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Styrene Allies to Recommend Lower PEL
As a result of new research, the international styrene industry associations are expected to adopt in 2011 a revised 8-hour recommended Occupational Exposure Limit (OEL) for styrene of 20 ppm.

More Than Just Hanging Around
The U.S. Forest Service estimates that more than 160 million wood poles are in service in North America alone. But oftentimes, the service life of a wood pole is cut short by natural enemies, giving FRP composite poles room to make its mark in the utility industry. By Richard Stewart

Resins Getting Greener, More Tailored
Stricter EPA regulations, along with state and federal guidelines on health and safety in the workplace, have prompted more composites firms to produce products that are both user-friendly and environmentally safe. In turn, resin suppliers are developing more eco-friendly, customized solutions. By Darin Painter

Key Numbers and Economic Indicators
Coming on the heels of an unprecedented 35 percent collapse in 2009, 2010 was a year of partial recovery for most manufacturers, suppliers and distributors serving the U.S. composites industry. Looking ahead, 2011 will prove to be a year of slow and steady growth for certain sectors. By Ray MacNeil

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The Best November in 6 Years!

My wife Juanita and I like to believe that the swimming pool industry is a leading economic indicator. Our reasoning is that people buy swimming pools when they’ve saved up some of their hard-earned money and have a little leftover to spend. More importantly, they’re confident about not losing their jobs or needing that money for something else. Swimming pools are a luxury for many homeowners, and people don’t spend their discretionary income on luxuries unless they feel good about the economy.

Alaglas Pools just had its best November in six years, so if we’re right about being a leading indicator, then 2011 is going to be a good year.

It’s not just in our small town of St. Mathews, S.C., where things are picking up. On a macro level, the composites industry is starting to gather steam again. We may not experience the same fast rates of growth that existed in the past, but at least we’re moving in the right direction.

The key for the industry and ACMA is to keep communicating what makes composites unique and how they add value to whatever products and markets you’re in. This year will be exciting for ACMA, as we start with the COMPOSITES show in February. There are already more exhibitors planning to be there than ever before, along with relevant education sessions and networking opportunities. We also plan to build on the legislative initiatives we started last year, including our work with the Composites Caucus and PAC.
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When Manassas, Va.-based Aurora Flight Services started designing the 150-foot wing for Boeing’s Phantom Eye High Altitude Long Endurance (HALE) aircraft demonstrator, winning awards for innovation was not among its priorities, which were to design, manufacture and test a low-weight, high-stiffness structure, arguably the largest that was ever created using out-of-autoclave (OOA) composite materials with a unique and highly efficient airfoil.

However, Aurora Flight Services recently garnered awards from Aviation Week & Space Technology and Defense Technology International for producing the overall most innovative product and as the winner in the Company Less Than $80 million in Revenue Category.

The wing was designed at Aurora’s Manassas, Va., location, and fabricated and tested at its Columbus, Miss., location. According to Phil Chu, program manager for Aurora, there were three major innovations achieved in the wing build:

- The wing component was designed to employ low-cost tooling more common to marine applications using industrial materials than those typically used in the aerospace industry.

- For certain parts, OOA materials allowed modular ovens to be assembled over the lay-ups for cure instead of costly, very large, single-piece tools. The large tools could be laser located and secured to the floor, avoiding the need for large dolly fixtures.

- Full-scale testing to 100 percent design limit load was used to validate the design and analysis methodology. A dead mass of 13,000 pounds was applied to the wing in the form of concrete-filled buckets suspended at multiple points. The buckets were drawn toward the center line to maintain the appropriate direction of the force. This method replaced a relatively complex whiffle tree, which would have been required for this class of high-aspect ratio wing. From a design standpoint, the force required is derived based on a combination of a safety factor with a required g load.

**Manufacturing Approach**

Aurora’s approach to prototype manufacturing is to seek the best trade-off between technical aspects such as weight, materials, design, fabrication and testing, Chu explains. For a prototype program in which a small number of units were to be made, limiting tooling costs became a critical factor since the tooling costs could not be amortized across quantities.

"Because standard tooling made of carbon or metal can be costly,

Aurora Flight Services’ 150-foot wing on the Boeing Phantom Eye surveillance aircraft is one of the largest out-of-autoclave composite structures ever built.
we explored low cost tooling made of materials like foam or medium density fiberboard (MDF),” Chu says. “However, this tooling’s downside is that it’s limited to low cure temperatures, typically below 200 F. So we were forced to use materials that have low temperature cures and that do not require autoclaving. These materials typically have lower interlaminar strengths, but similar in-plane strengths to higher temperature, autoclaved materials. As a result, more material was needed in certain areas because of the materials low interlaminar strength. We also had to increase the number of parts slightly in order to have a design layout with loads paths appropriate to the materials,” he explains.

A combination of plain-weave carbon fabric prepregs and unidirectional prepregs were chosen for their properties, and the parts were manufactured by hand lay-up. “Assembly was done using the upper skin cure fixtures as a platform to reduce the amount of assembly tooling required,” says Chu.

Boeing gave Aurora full design authority for the wing and the two teams worked collaboratively throughout the project. This enabled a confident concurrent design and manufacture that significantly shortened the project schedule, Chu notes. “Our on-time and on-budget delivery of the wing is all the more impressive given that the wing was 12 percent under its weight allocation,” says Aurora CEO John Langford. “The design team performed extensive stress analysis to squeeze out each ounce where they could,” Chu adds. “For example, rather than using a uniform or constant minimum thickness layup, which would have been easier but heavier, the design team generated custom, optimized ply layups for each part. They also looked at the whole wing system and oriented the design so that more of the load was taken by the spar and less by the skins than in a typical wing design because of the weight savings.”

The entire wing program was executed under a rapid prototyping process. And while there was concern about void content (air bubbles or empty spaces), Chu acknowledges that worry is present whenever composite materials are used. “While some out-of-autoclave material systems can have higher void contents, the wing is sized to material properties that account for void content. We did not run a full characterization of void content, but photomicrographs showed void content consistent with the aerospace standard of 1 percent or less,” he says.

Boeing hopes the Phantom Eye will usher in a new era of unmanned airborne surveillance with its ability to stay aloft for four days, eventually 10, at 65,000 feet. “While 16 months might seem like a long time in human terms, it represents a short time span to design and fabricate a wing, which is one of the largest structures ever created using OOA materials. We could not find anyone who says they have built a larger structure,” says Chu.

Dennis Seeds is a freelance writer based in Lakewood, Ohio.
Canada’s first bio-composite-bodied electric car recalls Henry Ford’s innovations in its use of hemp mats.

The Kestrel is an electric 4-passenger bio-composite compact vehicle, designed and engineered by Motive Industries Inc. in Calgary, Alberta, Canada.

“The very first Model T in 1912 was made of hemp and ran on hemp oil,” says Nathan James Armstrong, president of Motive Industries. “Then in 1941, Henry Ford made one attempt with hemp in automobile design, and in 2005, the Lotus Eco-Elise pushed the envelope further and came out with body panels made of hemp.”

Darren McKeage, the firm’s vice president of design, marketing and media relations, says mass-produced hemp cars never picked up since Henry Ford. That’s changing now, says Armstrong, as industrial hemp, bioengineered to produce maximum fiber, is an ideal green alternative. “There are no pesticides. There are no known pathogens. It’s a dense crop and is very clean and a very hardy plant.”

Armstrong says the Kestrel is the first production vehicle to use hemp in inner secondary structural elements. Motive Industries designed the Kestrel with the goal of increasing electric vehicle production in Canada. It is a product of Project Eve, a Canadian initiative to further the production of electric vehicles and components in Canada.

Funding for the Kestrel’s initial design came from the National Research Council in Canada, says Armstrong, who declined to reveal the specific amount, but said it was significant. “But the launch of the Kestrel officially began with the X-Prize,” he says, referring to the Progressive Automotive X-Prize, awarded by the X Prize Foundation for “radical breakthroughs,” according to the foundation’s website. Armstrong says his team decided to redesign an earlier car, the Switch, to have wider appeal.

From 1995 to 2004, Armstrong worked in California, building concept and advanced prototype vehicles for the major OEMs. “I started in 2004 with the idea to take the composite materials, tooling techniques, engineering techniques and assembly techniques and move it out of the concept world and take those materials into the production arena,” he says. “We’ve done over 200 prototypes, concept cars and advanced prototypes.

“The main challenge was, how do we standardize this bio material? If you have a dry year, if you have a wet year—how does it affect the fiber? We’re working toward a worst case. We’re getting to the point of analyzing the gray area of an engineered product. It’s made of a natural fiber with crop variations depending upon the climate,” says Armstrong. “It’s blurring the line of what is an engineered material versus what is an organic product.”

Armstrong says the harsher the climate, the more the hemp produces a really tough fiber. “In Alberta, it does well here. We’re purposely stressing the plant to produce a stronger fiber. Man-made synthetic materials are easy, because of the predictability. Natural fibers bring the element of natural-growth variances, which is a challenge we’re going to have to learn to work with, if bio-fibers are to make a bigger impact in the composite industry,” says Armstrong.

“We might find we can get material to make the primary structure that is 90-percent natural. Hybridization is where it’s going to get interesting—it’s like a composite-composite, using a blend of natural and synthetic fibers and fillers to achieve the best performance possible, says Armstrong. “We are looking into carbon nanotubes, nano-crystalline cellulose fibers and mixing in traditional fibers such as...
carbon and silica.”

He says the goal is to produce materials containing the highest percentage of natural fibers possible that are capable of absorbing secondary loads, while still meeting performance requirements like lifecycle, creep, durability, and price point. “We might find this is around 50 to 60 percent for a part like a floor plan, for example, while 80 to 90 percent plant-fiber content might be possible for parts like fenders and hoods,” he says.

The hemp-based components are 10 percent lighter and 20 percent cheaper than fiberglass, Armstrong explains. “With the supply chain getting quite big in a natural fiber, the difference between the two might become more dramatic in the next five years. Fiberglass requires a huge amount of energy. The complete manufacturing cycle’s true price isn’t being reflected. There could be potentially more savings in volume purchased between the two,” he says.

“The sweet spot for composite materials is 5,000 to 15,000 [production units] per year. Above these numbers, composites have had a harder time competing with steel,” says Armstrong. “At 5,000 to 15,000 per year in production, it’s largely a savings on tooling. But, we can still best metal with the ability to manufacture advance design language and provide weight savings.”

Jan Fletcher is a freelance writer based in Spokane, Wash.
Pedestrian Bridge Expands Composite Capability

Already known for creating recycled plastic composite bridges that can support military tanks and trains, Axion International, headquartered in New Providence, New Jersey, has turned to smaller projects like the pedestrian bridge in Fort Lee, Va. Similar to the company’s larger bridges, but on a smaller scale, the pedestrian bridge was built in a factory and shipped whole to the site, where it was dropped into place.

For its recycled structural composite, Axion collects post-consumer plastics, mostly high-density polyethylene (HDPE), combines them in a proprietary mixture, heats then extrudes them into structural forms such as I-beams, marine pilings and railroady ties. Accelerated aging tests have indicated that the material is not subject to degradation from moisture or other environmental elements, and Axion CEO and founder James Kerstein notes that it is fully recyclable into more lumber at the end of its life in the field.

This is not the first recycled plastic lumber on the market, but it is the first that can hold significant structural loads. A team of scientists at Rutgers University helped develop the material, which resists creep, or the long-term deformation of the material under heavy loads. According to Thomas Nosker, preliminary investigator at Rutgers, Axion’s material is creep-resistant up to 600 pounds per square inch (straight HDPE creeps at 60 pounds per square inch.)

According to Kerstein, only about 30 percent of plastics made in this country are collected for recycling, and only about half of what’s collected gets recycled and Kerstein wanted to find a way to expand recycling opportunities while improving plastic lumber. “If we use these materials in something useful, that’s combating planned obsolescence,” he said. “We get a 50-year life out of these materials.”

What really sets Axion’s material apart, however, is the cost. According to Nosker, no other manufacturers provide the structural integrity and environmental performance that Axion does at a cost that rivals treated wood. This cost advantage is part of what drew the attention of the U.S. Army Corps of Engineers when it started researching plastic lumber for permanent installations on its bases.

According to Rich Lampo with the Army Corps of Engineers, the Army has been working with Rutgers for years on various research projects, he says, and worked with Nosker and Kerstein on an early prototype bridge at Fort Leonard Wood in Missouri, built in 1998. That bridge, said Lampo, was more expensive than a treated wood counterpart in terms of first-cost, but low maintenance requirements meant that it would pay for itself in less than eight years. After 10 years, said Lampo, “One board on the bridge had some screws that needed to be refastened, but overall it looks very good.”

The Army Corps of Engineers developed general specifications for all of its bridge projects—including the pedestrian bridge in Fort Lee. While several companies vied for the contracts, Axion’s combination of cost-effectiveness and experience landed it on top. Its materials are being used in many vehicular and pedestrian bridges as well as railroad applications for the Army. According to Lampo, the Army is also exploring hybrid designs combining Axion’s fairly flexible composite with other, more rigid composite materials to allow for longer spans.

Other contracts—including some international projects—are coming, according to Kerstein, and the company plans to expand from two manufacturing plants to three soon. Kerstein sees great potential in markets where heat and humidity are a problem for conventional wood structures, such as the southern U.S. and South America.

Kerstein sees great potential in markets where heat and humidity are a problem for conventional wood structures, such as the southern U.S. and South America.
In spring 2010, Swedish-based Kockums AB announced that they were developing a new catamaran that would be the first to replace aluminum with composite material. Approximately one year later, they accomplished just that.

Thirteen months after FINTRY Marine placed the initial order for the commercial catamaran, the partnering companies launched the new generation of CarboCAT, christening it the ‘CarboClyde.’ The new 23-meter long catamaran is the first commercial workboat built entirely of carbon composites and will initially be used in the Baltic region to maintain offshore wind farms.

“The concept and outer appearance of the multipurpose vessel comes from FINTRY Marine Design AG, whereas Kockums AB provided the engineering and know-how of the catamaran and built it in accordance with necessary regulations,” explains Kaus Vorwerk, managing director of FINTRY Marine. “It can travel up to 25 knots and transport up to eight tons of material and 12 to 24 technicians. Part of its unique design includes a working deck and an interchangeable 10-foot container transport platform for the technicians’ equipment. The concept for securing the cargo on the forecastle was copied from container ships and all the packing systems are secured with twist locks.”

The vessel was manufactured using carbon fiber sandwich technology and employs a double bottom structure, which the company says makes it safer than competing boats. “If you compare composite material with others, such as aluminum, it is possible to reduce the weight by approximately 30 percent and even more compared with steel,” says Lars Tedehammar, senior vice president of Kockums. “And if the vessel engines with preserved speed and therefore have the ability to load more cargo per load.”

When drafting the plans for the CarboClyde, composites not only won out in weight savings, but in maintenance costs as well. “Compared with metallic materials, composites don’t have fatigue problems; therefore, using composites enables us to reduce maintenance costs by up to 25 percent,” says Vorwerk. “Composites also give us the ability to make complex design solutions at relatively low cost by the way the parts are manufactured, not to mention its forgiving nature in structural damage.”

But there are a few disadvantages to a new composite model, Tedehammar states. These include a composite’s inability compared to steel to handle local pressures or loads in a sandwich solution. Yet Tedehammar explains this can be overcome by using a different inlay or a better quality core.

### Composite Catamaran Overview

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<td>Service speed half load</td>
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The CarboClyde, made by Swedish-based Kockums, is the first commercial workboat built entirely of carbon composites.
Greening the Surfboard

Perhaps because the sport involves riding a force of nature, surfers tend to be environmentally conscious. But the tool of their trade, the surfboard, has traditionally been anything but green.

That irony was not lost on Ryan Siegel, who has been shaping boards in Ocean Beach, Calif., for 13 years. By 2007 he was looking for an alternative to the polyurethane foam blanks made with toluene diisocyanates (TDI), which off-gas volatile organic compounds (VOCs).

A friend introduced him to San Diego-based foam manufacturer Malama Composites, founded by Ned McMahon, a former surfboard shaper and marketing director for Hawaii-based board maker T&C Surf Designs.

Although officially incorporated in 2009, McMahon and his team had been working since early 2006 to make the process of manufacturing surfboard blanks cleaner and greener. They started out working with suppliers in the U.K. to replace TDI with less toxic methylene diphenyl diisocyanates (MDI) in their foam. Soon after, they experimented further by replacing the petroleum polyols used in the process with polyols derived from renewable plant-based oils, such as soy, castor and jatropha.

No one on the Malama team had a background in chemistry, McMahon says, so the process involved a lot of research and development. “We had basic knowledge of formulation, and of course we asked our suppliers questions all the time,” he says. “But frankly, a lot of it was our own testing—pouring a little bit, testing, playing some more. We had a process of running percentages. When things were going in a good direction, we’d go down that road.”

When things were going in a good direction, we’d go down that road.”

After about 12 months of testing, the team developed foam that doesn’t off-gas VOCs and can be reused or recycled. The company calls its product AinaCore, after the Hawaiian word for “Earth,” and for good reason, Malama doesn’t just use renewable resources to make its foam; it also considers the lifecycle of the materials it uses.

Siegel, who shapes boards under his own name but is affiliated with the nonprofit artist collective Sezio, started using Malama’s MDI and soy foam blanks in 2007 and estimates he has used them in 150 to 200 boards. He now uses them nearly exclusively, though he does use other blanks upon request. Both types of foam, says Siegel, who now serves as Malama’s post-production manager, have the same or better characteristics as more toxic TDI versions. The soy blanks, in particular, have better memory and resist pressure dings better than standard surfboards. The MDI blanks even have the same clean white color.

“The soy blanks shape out pretty much the same way as any other surfboard blanks, but the main difference is the color of the foam,” Siegel says. “They have an off-white-yellow color, so it looks like a board that’s been sun-damaged...Other than that, the density, the weight of the foam, the feeling of it as a shaper is all really similar to a standard surfboard blank.”

Siegel shapes each of his boards by hand, though he says the Malama blanks can also be shaped by machine—a process many shapers are adopting. Once he shapes a board, he sends it to San Clemente-based Bashams to be airbrushed with a design or tinted with resin (if the customer chooses); wrapped in fiberglass cloth and coated with layers of polyurethane resin; fitted with a fin system, which can be inserted with plugs or fiberglassed on; sanded; and possibly finished with a gloss coat of resin and buffed out. The process, he says, is the same with the MDI and soy blanks as it would be with any other foam, with one exception.

“With the soy foam, the only thing you really need to take caution on is air brushing,” he says. “You can’t actually airbrush or paint the foam itself or else the paint will crystallize after glassing. You have to seal the blank before painting it by putting on a cheater coat of resin.”

Siegel says boards made with Malama’s soy blanks perform as well or better than boards made with more traditional materials and are similarly priced—or, in the case of his boards, cheaper. Yet, he often has to sell customers on the new material.

“Most of the time, I have to push it,” he says. “I have had people come to me specifically, but most of the time I have to educate them, let them know it’s just the same performance-wise as a normal surfboard. That’s what people worry about the most, is it going to perform the same as their other board.”
Still, he believes there is a market for greener surfboards. “Surfers are pretty in-tune with nature for the most part, but a lot of shapers are stuck on the same path of using the same materials over and over, and they don’t want to change,” Siegel says. “Honestly, I think there are people out there willing to buy [greener] surfboards. They’re interested in it, but it’s just not readily available, and the reason for that is that the industry doesn’t want to change.”

Jamie Hartford is a freelance writer based in Hood River, Ore.
Pick up a drill, and instinctively, as the bit grinds through a board, wall plaster or aluminum, the urge to saw the bit back and forth to neaten the hole seems the right thing to do.

Do it with a composite, though, and those finishing touches are likely to ruin the project, an instructor in aerospace manufacturing explains to his students.

Richard Whitaker teaches the manufacturing courses for Texas-based Amarillo College in a program that was designed as part of the incentives to bring Bell Helicopter Textron’s V-22 Osprey assembly operations to Amarillo in 1998.

After Bell Helicopter chose Amarillo over other large cities in Texas for the plant that now employs 1,200 in the assembly of the Osprey and modification work on Cobra and Huey helicopters for the military, its engineers met with AC and West Texas A&M University instructors to develop courses for the initial 200 employees.

Initially, new hires took continuing education level courses; the certificate programs in mechanical and electrical assembly expanded on those courses when they were established in 2001. Today, students can choose between the 24-credit hour certificate program and the 61-credit hour associates degree, which includes an advanced course in composites repair.

And though 11 years have passed since the initial training push was put into place, Bell and Amarillo College remain partners in the program, with Bell serving on an industrial advisory board that is part of the program’s accreditation process, and providing tools and materials.

The school worked to obtain a grant for an autoclave so students could learn the fabrication process, which requires controlled high temperatures to bake the materials in a laminate. And in Whitaker’s classroom now, two helicopter doors improperly shipped are stacked on a table. Bell donated the doors because of damage to their edges.

Whitaker’s beginning students are learning how to assemble panels and to handle composite materials without damaging them.

He shows a laminate square from scrap materials donated by Bell where students learn how to use the carbide bits, also provided by Bell, to properly drill the holes that typically would be for fasteners in assembly work. The squares have a row of holes—some drilled properly with smooth edges and the layers intact all around the edges, and some improperly with egg-shaped holes or holes where the layers have peeled away from the holes.

In another exercise, students assemble a panel with honeycomb between the Kevlar layer and the composite panel held together by adhesives. To simulate the type of damage that can occur to an aircraft made from composites, Whitaker swings a ball peen hammer against the outer edge, leaving the kind of ding from a hail stone that can lead to severe damage if it were left unattended.

“Water can get into those areas and when the aircraft is in flight, it freezes and expands,” Whitaker said. “That causes cracks and separation.”

The students’ job is to cut away the surface damage, inspect the honeycomb for damage, cut it out and replace it, and then cut a patch and return the panel to its intact condition. “To do so properly, Whitaker explains, they must know which adhesives to use and the technique for keeping dust from accumulating in their samples.

Most students are returning to the
classroom from workplaces. While Bell guarantees an interview with every graduate, not all intend to work there, Whitaker says. They take their aerospace composites skills to other industries such as to nearby Pantex, a Department of Energy (DOE) and National Nuclear Security Administration (NNSA) plant where nuclear weapons are assembled and dismantled after they no longer are needed in the weapons arsenal, and some graduates work for Xcel Energy, an electric power company.

Amarillo College has graduated approximately 300 Bell employees over the past 11 years. New hires have a set routine in joining Bell’s workforce. Students earning their certificate in assembly are guaranteed an interview with the company.

Glen Phillips, Bell’s manager of employee training, said Bell considers the certificate the equivalent of a year of experience in aircraft assembly. He questions interviewees about their skills and knowledge in the process of drilling holes in composites, and about the consequences of delamination and how that flaw is detected.

Whitaker said the typical new worker will shadow a Bell employee for two weeks to learn specifics in both composite assembly and sheet metal assembly. With composites, he said, holes are first drilled with the proprietary carbide bits and then reamed to size.

For the next two weeks, the new hire is shadowed by the mentor before joining a regular crew.

To keep current with Bell’s practices and needs, Whitaker meets informally with Bell supervisors and adjusts the curriculum to account for new technologies and procedures as much as possible while staying within the college’s accreditation requirements.

Greg Rohloff is a freelance writer based in Amarillo, Texas.
Styrene Allies to Recommend Lower PEL
Recently published scientific research sponsored by U.S. and European styrene industries indicates that exposure to styrene levels at 40 ppm over 15 years results in reduced hearing function.

As a result of this new research, which studied approximately 250 workers at a German boatbuilding plant, the international styrene industry associations are expected to adopt in 2011 a revised 8-hour recommended Occupational Exposure Limit (OEL) for styrene of 20 ppm, and a recommended 15-minute limit of 70 ppm.

In addition to adjusting the industry recommendation to reflect the best science, these limits are consistent with the styrene worker exposure limits recently submitted under the European Union REACH program, as well as the ACGIH recommendation and the levels enforced by many countries.

Individual composite manufacturers will need to determine how to respond to the new recommended OEL. U.S. OSHA and state-OSHAs may ultimately adopt these as official limits. Under OSHA’s General Duty Clause, it is possible that the agency would enforce compliance with what could be considered an industry standard.

Compliance with a 20 ppm 8-hour limit will likely require greater use of job rotation and respirators, as pollution prevention and ventilation may not be effective in reducing exposures below 50 ppm, especially for the open molding of larger or custom products. If respirators are part of a company’s program to limit exposures, compliance with the OSHA Respiratory Protection standard will be required. Many companies will have to allocate significant management resources to ensure successful respirators usage.

A Short History of Exposure Limits

The OSHA Permissible Exposure Limit (PEL) for styrene has long been 100 ppm, enforced as an 8-hour time-weighted-average. OSHA also has a short term 15-minute exposure limit of 200 ppm.

In the early 1990s, new data suggested that workers may suffer short-term and reversible neurotoxic effects such as drowsiness and slower reflexes at exposure in the 50 to 100 ppm range. OSHA attempted to update the styrene PEL to reflect these new data, but a court ruled that OSHA had not fully satisfied technical rulemaking requirements, and the official OSHA styrene PEL was returned to 100 ppm. California OSHA continues to enforce an 8-hour limit of 50 ppm, and the industrial hygiene professional association ACGIH recommends an exposure limit of 20 ppm.

In 1996, the allied styrene industry associations signed a voluntary agreement with OSHA to encourage compliance with an industry exposure guideline of 50 ppm for an 8-hour average and 100 ppm for 15-minute exposure. The agreement with OSHA requires composites manufacturers to use engineering controls, including pollution prevention techniques such as low-styrene resin as well as ventilation, and administrative controls such as job rotation, to reduce exposures to 100 ppm. Then, if necessary, personal protective equipment (respirators) can be used to achieve the 50 ppm limit. Using low-emitting processes, ventilation and respirators, the large majority of composite manufacturers are complying with these recommended exposure limits.

Questions remained, however, regarding the appropriate level to ensure worker health and safety. While the extensive studies with more than 55,000 styrene workers did not show any styrene-related excess of cancer or other chronic disease, there have long been a number of short-term studies that suggested that exposures of 20 ppm or lower could cause mild and temporary neurotoxic effects, although these studies are of questionable validity and can be difficult to interpret. This most recent research used a large number of subjects to carefully study a range of possible effects including color vision, coordination and balance, and psychological factors. Hearing was the only measure that showed an effect related to styrene exposure.

The international styrene industry associations are expected to adopt in 2011 a revised 8-hour recommended OEL.

For more legislative and regulatory information, visit ACMA’s webpage www.acmanet.org/ga.
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Schedule-at-a-Glance

**Wednesday, February 2**
- 9:00 am – 12:00 pm
  Education Sessions, Workshops and Technical Papers
- 12:00 pm – 1:30 pm
  University Poster Session
- 1:30 pm – 2:45 pm
  Keynote General Session (open to all!!!) – General Stanley McChrystal
- 3:00 pm – 5:00 pm
  Education Sessions, Workshops, and Technical Papers
- 5:30 pm – 7:00 pm
  Opening Welcome Reception
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**Thursday, February 3**
- 8:00 am – 9:15 am
  General Session (open to all!!) – The Future of the Composites Industry
- 9:30 am – 5:30 pm
  Exhibit Hall Open
- 12:00 pm – 1:30 pm
  Awards Lunch
- 2:00 pm – 5:00 pm
  Education Sessions and Technical Papers
- 5:00 pm – 6:30 pm
  Specialized Industry Networking Receptions
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**Friday, February 4**
- 8:00 am – 4:00 pm
  Education Sessions and Technical Papers
- 9:00 am – 3:00 pm
  Exhibit Hall Open
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A properly maintained wood utility pole can last 35 years or longer, according to the U.S. Forest Service, which estimates that more than 160 million wood poles are in service in North America alone. But oftentimes, the service life of a wood pole is cut short by natural enemies, such as woodpeckers, termites, rot, fire, high winds and excess loading. For that reason, steel and concrete poles have been incorporated into the power grid. And slowly but steadily, FRP composite poles, typically pultruded or filament-wound hollow tubes, are making their mark in the utility industry. That mark tends to be increasingly durable, with an estimated service life of 80 years.

The American Composites Manufacturers Association (ACMA) Utility and Communications Structures Working Group (UCSWG) has done extensive research and developed strategies for promoting FRP poles and crossarms to utilities, public utility commissions and others who specify and purchase these products. The group’s primary objective is to convince users to evaluate composites based on life-cycle costs rather than initial purchase price, according to Brian Lacoursiere, chairman of the working group and senior VP sales & engineering of Chicago-based FRP pole supplier Duratel.

Composite utility poles were first installed during the early 1950s in Hawaii, where termites make short work of wood poles, giving them an average eight years of service life, relates Lacoursiere. “Those FRP distribution poles, which didn’t have any UV protection as we know it today, were taken out of service after 50 years. It wasn’t for structural reasons, but because of fiber blooming—the fibers started protruding through the surface and aesthetically didn’t look good,” he notes. “Today, composite pole manufacturers incorporate multi-faceted UV protection in their products, and that’s why we’re confident of the 80-year life.”

Power distribution poles range...
in length from about 35- to 50-feet and are produced in sections or as a single piece in various strength classifications. Transmission line poles are stronger and longer, up to 130 feet. Duratel, which launched its pole in 2008, offers one-piece products ranging from 35- to 75-feet in 11, 12 and 14-inch diameters. Plans are to extend the product line to as long as 110 feet. The poles, which are pultruded for Duratel by Bedford Reinforced Plastics, come off the pultrusion line at about a foot per minute for the 12-inch diameter, notes Lacoursiere.

Duratel poles, produced using polyester resin and E-glass, weigh about two-thirds less than wood. A 40-foot Duratel pole weighs 300 pounds vs. about 1,000 pounds for wood. The Duratel products feature UV inhibitors throughout the resin and a protective veil cloth on the surface. The company sees its 14-inch diameter pole as its entrance into the transmission market.

Easier to Install
Lacoursiere observes that composite poles and crossarms appeal to utilities because of their reduced weight, making them easier to handle and install than heavy wood poles. FRP poles often are specified for installations in areas with limited access, which prevent the use of heavy equipment. FRP poles are especially useful for rugged terrain, where helicopters are commonly required to set wood poles. Lightweight FRP poles are often the only solution in confined urban areas, as well, he says.

The non-conductive nature of composites is another plus for FRP utility poles. “There has been extensive electrical testing done and, compared to wood, steel or concrete, composites are much safer for the utility crews and the public,” adds Lacoursiere. “FRP poles also don’t rust, unlike like steel poles; they aren’t treated with environmentally unfriendly preservatives; and they are maintenance free.”

Scott Holmes, UCSWG vice chairman, and president & CEO of Utility Composites Solutions (UCSI), relates that about 6 million poles are used annually in the U.S. for replacement and new grid growth. He asks: “Are composite pole manufacturers looking for 10 percent of that market? No. It’s a very small niche and we are happy to work with utilities for special applications such as difficult-to-reach sites and woodpecker and insect-infestation areas. It’s still a big market opportunity,” he says.

“Adopting new technology is a barrier for utilities,” continues Holmes. “First cost is their primary consideration in most cases. But if they were to look at things purely from a life-cycle basis, they’d be buying a lot more composite poles,” he maintains. “Composite materials that we have to choose from today are more robust and have a better chemical makeup and composition because they’ve had the benefit of 30 to 40 years of improvements.”

USCI recently ramped up production of its Intelli-pole for distribution applications. The poles, modular in design and tapered, are produced in sections by filament winding, using E-CR glass and a green vinyl ester resin formulation. “With a modular system, people are not handling 40- or 45-feet long pieces; they’re handling 10- or 12-feet long pieces,” says Holmes. “From the utilities’ standpoint, the ease of handling is a big plus.”

He notes that four sections are stacked to produce a 45-feet pole. The base section weighs about 250 pounds and the upper section weighs about 125 pounds, enabling a crew to carry them into an installation site by hand, notes Holmes. The modularity enables customers to keep various components in inventory and build up poles as needed. If a pole is damaged in an impact, the damaged section can be replaced while the upper sections of the pole remain intact.

Consider Installed Cost
“We’re about three to four times higher in pricing than wood. But that’s on the acquisition side,” says Holmes. “An installed-cost comparison is where the benefits to utilities can be measured,” he continues. “Utilities need to consider what it costs to bring in a helicopter or heavy equipment and the time involved to crane a pole into place versus how much less it costs to do it with a small crew by hand. Having portability with modular poles is an advantage.”

Another manufacturer of modular utility poles is RS Technologies, which won the Most Creative Application ACE Award at the 2005 ACMA COMPOSITES show for its RStandard pole. The company has been producing the product line for about six years, using a proprietary polyurethane resin to filament-wind subsets of ten different modules. They are assembled to make poles up to 175-feet long and can be nested inside each other to save transportation costs and storage space. The RStandard pole is rated for up to a mid-range transmission application, notes Howard Elliott, chief operations officer.

“Composites are actually the low-cost option in utility poles, considering all the factors—the installation cost, the maintenance, certainly the reliability, the risk in keeping the grid up and running during ice and wind storms. We’ve had a lot of projects that were cost competitive right off the bat because of high installation and transportation costs of conventional poles.”

An added benefit of a modular pole is the ability to add a section to convert it for tandem-use situations with a communications company, for example. But the primary advantage of composites over other types of poles is the ability to withstand storm-force winds and heavy ice loading. Elliott tells of an ice storm in January 2009 that took down more than 1,600 wood utility poles in Kentucky, while the RStandard composite poles that were installed as a pilot line on the grid remained undamaged.

“Utilities can use composite poles to harden the grid. They might install a composite pole every fifth one or so to stop those cascading failures that commonly occur with wood poles whenever a tree falls across a line or ice builds up,” he explains. “The composite pole, which can handle the additional load, stops that cascade.”

RS Technologies has invited many utility companies into its production facility to audit its manufacturing and
quality-related processes. “Utilities are looking to answer the questions: ‘Can you make the product the same way every time, and do you have a quality system that ensures that it will hold up and meet our specifications,’” says Elliott. “They watch us build product and observe our quality systems—we’re ISO 9001 certified and have a very conservative quality program.

“We demonstrate strength by bending a pole 45 or 50 degrees without failing. Utilities are generally surprised and impressed. There aren’t many materials that can handle that type of deformation and come back to where they started without noticeable fatigue,” adds Elliott.

Also in the Market
Other composites manufacturers produce utility poles, crossarms, polymer insulators and other products that offer a better alternative to traditional materials. Ameron International produces the sand-hardened uPole for distribution applications. Epoxy resin is used in a novel patent-pending process that adds layers of fine sand during the filament-winding of the poles, according to Product Manager Jim Davidson. Sand is also added to the final surface, before the pole goes through clam-shell heaters and is cut off in required lengths. “The sand bulks up the wall thickness and adds structural stiffness,” he explains. Ameron can produce a 40-foot pole in 45 minutes. “Our price is roughly double that of wood and very competitive with steel,” he notes.

Shakespeare Composite Structures is an early pioneer in FRP pole production, having started 20 years ago, and was the first to manufacture large poles (longest today is 130 feet.) The poles are filament-wound using polyester resins and a pigmented polyurethane topcoat for UV protection. “In the longer sizes, we become not only product competitive but price competitive with the other materials, relates Bill Griffin, vice president and general manager. “It’s hard to find trees in transmission lengths and difficult to move them around,” he says. The largest single length produced by Shakespeare is 50 feet. Longer poles are assembled from sections with overlapping joints.

Other leading players in this market include Composite Materials Technology, which produces tapered distribution poles using E-glass and polyester resin in a centrifugal casting process. Each pole starts with layer of polyester veil, on which a knitted fiberglass fabric is laid. Other reinforcements are added, and the pattern is inserted into a spin-casting machine. Resin is introduced as the machine spins, wetting out the reinforcements.

FRP Transmission Innovations (TI) has introduced C-channel shaped composite profiles for use as crossarms and braces for H-frame structures. Pultruded by TI’s strategic alliance partner, Creative Pultrusion, the products replace heavy wood timbers and steel beams. Two C-channels are joined back-to-back on either side of a pole to form a crossarm assembly. Grant Lockhart, managing director, notes that the products are comparable in price to wood and less expensive than steel. Creative Pultrusions also

Linemen working on a composite utility pole appreciate the non-conductive nature of composites as well as the lack of chemical preservatives.
produces Powertruson 8-inch and 10-inch distribution poles and crossarms, working with more than 25 utility companies.

Geotek produces composite crossarms under the brand name PUPI, which was launched in 1990. Pultruded PUPI crossarms, deadend assemblies and braces are used by electrical utilities around the world, according to Dean Casad, vice president of sales and marketing for Geotek, Stewartville, Minn. Three levels of weathering protection are used for the lightweight, high-strength products. Casad feels that the biggest roadblock to the widespread use of composites in utility applications is previous experience with inferior fiberglass products that may have been negative, often due to blooming.

Glasforms is a leading global supplier of pultruded composite rods for guy strain insulators and similar products that are lighter and more durable than conventional porcelain and glass insulators, reports Peter Pfaff, who heads the company. A key advantage of the FRP products is their superior ballistic resistance, he says, noting that more than a million porcelain and glass insulators are destroyed every year in the U.S. by people taking pot shots at them. The FRP versions do not fail catastrophically. About 75 percent of the insulators in use today incorporate FRP rods, notes Pfaff.

Our goal is to have these poles become a standard option alongside wood poles and structures. Composites can solve a lot of problems for utility companies that traditional materials don’t handle very well.

Says Elliott of RS Technologies: “The adoption of composites is still in its early stages in the utility industry—less than one percent. Our goal is to have these poles become a standard option alongside wood poles and structures. Because of their light weight, long life, high strength, non-conductivity and environmentally benign nature, composites can solve a lot of problems for utility companies that traditional materials don’t handle very well. We believe that once the utilities crunch the numbers, they will start moving composites into more and more standard installations.”

Richard Stewart is a freelance writer based in Tampa, Fla.
The team at Kamanu Composites in Kailua, Hawaii, has a laid-back personality, but it was ultra-serious about wanting to find a more environmentally friendly way to produce its outrigger canoes.

Envisioning a new canoe made of renewable, low-impact materials such as balsa, cork, hemp and flax, the Kamanu Composites team searched for a bio-resin epoxy with reinforcement from a traditional carbon fiber composite.

It found an answer in SuperSap INF, a new “green” resin from Entropy Resins, Gardena, Calif. As opposed to traditional epoxies made primarily of petroleum-based materials, SuperSap formulations contain bio-renewable materials sourced as a co-product or from waste streams of other industrial processes.

The natural components of SuperSap have excellent elongation and exceptionally high adhesion properties, according to Rey Banatao, Ph.D., head of polyester chemistry at Entropy Resins. With a viscosity ideal for hand layup processes and fast cures in ambient temperatures, it can be used as a laminating resin, a coating resin, or an adhesive, he says.

“We have a firm belief that there is no better chemist than Mother Nature,” Banatao says. “We strive to develop material solutions that strike a perfect balance between performance and environmental sustainability.”

All Entropy resins employ a minimum of 16 percent plant-based material. The source of this material is from the waste stream of biodiesel production that uses rapidly renewable biomass as its source, making users of the company’s resins eligible for LEED credits from the U.S. Green Building Council.

Balancing “Green” and Performance

Stricter EPA regulations, along with state and federal guidelines on health and safety in the workplace, have prompted more composites firms to produce products that are both user-friendly and environmentally safe.

While few composites pros question the notion that “green” is good, resin suppliers face the question: What actually constitutes green? Suppliers say resin formulation is closely tied to chemistry advancements, so as chemistries evolve to include bio-materials and nanotechnology, resin formulators achieve incremental improvements to accomplish green aims without sacrificing performance.

To that end, Reichhold Inc., Research Triangle Park, N.C., recently developed POLYLITE 31325-00, a low-viscosity unsaturated polyester that includes a green resin chemistry — 25 percent soy oil-based — that cost-effectively replaces glycol in bulk molding compound composites. Customers are using POLYLITE in several applications, including Class A body panels on agricultural equipment and automobiles, says John Ilkka, the company’s closed mold business development manager.

At NoVOC Performance Resins LLC, Sheboygan, Wis., which launched its first green resin in 1998, a significant portion of business comes from the sale of its styrene-free resins to the infrastructure rehabilitation market, says Rich Anders, the firm’s corporate technical director. NoVOC has its own lining division and has designed premium cured-in-place pipe liners for small-diameter potable water pipes, as well as styrene-free liners for larger-diameter sewer pipes. Anders says the green resins in both liners enable more efficient installation, with less hot water needed for cure and less overall energy required to install.

“It’s a never-ending effort to go to the next level of resin formulation,” Anders says.

Innovation in Thermoset

Suppliers are also making advancements in the two major categories of resins for composites—thermoset and thermoplastic. Thermoset resins such as epoxy, polyester and polyurethane, which are easier to process and are generally better suited for higher temperatures than thermoplastics, seem especially ripe for progression, they say.

Many suppliers are introducing new thermoset resins that help composites manufacturers lower costs and deliver customized solutions to their clients.

One example is AOC, a Collierville,
Tenn.-based global supplier of resins, gel coats, colorants, additives and synergistic systems for composites and cast polymers. It recently developed its Vicast A830 polyester casting resins for cultured marble manufacturers that want to lower material costs by 10 percent or more. Users save money because the technology is designed to work when more filler and less resin is used to produce finished marble composite products such as vanity sinks, tubs, shower pans, fireplace surrounds and flat panels.

“It may seem unusual for a resin supplier to pioneer technology that lowers resin consumption per part,” said Fletcher Lindberg, AOC’s business manager of non-reinforced products, adding that Vicast resins reinforce AOC’s commitment to help customers become more profitable and competitive. AOC provides a material cost reduction calculator to clients who use the new resin technology.

Another resin supplier making advancements is Warwick, R.I.-based RBC Industries. Its research and development lab recently worked with B&G Shore Products to develop a special epoxy adhesive to create The Harpoon, a design-your-own-fishing-hook kit. B&G wanted to fabricate the kit so that fishing enthusiasts could design their own customized stem hook rigging system in the field, so the adhesive joining the harpoon barb and hook had to cure very quickly. The consistency of the adhesive needed to be formulated so that the material could be easily applied without drips or sags. RBC’s successful two-component adhesive cures in eight minutes and forms a tenacious bond.

“The overriding factor in resin development is the specific needs of clients—that’s the key focus,” Lindberg says.

Darin Painter is a freelance writer based in Strongsville, Ohio.

Biomaterials Research Effort Underway

A two-year research effort at the National Composite Center (NCC) in Kettering, Ohio, aims to encourage fabricators and end users to use nano-resins and bio-resins.

A scientific team at NCC’s Bio-Lite Technical Center of Excellence and a new bio-composite laboratory on the Dayton Campus for Advanced Materials Technologies is screening mechanical properties from a large pool of biomaterials submitted from sources worldwide.

Ashland Inc., Dublin, Ohio, and glass fiber reinforcements supplier Owens Corning, Toledo, Ohio, are supporting NCC’s materials screening efforts.

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May 9-11, 2011
Caesars Palace, Las Vegas, NV
The Great Recession of 2007-2009 set many records in the U.S. economy at large and within many specific industries. The unusual drop-off in demand that we experienced in the composites business makes for an ugly line graph but is not dissimilar from what most other industries experienced during the same time frame (graph1). We are fortunate that many composites segments, such as automotive, industrial and oil field applications, have begun to recover fairly quickly. Other segments like construction, marine, infrastructure and wind energy appear to have stabilized but will be slower to recover the ground lost. Here I’ll focus on some leading composites segments and key economic indicators relevant to demand of our products.

2010 was a year of partial recovery for most manufacturers, suppliers and distributors serving the five billion pound U.S. composites industry. Coming on the heels of an unprecedented 35 percent collapse of industry demand in 2009, this year provided welcome relief to most sectors of the composites community. However, 2010 did not return the industry to its previous high point from 2006, but it showed a remarkable V-shaped rebound in overall demand. With many inventories in the supply pipeline now replenished, 2011 shipments will level off to a single digit rate of growth and should provide additional volume to fabricators serving automotive, energy, and diverse industrial markets.

There is no industry database or reporting agency able to measure precisely the number of pounds of finished composites shipped in the U.S. each year because of the huge diversity of composite products made and scores of industries served. Some demand is also met by imported finished products. So we attempt to gauge the historical volume of composites by monitoring key raw materials used by all composites fabricators, like the more common thermosetting or thermoplastic resins and reinforcements, usually fiberglass. The predominant resin system used in the industry is unsaturated polyester, and its manufacturers collectively reported a 30 percent decline in shipments in 2009 followed by a 16 percent recovery in demand experienced in the first two quarters of 2010. Domestic shipments by U.S. fiberglass producers and fiberglass imports fell 35 percent in 2009 and rebounded an estimated 40 percent in 2010. fiberglass shipments are a more broad-based proxy for composites demand since they encompass fabricators working with epoxy and phenolic resins, as well as a series of thermoplastic resins like nylon and polypropylene. Further ratio analysis enables us to estimate the pounds of finished composites.

Purchasing Managers’ Index of Manufacturing
A popular indicator, the Purchasing Managers’ Index of Manufacturing (PMI) (graph 2) is a data series published by the Institute for Supply Management.
Today there are 12 blade making plants in the U.S. and they are forecasted to see flat, year-over-year business in 2011 around the level of 5,000 to 5,500 MW.

(ISM), established in 1915. Every month since 1931 it has published this report based on a survey of 400 industrial companies.

- **For the month of November 2010, the index was 56.6 percent**, the 16th consecutive month the index indicated expansion by manufacturers and the 19th consecutive month it marked growth in U.S. GDP. Any reading above 50 percent (red line in this graph) indicates the manufacturing economy is growing. Any score above 42 percent (the blue line) indicates an expansion of the gross domestic product (GDP.) The PMI for manufacturing turned positive in August 2009 and peaked at a reading of 60.4 percent in April 2010. Since then it has moderated a few percentage points but is still solidly positive.

- **The PMI is considered a strong and reliable indicator because it captures 10 separate measures in its monthly survey:** new orders, backlog of orders, new export orders, imports, production, supplier deliveries, inventories, customer inventories, employment and prices, each of which is scored and reported each month. The strongest factors last month and their respective scores were prices (71 percent), production (62.7 percent) and new orders (58.9 percent), a healthy combination of elements.

- **10 of the 18 manufacturing industries in the survey reported growth** in November, and the Plastics & Rubber Products segment ranked 6th among the 18 industries reporting growth.

It’s worth pointing out that a PMI reading of nearly 57 percent correlates with GDP growth **above 5 percent**, more than twice what the U.S. economy has delivered over the last several months. The rest of the U.S. economy simply has not matched the strong performance by manufacturing. That is partly because manufacturing is a relatively small part of the U.S. economy—it employs about 9 percent of the work force and contributes about the same percentage of total GDP. Furthermore, over the course of 2009-10, U.S. factories have already benefited from inventory restocking and strong export demand. So while manufacturers can congratulate themselves on a strong performance in 2010, the worry is that manufacturing strength isn’t spreading fast enough throughout the economy at large. Put another way, manufacturing alone can’t solve U.S. economic problems.

Construction: In a Holding Pattern

Construction has always been one of the key segments of composites demand in the form of bath tubs, shower stalls, flat, corrugated and architectural grade panels, residential doors, garage door skins, and window frames. New housing starts and remodeling expenditures are the primary drivers of composites usage—and we all know how miserably weak those statistics have been. As of October 2010, the industry built homes at a seasonized rate of 519,000 per year, which means the rate of builds has fallen **75 percent** from its peak in 2005. Housing starts were able to virtually ignore the last recession in 2001 but led the economy into the Great Recession this time around. Many contractors and lending institutions have been driven to bankruptcy, some 1.6 million jobs were lost in construction and the rate of unemployment in homebuilding is 18.8 percent or twice the national average.

The homebuyers’ tax credit, which expired in April 2010, stimulated home sales somewhat but, in hindsight, the program appears to have merely pulled sales forward from later months. This suggests a weak market that was temporarily revived by the tax credit. The single-family market remains in a holding pattern as potential buyers await solid positive economic indicators that their jobs will remain in place and that the economy is moving forward. The new home inventory is at a 42-year low, and new home sales have improved recently, albeit at a very low pace. Hence, some ongoing new construction is needed to respond to demand that is growing in those geographic markets that did not experience overbuilding or abnormal price increases.

However, the housing picture is significantly different in the multi-family or rental construction sector. While single-family construction has remained at about the same level for the last four months, multi-family starts dropped 44 percent in October. That statistic may be an aberration since industry analysts claim renewed demand for rental properties and tight credit standards for prospective home buyers should raise rental demand as the economy improves and new job entrants form new households and choose to be renters. There are other sizeable challenges ahead, too, for companies operating in the housing market, such as weak home prices, potential foreclosures and oversupply of existing homes. Against this difficult context, the housing outlook for the year ahead is for gradual improvement but only to about 785,000 total starts in 2011, up from the estimated 605,000 in 2010.

Automotive: Revving Up

U.S. auto makers posted healthy sales in October and November, lifting hopes for a strong finish to the year. November sales were 870,000 cars and light trucks, up 17 percent from the corresponding month of last year and

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Buried in the Q4 statistics were above-average sales and share gains by GM, Ford, Chrysler and most of the domestic transplants, excluding Toyota. Sales of domestically-produced light vehicles were up 15.1 percent through November, whereas imports had risen only 0.1 percent.

11 percent ahead in YTD cumulative results. Passenger car sales for 11 months were up 4.7 percent, and light trucks were 18.1 percent ahead. Even more encouraging was the fact that the seasonally-adjusted annual rate (SAAR) of sales in November was 12.3 million vehicles. It was the second month in a row that the closely watched annualized figure topped 12 million and gave the industry a running start on 2011 when full year sales are expected to be 12.8 million (see graph 3).

Buried in the Q4 statistics were above-average sales and share gains by GM, Ford, Chrysler and most of the domestic transplants, excluding Toyota. Sales of domestically-produced light vehicles were up 15.1 percent through November, whereas imports had risen only 0.1 percent. Good fortune among the domestic OEMs converts to more builds, thus more components fabricated in U.S. composites shops. Add to the pent-up sales demand the need to replenish inventories on car lots, and the outcome is significantly more domestic auto production. In 2009, U.S. assembly plants made 5.6 million light vehicles and the estimate for all of 2010 was 7.5 million, an impressive 34 percent one-year gain (graph 4). This has added entire shifts of work for compounders and fabricators of sheet molding compound (SMC) and compounders/molders of injection-molded and LFT (long fiber thermoplastic) components for the auto industry. The sharply increased demand comes at a moment when Detroit is trying to lightweight its vehicles and roll out several new fuel-efficient or electric-powered models and auto engineers are specifying more composites to do the job.

For example, heavy trucks (classes 6-8) represent a numerically small portion of total automotive builds but account for a disproportionately large share of composites used in vehicle exterior applications. In terms of production and sales, the USA, Canada and Mexico are effectively a closed system, meaning that few heavy trucks are exported or imported, hence production is fully dependent on the sales level in the region and vice versa. Output within the area fell 66 percent from 642,000 in the peak year of 2006 to just 217,000 trucks in 2009. The 2009 trough was all the more painful as this was long expected to be a record buying year, when many haulers would buy equipment in anticipation of EPA’s new emissions norm to take effect in 2010. This time around, the new engine technology had a proven track record in other regions, so there was no fear of the unknown motivating truckers to buy early and the miserable business and finance conditions of 2009 kept many potential buyers out of the market. A very modest recovery began in 2010 and should lead to stronger growth for heavy trucks in 2011 and 2012.

Energy: Which Way Does the Wind Blow?

The utility-scale wind energy market was born in the U.S. and was the global leader in the first half of the 1980s. By 1986, the U.S. was home to around 90 percent of global wind installations, mostly in California, and driven by a favorable policy environment, becoming the early global leader in wind technology and installations. In following years, strong policies in Europe and the expiration of wind energy incentives in the U.S. led to more growth overseas and domestic stagnation. Between 1987 and 1997, the U.S. wind industry installed less than 50 MW of new wind projects per year and by 1998, the U.S. had 1,853 MW of wind power compared to 6,453 MW in Europe. During this time, the technological expertise for wind turbine manufacturing matured in Europe and many of the global leaders today are headquartered in European countries. In 1992, a production tax credit (PTC) was established for U.S. wind producers and growth resumed even though the
Composites usage is thriving nowadays in one of the more traditional forms of energy—crude oil production. Glass-reinforced epoxy piping in diameters ranging from 2 to 40 inches proved itself decades ago as an excellent corrosion-resistant alternative in the oil patch to carbon steel pipe.

federal government was sometimes tardy in renewing the PTC. Several U.S. states adopted mandatory renewable standards and goals which assisted growth during the 1990s and into the 2000s. Between 2005 and 2009, the PTC was extended steadily and this relative policy stability enabled the U.S. to regain its global lead in installations. The industry grew from around 6,700 MW at the end of 2004 to 35,000 MW at the end of 2009, a five-fold increase in just five years.

In 2009, the U.S. wind energy business experienced a phenomenal year of growth and installed 9,922 megawatts (MW) of wind power capacity. The accomplishment was a 16 percent increase over a strong 2008 performance and 89 percent greater than what the industry installed in 2007. With glass-reinforced epoxy or vinyl ester composites the standard material used by all blade makers, the wind energy segment has become the most promising growth application in the entire composites industry. Then we arrived at 2010 and the number of new wind turbines installed nosedived. In the first three quarters of the year, the U.S. installed 539,700 and 395 MW, respectively. With greater than 6,000 MW of capacity under construction in the fourth quarter of 2010, the American Wind Energy Association (AWEA) estimated the industry would experience another fourth quarter surge and bring about half those projects online by year-end. Under this optimistic scenario, the U.S. wind market was to deliver only about half the previous year’s volume or about 5,000 to 5,500 MW for the year 2010 (graph 5).

The U.S. is currently the global leader in cumulative wind energy installed, but the momentum earned in recent years could be squandered if the U.S. does not take steps to encourage more new installations like several other countries have. AWEA advocates establishment of a national Renewable Energy Standard to sustain the pace of recent years and to keep the U.S. competitive with other countries like China, India, Brazil and the EU.
While manufacturers can congratulate themselves on a strong performance in 2010, the worry is that manufacturing strength isn’t spreading fast enough throughout the economy at large. Put another way, manufacturing alone can’t solve U.S. economic problems.

Community who are aggressively adding wind farms to their national electrical grids.

Energy: Oil Produces Opportunity

Composites usage is thriving nowadays in one of the more traditional forms of energy—crude oil production. Glass-reinforced epoxy piping in diameters ranging from 2 to 40 inches proved itself decades ago as an excellent corrosion-resistant alternative in the oil patch to carbon steel pipe. For low, medium and high pressure pipe systems operating in harsh environments or transporting corrosive liquids like crude oil, salt water, sea water, waste water, sewage or other corrosive materials, composite pipe provides outstanding service, long life and maintenance-free service. U.S. manufacturers of filament-wound composite pipe are experiencing very strong demand due to resurgence in gas and oil drilling since mid-2009, which has doubled the U.S. rig count in just 15 months. Driving the increased drilling activity are new onshore gas fields and the rising price of crude oil, which usually seems to coincide with the U.S. rig count (Graph 6). Forecasts of the price of oil are usually controversial and often wrong but the long term trend clearly seems to be upwards, so we should be able to confidently forecast a robust outlook for composites demand in the oil patch. Other end uses of composite pipe for civil construction and water transport are likely to see only sluggish demand until the economy strengthens and municipalities are able to fund more infrastructure projects.

Conclusion: Single-Digit Recovery

The composites industry is a checkerboard of business segments which sometimes operate independently and react differently to the economic environment. We should consider it a strength of our industry that we have such a diverse collection of markets and customers. Furthermore, each business cycle in the economy and in our industry is unique and plays out differently. Since 1960, the U.S. composites business has experienced eight downturns of one to three years. The severity of the downturns has ranged from -5 percent to -42 percent in lost volume, and the average downturn has caused the industry to lose 19.4 percent in volume. On the flip side, the industry has benefited from seven upturns or expansion periods since 1960, ranging from three to eight years. The growth experienced during those positive years varied from 29 to 277 percent and averaged 91 percent. Composites can rightly claim to be a high-growth industry because the average upturn has been two-and-a-half times as long as the average downturn, and the growth during the expansion phases has, on average, been 4.7 times greater than the volume lost during the downturns. 2011 will not have as much spring-back as we experienced in 2010, but composites still should see strong single-digit recovery in 2011 and over the next three to five years.

Ray MacNeil is a composites consultant based in Wexford, Pa. He can be reached at raymacneil@comcast.net.
Composite Manufacturers | Take On the Green Challenge
Nathan Armstrong is president of Motive Industries Inc., an automotive design firm in Calgary, Alberta, Canada that is developing bio-composite-bodied electric cars using industrial hemp fiber in the manufacturing process.

Successful R&D Starts with Listening
Mike Lopez has more than 25 years’ experience in composite design and manufacturing, with an emphasis on the sporting goods industry. He takes new product concepts through the design and prototype stages and production. He previously worked in different capacities at Reynolds Composites, Unifiber USA, Competition Composites and Cape Composites.

Composites Will Fill the Need for Green Aircraft
Dan Brady joined Aurora Flight Sciences as Vice President of Aerostructures in June 2007 from Vought Aircraft Industries where he was Director of Global Supply Chain Management and previously Director of Boeing and Bell Military Programs. He works directly with Northrop Grumman on the Global Hawk programs and Sikorsky Aircraft on multiple programs.

Uniform Standards Can Protect Composite Manufacturers
David Lipiro is a consulting scientist with over 30 years of industrial experience, who founded Environmental Compliance & Risk Management 13 years ago. His areas of expertise include air permitting, emission factor development, compliance auditing, and database development. He also chaired and remains active on the ACMA Green Composites Committee (GCC), a group focused on expanding the role of composites in sustainable development through education.

Renewable Energy Brings Growth to Marine Manufacturing
Warwick Buckley completed his apprenticeship in 1978 and became naval architect in 1997. Since then, he has been involved in boat building companies, finally opening his own composite boat building company, British-based Composite Moulding.

To read the interviews with these and other leading members of the composites industry, visit www.composites-manufacturingblog.com and click on “Q&A Interviews.”
PIC Completes Pultrusion Pre-Standard for Engineers

The ACMA Pultrusion Industry Council (PIC) has successfully completed a three-year project with the American Society of Civil Engineers (ASCE) to develop a Pre-Standard for Load & Resistance Factor Design (LRFD) of Pultruded Fiber Reinforced Polymer (FRP) Structures.

This Pre-Standard was developed using principles of probability-based limit states design to provide uniform practice in the design of pultruded FRP structural systems. It will allow engineers to design structures using pultruded structural shapes similar to design standards currently used for steel, wood, and aluminum.

The next step is for ASCE to convene a standards committee to promulgate the pre-standard using the ANSI process. This process is expected to take one to two years. In the meantime, the PIC will use the Pre-Standard to educate engineers on the use of the standard and develop complementary tools that engineers could use to make efficient use of this standard.

A special presentation on the key elements of the Pre-Standard will be delivered at COMPOSITES 2011. For more information or a copy of this standard, email John Busel at jbusel@acmanet.org.

Sacramento Event Will Push for Scientific Styrene Assessment

At a Styrene Legislative Day planned for Feb. 16, 2011 in Sacramento, industry members with operations in California will continue to support for reform of the state’s styrene health effects assessment process. A registration website and final schedule for the Feb. 16 event will be available in early January. For more information, email John Schweitzer at jschweitzer@acmanet.org.

Education Topics at COMPOSITES 2011

A list of all Education Session and Technical Paper topics is now available online. Topics focus on green and sustainability issues; manufacturing and materials; design and engineering; cast polymer; regulatory and legislative; growth and emerging markets; and business operations. Plus, two sessions on high performance materials are organized by SAMPE and SPE. You must register for the full conference in order to attend all the sessions. Visit www.acmashow.org for more information and to register.

Composites’ Role in Vehicle Fuel Economy

At a Dec. 10 briefing in the Rayburn House Office Building, ACMA members educated Congressional staff regarding the ability of composites to reduce the weight and improve fuel economy of cars and trucks. For more information on how you can get involved, email John Schweitzer at jschweitzer@acmanet.org.

ACI 440 Balloting New Standards

The American Concrete Institute Committee 440 (FRP Composites) will ballot several important documents related to FRP and concrete over the coming months. The documents include updates to the 440.1R-06 on FRP rebars in concrete information on deflection and serviceability issues, 440.1R-08 on a new chapter for FRP strengthening materials used in seismic strengthening applications, and a first ever report on FRP durability in concrete applications that offer accelerated conditioning protocols for FRP products. For more information, email John Busel at jbusel@acmanet.org.

Small Business Advocate Weighs in on Styrene

Dr. Winslow Sargeant, Small Business Advocate, wrote HHS Secretary Kathleen Sebelius expressing concerns about the listing of styrene as a “reasonably anticipated” carcinogen. He also raised doubts about the process used to evaluate styrene by the National Toxicology Program and highlighted the impact of the negative ruling on ACMA. For more information or a copy of the letter contact Tom Dobbins tdobbins@acmanet.org.

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Big Accomplishments Take Time

ACMA recently finished one of the biggest projects in its history: An LRFD pre-standard for pultruded composites has been adopted by the Pultrusion Industry Council (PIC) and now undergoes the adoption process by the American Society of Civil Engineers. This is a major accomplishment, since the final standard will give engineers more confidence to design with composites. It took several years, a million dollars, and many hours of staff and member-volunteer work to reach this point, but when the final standard is adopted, composites will compete on a more level playing field with other materials. This is another example of how ACMA continues to be the voice of the composites industry.

Tom Dobbins, CAE

New Members

- Duratel
  - Chicago
- Engineered Composites Inc.
  - Buffalo, N.Y.
- Engineered Syntactic Systems
  - Attleboro, Mass.
- General Plastics Mfg. Co.
  - Tacoma, Wash.

- Daniel Fortune, CCT
  - Caruthersville, Mo.
- Noi Chine, CCT-I, CCT
  - Grand Forks, N.D.
- Don Stills, CCT-CM
  - Geneva, Ohio
- Diana Sanchez, CCT-CM
  - Geneva, Ohio
- Rich Elrod, CCT-CM
  - Geneva, Ohio
- John Carpenter, CCT-CM
  - Geneva, Ohio
- Charles Sparks, CCT
  - Geneva, Ohio
- Greg Thom, CCT
  - Geneva, Ohio
- Paul Wright, CCT-CM
  - Geneva, Ohio
- Doug Williams, CCT
  - Bloomfield, Ontario, Canada
- Travis Cox, CCT
  - American Canyon, Calif.
- Eloy Sierra, CCT
  - Chickasha, Okla.
- Benny Hallmark, CCT
  - Chickasha, Okla.
- George Wise, CCT-I
  - Avon, Ohio
- Mohammad Hossain, CCT-I
  - Kelowna, B.C., Canada
- Matthew Cote, CCT
  - Eastport, Maine
- Edward Sambback, CCT
  - Eastport, Maine
- Jon Stevens, CCT
  - Eastport, Maine
- Edward Scott, CCT
  - Eastport, Maine
- Sean Payeur, CCT
  - Eastport, Maine
- Luke Patry, CCT
  - Eastport, Maine
- Nicholas Cote, CCT
  - Eastport, Maine
- Matthew Bolec, CCT
  - Eastport, Maine
- Benjamin LeClere, CCT
  - Eastport, Maine
- Jean Alvarado, CCT-CP
  - Tucson, Ariz.
- Dean Qadri, CCT
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Confounded Composites!

Take a second look and see if you can find the differences in these two pictures.

In spring 2010, Swedish-based Kockums AB announced that they were developing a new catamaran that would be the first to replace aluminum with composite material. Approximately one year later, the new CarboClyde is making the maintenance rounds among offshore wind farms.

To read more about the CarboClyde, turn to page 9.

Changes

Keep Score

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10

Changes
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