow carbon fiber prepreg supplied by Gurit.

Pipe and Tank
Oil and gas and chemical segments together accounted for more than 55 percent of the FRP pipe market in the United States, followed by retail fuel, marine/offshore, waste/wastewater, sewage, power and pulp/paper. In the last five years, the power segment grew at a faster rate with a major focus on large-diameter pipes. There also is a trend toward using large-diameter pipes in sewage applications. In 2013, FRP pipes in municipal water systems and pipe rehabilitation grew slightly. In the last several years, major players established strategic alliances. The largest FRP manufacturer, NOV Fiberglass, acquired two major U.S. FRP pipe manufacturers – Ameron and Fiberspar. Future Pipe Industries
acquired ITT Exelis. Ershigs established a joint venture with Hanwei Energy Service to establish Hanwei Ershigs. Last year, Ershigs acquired Fibra S.A.

FRP tanks had a mixed performance. Underground petroleum-based tanks grew at a faster pace among all segments due to increasing demand of FRP tanks from independent service stations, whereas underground water-based tanks grew marginally.

Other Markets

In the construction industry, composites demand registered 8.3 percent growth in 2013. Construction continues to be the second largest market (after transportation) for composite materials. The main drivers for composites usage are new housing and remodeling, both of which have grown significantly thanks to the economic recovery. The government also is allocating funds for the retrofitting of old infrastructures, especially bridges and roads, which further drives composites demand in the construction sector.

In the marine industry, composite materials grew 3.4 percent in 2013 due to the improving economy, increased consumer spending and the rise in employment rates. In the United States, boat production grew more than 5 percent. Such growth benefits the composites industry since approximately 70 percent of boats are made with composite materials.

The U.S. consumer goods market grew 3 percent in 2013. Composites are used in seven out of 10 products in the most popular outdoor sports and recreational activities. For example, carbon fiber is the predominant material in golf shafts, fishing rods and tennis rackets.

Innovation Potential in Composites

There will be significant innovations in the composites market in the next 50 years. In aerospace, automotive, construction, pipe and tank, consumer goods and other industries, composites are underrepresented. Some of the future innovation areas for composites are:

- Lightweighting of automotive, aerospace and industrial parts
- Cost reduction in various composite parts
- Smart structures for quality control and damage monitoring
- Reduction in number of part counts in many applications
- Advanced composite parts for mass produced cars
- Faster and predictable infusion
- Reduction in the price of composite materials, including carbon, aramid and resins
- Environmentally-friendly resin and fiber systems
- Enhanced mechanical, chemical and conductive properties of fiber and resin systems

Lightweighting and cost reduction are two mega trends across industries. There’s been a shift to carbon fiber driven by its low density, high strength and stiffness compared to traditional materials. The key factor limiting the penetration of carbon fiber is its high cost, which will gradually decrease.

Figure 3 compares relative part weight and part cost of various competing materials, such as steel, high-strength steel, aluminum, carbon composites, etc. Carbon composites have the highest weight reduction potential (up to 60 percent lighter than steel), but is by far the most expensive alternative (~500 percent costlier than steel).

In automotive, the current usage of carbon composites is limited to...
sports, electric and high-performance cars with annual production of less than 10,000 units. However, OEMs are targeting the use of carbon composites in high-volume cars with annual production of 20,000 to 40,000 vehicles. High fuel efficiency (54.5 mpg target by 2025), emission concerns and government policies are generating pressure on OEMs to manufacture lightweight vehicles. Here, carbon composites have a large role to play and can prove to be the game changer. However, price of carbon fiber is a big concern to automakers.

Since the introduction of the Kyoto Protocol, an international agreement that sets binding emissions reduction targets, the use of lightweight materials has offered a monetary benefit. This justifies increased use of lightweight materials in the future. There is a potential of approximately 40 to 60 percent cost reduction in carbon composite parts, with improvement in precursors and advancements in carbon fiber manufacturing processes as shown in Figure 4.

Industry strives to improve manufacturing processes and reach a low cycle time – one to two minutes. There have been numerous successful landmarks in minimizing the parts manufacturing cycle time. In 1981, McLaren introduced the F1 car with a chassis made of carbon composites using prepreg layup. The company took 3,000 hours and 100 employees to build the chassis. When the Mercedes SLR was introduced in 2003, that figure decreased to 400 hours. In 2011, the manufacturing time plummeted to 4 hours for the MP4 12C monocell using the RTM process.

To contribute further, Plasan Composites joined with Globe Machine Manufacturing Co. to develop the pressure press process, which has a parts cycle time of 17 minutes. Lamborghini teamed with Callaway Golf on a forged composite process, which has a parts cycle time of 8.5 minutes. Various other machine manufacturers rely on high pressure resin transfer molding (HP RTM) for fabricating parts in three to four minutes.

Advancements in the aerospace industry are tied to the need for improved fuel efficiency. Jet fuel...
prices almost doubled to $112/barrel in 2012 from $65/barrel in 2006. Companies are working to reduce cost and improve material performance in airframes. For example, Lockheed Martin is evaluating carbon nano-reinforced polymers (CNRP) to replace approximately 100 components made with other composites or metals throughout the F-35’s airframe. CNRP offers a 20 to 30 percent weight reduction at one tenth of the cost of carbon fiber reinforced plastics (CFRP) and several times higher strength. Recently, Hexcel came up with a carbon fiber/epoxy sheet molding compound that enables complex shapes to be manufactured in series production.

The benefits of using composites in up to 50 percent of the structural parts of the 787 are shown in Figure 6.

The aerospace industry is moving toward automated tape laying (ATL) and automated fiber placement (AFP) to fabricate parts. Both ATL and AFP machines are very costly and complex to operate. Mikrosam AD has developed a new line of automated fiber placement machines that apply both technologies (ATL and AFP) on a single mandrel. From a single computer, producers can program both technologies. This has resulted in no downtime to change from one machine to another, low manpower and drastic savings in machine investment.

Advancements in the wind energy industry focus on blade length, which has continuously increased in the last 10 years and is expected to increase at an even faster pace in the future. The average turbine size in the United States was 0.89 MW in 2000: This reached 1.94 MW in 2012. All major OEMs are working on large size turbines. For example, Vestas has launched an 8 MW wind turbine and Samsung Heavy Industries introduced a 7 MW turbine. Mitsubishi, Sinovel, Goldwind, Guodian United Power, Sway and Clipper have plans to develop 10 MW turbines, while GE Energy will develop turbines ranging from 10 to 15 MW. In addition, Gamesa plans to make a 15 MW turbine.

Increasing blade length requires the use of high-performance materials to increase stiffness and reduce weight. Vestas and Gamesa were early innovators and started using carbon fiber in spar sections. After seeing the benefits, other players followed suit, including GE Energy via Tecsis, Samsung Heavy industries via SSP Technology and ETI via Blade Dynamics. Figure 7 demonstrates the spar cap mass and spar-to-blade weight ratio at various blade lengths.

Material suppliers are stepping up to the plate to provide solutions to the wind market. Owens Corning, PPG and 3B introduced glass fiber with high strength and stiffness properties. Resin suppliers such as Huntsman, Dow Chemical, Ashland and DSM have launched toughened resin systems for wind applications. A new resin from DSM – ZW7844 – offers wind turbine blade manufacturers the mechanical performance of epoxy resin with

Demand in the U.S. composites market is expected to reach $10.3 billion by 2019, at a compound annual growth rate (CAGR) of 6.6 percent.
the processing advantages of unsaturated polyester resin. Bayer Material Science recently introduced a new class of nano-enhanced Baydur polyurethane systems, which offer blade manufacturers low volatile organic compound emissions and faster infusion time.

Another overall trend in composites is the use of environmentally-friendly materials for various applications. This has led to significant innovations in formulations of bio-based resins. New refinery technology that can produce plant-based bio-chemicals for key resin monomers are also driving this market. Many resin suppliers, including AOC, Ashland, Reichhold, Huntsman, DSM, Cereplast, Natureworks, Dixie Chemical and CTS, are developing resin systems which have less volatile content. There is still not much traction in the use of bio-resin in the composites industry, however its usage is increasing in other industries. Some of the applications for bio-resins and natural composites are in electronics and automotive industries. (For an in-depth look at bio-resins, read the article on page 30.)

In conclusion, there is both opportunity and risk in driving innovations. Approximately 95 percent of new product launches fail for various reasons, including insufficient market research, ineffective marketing and poor understanding of the competition. Sophisticated analytical tools and data-driven decisions can reduce risks. It is important to cautiously invest in opportunities that will bring long-term growth.

Dr. Sanjay Mazumdar is CEO of Lucintel, a global market research and management consulting firm. Email comments to sanjay.mazumdar@lucintel.com.

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Figure 7: Spar Cap Mass and Spar to Blade Weight Ratio at Various Blade Lengths: Glass v/s Carbon Fiber (Source: Lucintel)

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Eager for More Industry Insight?
Join ACMA for its inaugural Composites Executive Forum April 1-3 at the Loews Madison Hotel in Washington, D.C. The event provides senior business executives an understanding of the economic, manufacturing, global and political trends affecting the composites industry and ways to use these trends to identify potential market growth opportunities. Executives will

- Hear specifiers, OEMs and end users detail the objectives and needs that influence their choice of structural materials.
- Learn how to develop and promote products that take advantage of government-driven market trends.
- Participate in the development of an options summary for ACMA’s market growth and public policy initiatives.
- Network with other executives.

For more information, visit acmanet.org/meetings.
Bio-Resin Market: Still Budding, But No Boom

By Darin Painter
In late August each year, more than 100 boat dealers gather in Kelowna, British Columbia, to test new models developed by Canada’s largest boat manufacturer, Campion Marine Inc. Before these dealers place orders, they place judgment: How will a fiberglass hull perform when it’s whipping across Lake Okanagan at 60 mph? How will panels hold up to the freezing winter?

These dealers are under the gun and under the microscope. Their customers crave “runalongs” that cut through the water, with laminates that won’t crack. So when Campion’s dealers come to Kelowna, they literally mean business – and there’s no shortage of testosterone. Which makes this interesting: Some of Campion’s hardest-won dealers love chatting about soybeans and corn.

In 2010, Campion introduced two ready-for-market powerboats made with resin formulated from soybean oil and corn-based ethanol, rather than from conventional petroleum. Campion’s leaders, renowned for their boatbuilding precision and innovation, expected to field questions from dealers about the decision to “go green.” Earlier, one Campion designer had joked that if the boats didn’t perform well during testing, at least the boats could be eaten.

But after two years of vigorous in-the-lab and on-the-water testing beginning in 2008, Campion’s leaders believed in the resin – Envirez 86300 T-25 from Columbus, Ohio-based Ashland Performance Materials. To them, reducing a carbon footprint was nice – 38,000 pounds of the product would yield a reduction of 16,600 pounds of carbon release, and that same batch would require 1,815 fewer gallons of crude oil than petroleum-based resin. But ensuring excellent quality was necessary: Envirez exhibited the same hardness as Campion’s regular petro-based resin, stood up well to UV light, passed stringent water absorption tests and seemed less likely to fracture because hull panels were a bit more flexible.

Campion is now building all 37 of its boat models (ranging from 16 to 30 feet) with Envirez, says Brock Elliott, Campion’s general manager. Recently, the company received one of Boating magazine’s first Eco Awards, in part because of its commitment to using bio-based resin for all new boat construction.

**Toward Sustainability and Transparency**

More composites manufacturers are creating and marketing environmentally friendly products, as architects and building designers are incentivized to use sustainable materials and methods. Meanwhile, many organizations of all kinds are embracing the “triple bottom line” of sustainability – healthy communities, the natural environment and economic vitality (“people, planet and profits”). Bio-resins are on the periphery of that push, suggest the people who develop and market them.

A bio-resin is a resin that derives some or all of its monomers from biological sources – mainly corn and soybeans (the two leading U.S. crops by far), but also from sugar cane, potatoes, sugar beets, whey and algae. “As countries and companies aim to reduce their dependence on petroleum, composites firms offering bio-based resins will be positioned for growth,” says Dr. Alejandrina Campanella, bio-composites platform leader at Dixie Chemical Inc., a global supplier of specialty chemicals that’s committed to sustainability. “Bio-based resins can expand existing composite markets and open the doors of new markets to composites.”

Bio-resins have substantial appeal, agrees John McAlvin, R&D manager at AOC, a Collierville, Tenn-based resins manufacturer that has sold more than 20 million pounds of bio-based resin. “The chemical industry for many years has been reliant solely on petro-based raw materials – crude and natural gas,” he says. “Now, with the evolution of the chemical industry, many of the same building blocks and materials you can use to make polymers are available from rapidly renewable resources.”

In addition to reducing overall dependence on petrochemicals, bio-resins enable organizations that use them to promote “greener” products that have a more favorable lifecycle. The increased emphasis on lifecycle analysis has led many thermoset resin manufacturers to develop full-fledged bio-resin product lines: Ashland’s Envirez (with bio content ranging from 13 to 22 percent), AOC’s EcoTek Green Technologies, Reichhold’s ENVIROLITE and others.

These firms are carrying the torch with a cohesive message: Bio-resins offer comparable mechanicals to petro-based resins, plus they have the perk of environmental friendliness and the potential compliance with initiatives such as the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) program and the U.S. Department of Agriculture’s BioPreferred program (which helps firms promote bio-based products through a distinct label).

“More than anything, we want to give consumers eco-friendly options without asking them to accept performance trade-offs,” says Michael Gromacki, Dixie Chemical’s vice president of operations and sustainability, and co-chair of the Bio-composites Committee of ACMA’s Green Composites Council. “There’s a big movement in general toward transparency – talking about your material ingredients, proving your reduction of higher-toxicity components and supporting customers in their green programs,” says Bob Moffit, Ashland’s senior product manager. “While the bio-resin market hasn’t taken off yet, there’s no doubt that it’s active and important.”

**Construction Is Main Driver**

The commercial bio-based resin market has expanded since Ashland first introduced its Envirez line a decade ago, when it provided John Deere with a resin based on...
soy oil and corn-based ethanol for a tractor panel. “Today, opportunities exist in diverse market sectors such as automotive, electronics, building materials, appliances, sports equipment, furniture, and many others,” says Campanella. At the COMPOSITES 2012 event, she demonstrated how plant oil-based resins such as “MAESO” (maleinated acrylated epoxidized soybean oil) are used in a variety of composites applications. For example, Dixie Chemical recently collaborated with the University of Delaware and Crey Bioresins to develop commercial-scale bio-resins derived from plant oil. The resins are similar to ones made from polyesters. “We want to offer product options that reduce environmental and health impacts for thermosets, and we want to support our customers in their efforts

Benefits of Bio-Based Resins

Dr. Alejandrina Campanella, bio-composites platform leader at Dixie Chemical Inc., a global supplier of specialty chemicals that’s committed to sustainability, says these are the benefits of bio-based resins:

- Reduce dependence on petroleum-based products
- Increase the use of renewable resources
- Reduce emissions and impacts on the environment and health
- Improve working conditions and worker safety
- Introduce sustainable materials with comparable properties
- Differentiate with competitive offerings
- Open new markets throughout the supply chain
- Aid the rural community
- Improve the product life cycle footprint
- Expand options for end-of-life recycling and reuse
- Help customers adapt to local, regional and federal regulations
to adapt to environmental and safety regulations,” Campanella says.

Mainly, though, bio-resin use is driven by the building and construction industry. The LEED program motivates builders, architects, designers and others to search out lower-impact methods of constructing and operating buildings, Moffit says. “Composites are well positioned to meet the needs of green builders because of the inherent characteristics of durability, low weight, design flexibility and low thermal conductivity.”

Moffit adds that companies embracing bio-based resins tend to have market drivers that support this choice. He cites John Deere’s use of them to strengthen its connection with farmers, and engineered quartz surface producer Cosentino’s use of the resins to bolster its relationship with clients who value recycled content.

Campion Marine Inc. builds all of its boats, including the 18-foot Campion Chase 550BR shown here, with resin formulated from soybean oil and corn-based ethanol.

Growth Ideas? Get Involved

“A group of dedicated industry people is trying to advance all composites for green and sustainable applications, says Michael Gromacki, Dixie Chemical’s vice president of operations and sustainability, and co-chair of the Bio-composites Committee of ACMA’s Green Composites Council. “We need all the help we can get to increase the growth of the composites market in general.”

The Green Composites Council, part of ACMA’s Composites Growth Initiatives (CGIs), is a specialty industry committee focused on growing composites by understanding, educating and promoting how “green” and sustainable composites are. The group focuses on three technical areas: Life Cycle Assessment, recycling, and bio composites.

To become involved or to learn more, visit acmanet.org/initiatives or email Andrew Huber, CGI manager, at ahuber@acmanet.org.
An AOC customer, Alaglas Swimming Pools, touts its ability to assure customers that their pools were made from environmentally friendly technology, thanks to the company’s use of AOC’s EcoTek H460-EKAG bio-based resin. Some 28 percent of the resin is derived from biologically renewable content (reclaimed polyethylene terephthalate, or PET, that would otherwise be destined for a landfill, and from reclaimed glycols that would require diversion into a chemical waste stream). Alaglas pools made with the resin are durable enough to be sold with the same 50-year structural warranty that the company offers to owners of pools made with traditional resin.

Cost Is Main Hurdle
Proponents of bio-based resins say the challenge isn’t in the makeup of bio-based materials – Henry Ford once took an axe to his soy-composite automobile trunk lid to demonstrate its strength – but rather in their mark-up. The main hurdle has been to cost-effectively convert corn and soybean products into the monomers required to create a resin.

“Bio-based resins tend to win all ties,” McAlvin says. “If you have one material that’s derived from petro, and another that’s derived from rapidly renewable materials or even recycled materials, the greener product will usually win if everything else is equal. But in general, fabricators aren’t willing to pay more for bio-based resins.”

Moffit concurs, adding that green resins “aren’t that far away” in price today – about 10 percent higher than petroleum-based resins – and that their cost tends to fluctuate. Also, he says, two supply-side issues exist: (1) Unsaturated polyester resin monomers are available in production quantities only from petrochemical sources, and (2) there’s a lack of bio-based alternatives to styrene. “Those issues make the bio-resin supply chain more questionable, and if you can’t have confidence in it, people tend not to take something beyond ratings in lab testing.”

Actually, two letters that indicate a different kind of rating – PG – might eventually spark the bio-based resin market. Agriculture firm Archer Daniels Midland Co. (ADM) has developed a process that converts soybeans into glycerol and corn into sorbitol/dextrose. From a new facility in Illinois, ADM is converting those materials into propylene glycol (PG), which is a major ingredient of bio-resins. A PG supply chain could eventually open the bio-resin market to more manufacturers and their customers.

Darin Painter is a freelance writer based in Cleveland. Email comments to darin@writingmatters.com.
Big Ideas Shared in the Lone Star State

In November, I joined more than 170 attendees at the Chemical Processing Symposium (CPS) in Galveston, Texas. It was a great conference loaded with opportunities for education and networking. Enduro held a reception at its new 75,000-square-foot plant. It is an impressive facility for manufacturing fiberglass process equipment solutions. The symposium also included case studies by chemical companies and updates on research.

The day before CPS events began, ACMA’s Corrosion Control Division (CCD) held a meeting to discuss upcoming projects. John Busel, vice president of ACMA’s Composites Growth Initiatives (CGIs), submitted a laundry list of potential projects. The CCD’s members will mull them over and select a few to work on. I can tell you they have a lot of great ideas to choose from.

One potential project aims to educate engineering students. During the conference I spoke with a graduate from Winona State University in Winona, Minn. (To my knowledge, the university has the only engineering degree devoted to composites.) We discussed how to make Winona’s curriculum available to other engineering schools. Since the CPS, ACMA has contacted Winona to explore options as well as develop a PowerPoint presentation that our members can use to educate local schools about composites.

Some of the other possible projects presented to the CCD include delivering a Congressional Briefing for the Congressional Composites Caucus and producing a webinar on the design and specification of corrosion-related products for designers and engineers. The CCD is also considering developing work statements to guide government research project funding to study the degradation of composites when exposed to various environments.

Any projects undertaken by the CCD will follow the successful launch of its website at corrosion-resistant.org. It is packed with information about FRP corrosion applications for designers, engineers and specifiers. (Other committees in ACMA’s CGI have created or are working on similar sites.)

If you’re involved in corrosion-resistant industrial solutions and have not yet joined the Corrosion Control Division, now is the time to put up the $100 and get on the train. Become part of this dynamic group of leaders providing education on issues relating to quality, production, safety and regulations in the corrosion segment of the composites industry. For more information or to join, email Andrew Huber, CGI manager, at ahuber@acmanet.org.

Tom Dobbins, CAE
ACMA President
ACMA Calendar of Events

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

January 16 – 2 p.m. EST
Webinar: “Composites Must Dig Down to Open New Markets”**

January 23 – 1 p.m. EST
Webinar: “Policy Spotlight LIVE: Conflict Minerals Update”**

February 20 – 1 p.m. EST
Webinar: “Policy Spotlight LIVE: Conflict Minerals Update”**

March 11–12
CCT-Instructor Course
Arlington, Va.

April 1-3
Composites Executive Forum
Washington, D.C.

April 2-4
IYRS/ACMA CCT Seminar
Bristol, R.I.

October 13-16
CAMX – The Composites and Advanced Materials Expo
Orlando, Fla.

* Note: All webinars are free for ACMA members.

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IFC=Inside Front Cover
IBC=Inside Back Cover
New Members

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Edmonton, Alberta, Canada

Fiberlay Inc. – Headquarters
Seattle, Wash.

Sky Climber Wind Solutions LLC
Delaware, Ohio

Wetstyle
Beloeil, Quebec, Canada

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

New CCTs Now Online: The Certified Composites Technician (CCT) program is the industry’s gold standard for composites training. For a list of the newest CCTs, visit compositesmanufacturingblog.com and click the tab marked “Training/Education.”

Seeking to Share Your Expertise?
The Composites and Advanced Materials Expo (CAMX), produced by ACMA and SAMPE, is requesting industry experts to submit 250-word abstracts for technical papers and presentations. Held Oct. 13-16, 2014, in Orlando, Fla., CAMX will be the premier event for networking, finding products and solutions, and advancing all segments of the composites and advanced materials industry.

Before accepting full papers and submissions, CAMX requires a 250-word abstract detailing the proposed paper or presentation. Abstracts are due Feb. 7. Areas of interest include design and engineering, green composites manufacturing, market applications, materials, modern applications, pultrusion, regulatory and legislative, and more. For submission details, visit theCAMX.org or contact Caitlin Felker, ACMA’s associate director of education and certification, at cfelker@acmanet.org.

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ACMA has developed an online resource for all its education offerings. Starting the first quarter of this year, members will have on-demand access to webinars, Certified Composite Technician (CCT) materials, books and more. Here is just a sample of what the association will roll out this year:

**CCT Materials:** The industry’s elite certification program boasts more than 3,000 CCTs, with hundreds of professionals attaining certification each year. “ACMA Online: Education On Demand” now provides composites professionals a quick, secure way to take their CCT exam or recertification exam.

**Webinars:** AMCA offers informative webinars on business management, legislative and regulatory issues, composites technology and more. Missed a webinar? Now you can download it for viewing at your convenience.

**Books and White Papers:** ACMA offers a variety of composites books, white papers and CCT study guides available to order online.

Throughout 2014, ACMA will continue to add products to “ACMA Online: Education On Demand.” For more information, contact Caitlin Felker, associate director of education, at cfelker@acmanet.org.

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Top CM Interviews of 2013

Our editors interviewed dozens of industry experts last year. Here are the top three people whose Q & As generated buzz in 2013. You can read the full interviews at compositesmanufacturingblog.com.

Richard Cubeta is a self-proclaimed “black-and-white” guy – straightforward and practical. So when his Houston-based company, SolidCast Polymer Technology, discusses “green” composites with clients, Cubeta approaches the topic with a rational, down-to-earth perspective. He explains how his firm can help companies solve a business challenge, not just save the planet.

Chuck Lawson – the health, safety and environmental manager at MFG Composite Systems Company (CSC) – shared information on the manufacturer’s plant safety strategies in the November/December issue of Composites Manufacturing magazine. But there were plenty of interesting tidbits and tips that didn’t fit in our print publication. He delves deeper into safety in this CM Interview.

Yasunari Hotani, General Manager, Advanced Composites Business Development Group, Teijin Composites Innovation Center, Teijin Limited, is responsible for promoting the Teijin group’s carbon fiber thermoplastic composites business within the global market.

CM Online Exclusives Straight from the Source: Industry Leaders Speak Out

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The first Boeing 787 Dreamliner was delivered in September 2011. Since then, 60 customers from six continents have placed orders for more than 950 airplanes. The 787-10 – the third model in the Dreamliner series – was launched last June with the first delivery scheduled for 2018. The 787 uses more composite materials than any previous Boeing commercial airplane: Nearly half of the airframe is made of advanced composites, such as carbon fiber. In comparison, the Boeing 777 featured only 12 percent composites by weight.

Aside from reducing the overall airplane weight, composites provide other benefits. For example, expanded use of advanced materials, especially in the highly tension-loaded fuselage, significantly decreases maintenance due to fatigue compared to an aluminum structure. Composites also reduce scheduled maintenance because of their corrosion and fatigue resistance: Boeing says the composite tail on its 777 is 25 percent larger than the 767’s aluminum tail, but it requires 35 percent fewer scheduled maintenance labor hours. In addition, Boeing attributes advances in its 787 Dreamliner family to innovative manufacturing technologies, such as the one-piece barrel construction of the fuselage pioneered by the company.

### Materials in the Boeing 787

- **Advanced Composites**
- **Aluminum**
- **Titanium**
- **Steel**
- **Other**

![Bar Chart](image)

**Sky-High Composites**

**Carbon Laminate**
Carbon laminate structures are composed of strands of carbon fiber formed into a tape that is resin-infused. The carbon fiber layers are laminated to the desired thickness and shape, then cured for several hours. Parts of the 787 that include a carbon laminate are the fuselage, wings and horizontal and vertical stabilizers.

**Carbon Sandwich**
Carbon sandwich structures are fabricated by attaching two thin, stiff skins to a lightweight, thick honeycomb core. This combines high-bending stiffness with overall low density. The 787 features a carbon sandwich construction in its rudder, elevators, engine nacelles and other areas.

**Other Composites**
Other composites, including fiberglass and a glass/carbon hybrid, are used on the 787 Dreamliner’s wings and stabilizers. When integrated, these materials offer advantageous structural properties.