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Research and development in higher learning institutions around the globe is critical. It leads to breakthroughs that benefit industry and humanity. *Composites Manufacturing* did some research of its own to present a sampling of noteworthy achievements from various universities.

**By Susan Keen Flynn**

**Staying Afloat or Accelerating Ahead?** ........................................ 22

The U.S. recreational boat industry took a Titanic-sized hit in 2005, which continues to roil through the nation. Marine manufacturers share their experiences—good and bad—of moving forward amidst the changing economic climate.

**By Jan Fletcher**

**ACMA’s GAC Keeps an Eye on OSHA** ........................................ 28

ACMA’s Government Affairs Committee (GAC) is tracking a number of OSHA rulemakings and related programs that may impact manufacturing operations. See what’s on their watch list and how it may affect your business.

**Correction:** Within the article “Partners in Training” (p 16) of our July/August issue, Clackamas Community College was credited for developing CCT-VIP. The program was developed by Southern Maine Community College in partnership with Andre Cocquyt, president ACSM, and the American Composites Manufacturers Association (ACMA). It should correctly read, “Clackamas Community College offers a certification program featuring four classes…”
Don’t Let One Bad Apple Spoil the Bunch

This issue of Composites Manufacturing focuses on the “best of” university R&D in the past year. I can think of nothing more important to write about than what is threatening our industry’s ability to continue creating “best of” products. The listing of styrene in the Report on Carcinogens (RoC) as a “reasonably anticipated human carcinogen” is a drastic listing, which can have a lasting impact on many levels of our industry. I believe we should have “best of” science to back up such a listing, but in reality the science is flawed.

When a government agency devastatingly impacts an entire industry without following its own rules, they should be held accountable. This listing will make it more difficult for composite companies to remain in business, placing as many as 250,000 jobs at risk. This is where being united will benefit the entire industry. Join ACMA as it fights on your behalf to make sure your voice is heard.

I remember vividly the 1989 Alar Scare to the apple industry, probably because of the affect it had on my native Pacific Northwest. Almost overnight the Alar story seemed to be everywhere; on talk shows and news media. They stated, “The most potent cancer-causing agent in our food supply is a substance sprayed on apples to keep them on trees longer.” They further stated, “Who is at risk? Children who may someday develop cancer.” The publicity campaign resulted in declined apple sales, and 20,000 apple growers in the U.S. suffered financially—many went bankrupt. The tragedy is that many went bankrupt over unscientific data.

Alar was extensively tested before 1966 and cleared for use by the U.S. government. In laboratory tests, the amount fed to mice before showing effect was equal to an adult eating 28,000 pounds of Alar-treated apples each year. The campaign was started by the Natural Resources Defense Council, an environmental activist group that asked the EPA to declare Alar an “imminent hazard.” They claimed to have scientific evidence proving Alar might cause cancer. However, the evidence was never published where it could be reviewed by qualified scientists. Eventually, The Scientific Advisory Panel for EPA concluded the evidence was flawed and rejected it. But it was too late for a lot of farmers.

The apple industry was not prepared to fight this campaign because it took them by surprise. We are lucky we have many members in ACMA and industry partners willing to put their gloves on, dig their feet in and punch back. Recently thirteen ACMA member companies visited Senators and Representatives offices to advocate an effort to gain a scientifically accurate assessment of styrene health effects. This will assure that decisions are being made by the “best of” sound science. We are being proactive and we need our members’ help. Join ACMA on the Hill and make a visit to your Congressmen. If you don’t have time, make a contribution to the Composite Advocacy Fund that will help pay for our consulting and lobbying efforts. Another way to help is recruiting new ACMA members. The more of us that speak with one voice, the more leverage we will have.

So let’s not forget the Alar story, instead, let’s learn from it. Help ACMA get this issue taken care of before an advocacy group decides to make it the next Alar Scare.
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Composites Deliver Within New Shipment Vans

The Reach commercial van from Indiana-based Utilimaster and automaker Isuzu is advertised as delivering 35 percent better fuel economy than its conventional counterpart—a fact that, with rising gas prices, has lured delivery giants UPS and FedEx, among others.

Using composite materials for the body and cab areas, the van saves an average of 600 pounds per vehicle over more conventional materials, according to Utilimaster. When combined with an efficient engine and aerodynamic design, this reduced weight, results in a reduction of the vehicle’s carbon footprint by up to 11 tons per year.

The side panels, usually made from aluminum or steel, are made from polyethylene skins with a honeycomb core. “It’s a very lightweight way to achieve strength and stiffness,” says John Knudtson, vice president of product development at Utilimaster. “The composite panels also provide better thermal and acoustical performance than its metal counterparts.”

The floor of the van is made from two-inch-thick urethane foam core polyethylene panels, which gives it more rigidity than the side panels. They are also easier to remove and replace than conventional steel panels, according to Knudtson. Structural molded plastic elements like the dashboard panels and molding around the windshield lower the van’s weight and limit the number of parts used in the van, lessening installation labor. In the long run, this saves fleet owners money and limits the downtime.

Post-industrial recycled content also appears throughout the van, in molded plastic panels where “you’re not very concerned about appearance,” says Knudtson. Rubber from recycled tires is used on rear side bumpers, protecting the van from loading docks.

The lighter weight of the vehicle means less wear and tear on the chassis and other components, requiring replacement or repair less frequently. Composites are also corrosion resistant, says Knudtson, which give them a distinct advantage in snow environments where the road salts used are increasingly corrosive.

FedEx is currently testing five of the vehicles in Detroit, Jackson, Tenn., Jonesboro, Ark., and Memphis. The company is also testing all-electric and hybrid vehicles in denser, urban routes. The gasoline-powered Reach van, however, is better suited to rural and suburban routes with less starting and stopping and longer stretches between fueling or plug-in stations.

UPS liked the Reach van, but worked with Utilimaster and Isuzu to customize it, developing a prototype van called the CV-23. The UPS-specific van features modifications to the cab and several other details. However, like the standard Reach van it uses a smaller engine, lighter chassis, and lighter composite body than a conventional van.

Michael French, a public relations officer at UPS, noted that the time was right for a composite van. “Fuel prices are unpredictable,” he says. “Composites have been around for some time in passenger cars, so incorporating them into a delivery truck was a logical step.”

Like FedEx, UPS finds the vehicle’s use of traditional fuels to be a benefit on longer routes. The company is currently testing the vehicle in five locations: Albany, N.Y.; Flint, Mich.; Lincoln, Neb.; Roswell, Ga., and Tucson, Ariz.

These locations represent a wide range of conditions that UPS faces in delivering packages, from extreme temperatures to rough back roads to busy urban streets. According to French, there are few locations where the truck wouldn’t be useful. “The cargo capacity would be the vehicle’s only limiting factor, but the size of the vehicle’s cargo volume is similar to around 25 percent of the 70,000 vehicles in our U.S. delivery fleet,” he says.

Data on fuel economy and vehicle performance will not be available from UPS until after the company closes the test period on December 31, 2011. But the CV-23 is already getting good reviews. “The drivers are very positive about the vehicle, noting its excellent turning radius as a breakout positive,” said French.

Allyson Wendt is a freelance writer based in Brattleboro, Vt. Email comments to allysonwendt@gmail.com.
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Government Supports Composite Triumph

The world’s longest composite bridge now connects Barter’s Island Road from Hodgdon Island to the coastal town of Boothbay, Maine. This bridge, named the Knickerbocker Bridge, includes 64 award-winning hybrid composite (HC) beams and is anticipated to last over 100 years. The HC beam is a new composite-hybrid technology researched at the University of Maine Advanced Structures and Composites Center (AEWC), manufactured by a local manufacturing company and supported by the state of Maine. This accomplishment is drawing the attention of various Departments of Transportation (DOT) from across the world that want to increasingly design with composite structures.

The Maine DOT funded the Knickerbocker Project, which replaced the 80-year-old wood piling bridge with a 540-foot long installation. The DOT hopes this new technology can also help fix other elements of the U.S.’s deteriorating infrastructure. “As you look around the country, bridges are deteriorating at a high rate. Many of them were built in the 1930’s and have outlived their bridge life. Composites can offer corrosion resistance to infrastructure elements to help them last longer,” says Nate Benoit, project manager at Maine DOT.

Funding Composite Innovation

The state of Maine has been a leader within the U.S. in the development and implementation of composite technology in bridge infrastructure, thanks to the Bridge Innovation and Composite Initiative in 2008, part of a governor’s bill enacted following the collapse of a bridge in Minneapolis. The bill granted an increase in the state’s bridge funding by $160 million over a four year period, including financial support for Knickerbocker Bridge, and encouraged the development of composite technology. The initiative spurred a number of projects between the Maine DOT, AEWC and the Maine Composite Alliance (MCA) including the Bridge-in-a-Backpack and HC beam technology.

The Knickerbocker Bridge Project began in the autumn of 2005 and was originally designed to be a concrete bridge. However, at the end of 2008, after watching the HC beam develop, Maine DOT chose to move forward using hybrid composite technology at a location that would take advantage of composites innate properties such as lightweight construction and corrosion resistance. Knickerbocker Bridge was built close to the water and at high-tide the clearance is only four feet, making it the best bridge in the state to benefit from the corrosion resistant properties and mitigate the effect of salt water.

Testing the New Technology

Before implementing the technology in the design, the first step was to test the beams, which are composed of a fiber-reinforced shell filled with concrete compression reinforcement and steel tension reinforcement along the bottom of the beam. According to John Hillman, inventor of the HC beam, and Harbor Technologies, which manufactures the beam, the technology uses the best attributes of the three materials by providing the strongest, most corrosion resistant beam on the market. Harbor Technologies, a composite manufacturer based in Brunswick, Maine, produced a 70-foot-long scale test of the beam to certify at AEWC. The beams easily passed AEWC...
testing, allowing the Maine DOT to move forward with the bridge design. The construction documents were written by Calderwood Engineering and Hillman’s engineering firm, Teng & Associates, drawn to the specification determined at AEWC. The bridge was constructed ahead of schedule by local contractor Wyman and Simpson, connecting two important Maine tourist destinations in time for summer vacation.

The Future of Maine’s Infrastructure

“I tip my hat to the Maine DOT,” says Martin Grimnes, president of Harbor Technologies. “They’ve been a champion in finding infrastructure solutions, reducing operating costs and extending the lifecycle of their installations.” For over ten years, Maine DOT has held regular meetings with MCA, federal highway representatives and experts from the university and AEWC to discuss project opportunities and challenges related to designing with composite materials. “We all hover around the table and brainstorm,” says Grimnes. For Maine DOT, the purpose of the meetings is to gain a better understanding of composites and to better utilize the inherent properties of the product in transportation structures.

Previous to the Composites Initiative, Maine was already home to many composites companies, including marine and custom manufacturers. Today it is still heavy in composites manufacturing and the industry is expanding due to research and marketing from the AEWC and support from the local government. As for the future of composite technology in the state of Maine, “Currently Maine is a leader in researching, designing and implementing technology for transportation infrastructure. With AEWC in our state and companies like Harbor Technologies, Kenway, Advanced Infrastructure Technologies and several others, we expect to continue to be a leader in bridge infrastructure,” says Benoit.

Angie McPherson is the communications coordinator at ACMA. Email comments to amcpherson@acmanet.org.

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50 Years Strong
“The nicest thing about Mark Gelders is that he was forward thinking,” says Mark Pearson, president of Pearson Piling, LLC, in Fall River, Mass. Pearson approached the Dania Beach, Fla., marina operator at the Ft. Lauderdale International Boat Show in 2006, proposing a composite upgrade.

Gelders, general manager of Anglers Avenue Marine Center, convinced marina owner Dan Longman to launch a major marina restoration, replacing aging wooden piers and decks with composites. Longman had purchased the 125-foot slip marina in 2006, when the circa-1960s facility was in need of extensive repairs, Gelders says. Tired of battling boring-worm issues, Gelders suggested a makeover. “Composites always run more than conventional wood or pretreated wood, but over the long haul we won’t be dealing with these pilings again. The number one reason we did it was for looks and aesthetics,” says Gelders. “We did our homework and found that the lateral strength of a fiberglass piling is about five times that of a wood piling,” says Gelders.

Due to the material’s properties, Gelders says he was able to choose 10-foot fiberglass pilings, instead of 12-foot wooden pilings, in constructing a new feature added to the marina: in-slip, vertical, hurricane boat lifts. Construction began mid-2010 and is scheduled for completion in 2012.

“The marina was very much in need of repair. They are now using a product with a 100-year-plus lifespan, says Pearson. All the new slips at the marina have fiberglass pilings and composite decking. Since fiberglass pilings have five times the rating for hurricane force winds over wood, Gelders says that in strong winds the new pilings “will just bend and flex similar to a fiberglass fishing rod.” The lengthy lifespan was an incentive for the marina operator, too. “We do this once, and we don’t have to do it again.”

Decay rates in wood pilings are widely variable depending upon environmental factors, says Gelders. Even though the boating industry is undergoing an epic disruption, Gelders says that was exactly the reason why an upgrade was necessary. “We had to build a better dock. Compared to the rest of the marinas, ours is going to stand out.” The new materials were also easier on his customers’ bare feet, says Gelders.

With the boat industry still in a slump, Gelders says the upgrade ensures a competitive advantage. “My new composite docks are powered by a solar system, so, I don’t charge for electricity. You’ve got to make yourself stand out.”

“The real testament is the number of marinas that buy it, and there have been quite a few,” says Pearson. However, outside-the-box thinkers have found other uses for composite pilings, too. He cites Roger Williams Park Zoo in Providence, R.I., as one example. “They are using composite pilings to keep the elephants in,” he says.

**Expanding composites success**

According to Pearson Piling distributor Scott Tihansky, managing member at Innovative Marine Solutions, LLC in Allentown, Penn., the company’s latest large-scale project led to a groundbreaking entry within the last two years into government contracts. He says the company completed two fendering jobs — one in 2010 for the Texas Department of Transportation in Houston and one for the U.S. Coast Guard at Cape May, Del., in late 2009.

The installation in Texas involved replacing infrastructure made of timber and steel that was deteriorating at the junction of Interstate 10 and the San Jacinto River. “The interesting thing about this particular application was the minimum clearance under the bridge,” says Tihansky. The job involved installing 70-foot pilings while having only 18 inches of working headroom. “We had a splicing kit available,” he says. “We drove it 30 feet, then spliced the piling, drove it, and spliced the piling again. It was very cost effective.”

Tihansky says the vertical splicings met the needs of the embedment requirements while working around severe restrictions posed by the highway bridge height.

The U.S. Coast Guard fendering job in particular involved installing 18 pilings. “With any job involving the Coast Guard, it’s a big deal that you got their attention,” says Pearson. “The key is once you’ve gotten one, you’ll get more.”

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A new alliance between the U.S. Department of Energy (DOE) and the Department of the Army (DOA) to promote the development of clean energy technologies has the potential to drastically benefit composites manufacturers.

Through the Advanced Vehicle Power Technology Alliance (AVPTA), announced in mid-July, the two departments will leverage resources to foster development of technologies to improve ground vehicle power and meet U.S. energy efficiency goals, as well as speed military and commercial adoption of those technologies.

“The whole purpose of the alliance is to identify technology in which the DOE and DOA have common interest and a common background,” says Bruce Huffman, public affairs officer for the U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC), based in Warren, Mich. The DOA, Huffman says, will gain access to the DOE’s portfolio of cutting-edge clean energy technologies, while the DOE will gain an outlet to transition the technologies to a broader user base.

Among the technologies singled out for promotion by the alliance are “lightweight structures and materials,” including composite components such as space frames, carbon fiber and hybrid designs.

Among the technologies singled out for promotion by the alliance are “lightweight structures and materials,” including composite components such as space frames, carbon fiber and hybrid designs.

“Lightweight composites have been used in a variety of military and commercial applications, factors including cost, joining technology and repair have kept them from being used on vehicles, says Pat Davis, vehicle technologies program manager for the DOE. Through the AVPTA, the two departments will work to overcome those challenges.

Richard Gerth, with TARDEC’s National Automotive Center, in Warren, Mich., says the alliance will help composites manufacturers develop their technologies by working with the military as well as find ways to make them more cost efficient.

“We can provide an early opportunity for manufacturers to get their best materials or manufacturing processes—multi-material joining, advanced resin, low-cost carbon fiber—and try to work with us to develop it,” Gerth says. “Manufacturers can work with DOE to transition to us through our supply chains and improve their ability to mass produce for others in the future.”

Though details are still being hammered out, Eric Kallio, with the National Automotive Center, says that the formation of the alliance will not result in any operational changes for composites manufacturers already working with TARDEC or DOE. Information submitted to either department, for instance, through TARDEC’s ground vehicle gateway (online at https://tardec.groundvehiclegateway.com/) will be visible to both.

“Companies can submit technology offerings to us that they think would be of interest to TARDEC, and those could be identified as possible dual-use, joint TARDEC-DOE opportunities,” Kallio says.

But Gerth cautions that working with the alliance does not guarantee that a manufacturer’s technology will ultimately make its way into a finished vehicle. “I think it’s important to point out that this is primarily a research and technology transfer alliance, not a procurement action,” Gerth says. “Manufacturers can work with us to develop the research and demonstrate the technology through use on an actual vehicle, but if we buy something, it will ultimately be the manufacturer’s responsibility to get that technology in the supply chain of an OEM.”

The AVPTA’s first official event, the Advanced Vehicle Power Technology Workshop, took place July 18 and 19 in Detroit, where the alliance will be based. The workshop brought together experts from various fields to lay the groundwork for the alliance’s strategy. Participants included Senator Carl Levin (D-MI), U.S. Secretary of Energy Steven Chu, and Under Secretary of the Army Joseph Westphal.

“The fact that we had this caliber of speakers in attendance gives you the sense that the DOE and the DOA are very interested in this technology and the fruits of what this technology can bring to our war fighters,” Huffman says.

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Airborne Turbine
Prototypes Harvest
High-Altitude Winds

Innovators around the globe are working on prototype airborne wind turbines to bring high-altitude energy down to earth. R&D concepts range from little airplanes flying in circles to tethered aerostats or kites. “The technology has attractive features that are sufficiently compelling, it makes sense to continue to investigate it,” says Fort Felker, director at the National Renewable Energy Laboratory (NREL). “The challenges are huge, but the potential is immense.” And with a much higher premium on lightweight design, components like the blades and frame will use advanced composites.

Airborne turbines over land-based windmills

High-altitude winds have the necessary power density, consistency and geographic availability to potentially become a predominant renewable energy resource of the future. Scientists estimate that energy in the jet streams are 100 times the amount of power used worldwide annually. What’s more attractive is that the winds are stronger and steadier the higher you go. Consequently, airborne systems can be built smaller, more lightweight and cheaper than fixed-bottom turbines on the ground. It’s much more economical to deploy flying turbines on a lightweight tether that transmits the electricity back to the ground than installing an enormous cantilever steel tower that needs to be drilled into land or the sea floor. Those savings can bring the cost of high-altitude wind energy down to be competitive with the grid.

Airborne turbines can also be deployed over challenging, complex terrain without roads, over rocky ridges or offshore, opening up new territories for harvesting clean energy. For now, times stronger than where traditional land-based windmills can reach.

Unprecedented yet challenging characteristics

Before larger-scale deployment of airborne wind turbines comes within reach, the industry has to overcome major challenges. “Systems would need to be manufactured in quantity at a low enough capital cost to make them attractive to investors,” Felker says. He predicts a large use of advanced composites in future airborne systems for the “fantastically good fatigue characteristics.”

The bigger challenge is operational. How do you keep an airborne system flying autonomously 24/7 for months upon months, even decades? “No one has demonstrated a flight vehicle operating continuously even for a day,

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Takes a lighter-than-air approach

Massachusetts-based Altaeros Energies repurposed the buoyant lift technology of traditional blimps to build prototypes of its airborne wind turbine. The supportive fabric structure is filled with helium, lifting the turbine up to 2000 feet, where it will hopefully produce more power than a traditional, tower-mounted turbine. “Changing the design to the shape of a shroud or a diffuser actually provides additional benefits by augmenting the power flow through the turbine and increasing the advantages of the lighter than air structure,” says Altaeros founder Ben Glass, who has both a bachelor’s and master’s degree in Aeronautical and Astronautical Engineering from MIT.

“To make a new energy system economically viable, it will ultimately come down to the cost of the actual system and the operating and maintenance cost,” says Glass, who aims to achieve competitive energy costs through good design as well as by utilizing mature technologies, leveraging proven technical processes and fitting into existing policy and regulatory frameworks.

Altaeros uses advanced composite fabrics with a layer of mylar film or polyester film adhered to a scrim, like a carbon scrim or aero knit with specific strength and elongation behavior. “To leverage advances already made in another field, we use fabrics used in competitive sail racing to build our shroud with very lightweight, high-strength materials that are lower cost and will allow us to build a system that’s economically viable,” he says.

Aware that the long-term reliability of airborne wind turbines is a target for skepticism, Altaeros is building passive safety and stability into the system. “The static stability or directional stability is really coming from the aerodynamic design of the shroud itself,” Glass explains, asserting the system will remain stable and point into the wind regardless of the wind direction or turbulent conditions. Extreme weather conditions are by far the biggest threat to airborne wind turbines. “Typically, lighter-than-air devices rely entirely on the buoyant lift to keep them aloft. When the wind is buffeting them around and they get a big downdraft the system can get damaged,” he says. “Docking every time the weather gets rough is obviously not an option for a system designed to eventually operate autonomously by the thousands. “The goal is to produce aerodynamic lift as well as buoyant lift, making it less prone to getting buffeted around by the wind. In fact, in high wind conditions our system actually behaves from a dynamic perspective more like a kite than a balloon, which gives us more control authority without inflicting damage on the shroud, tail load or tethers.”

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Composites Add Thermal Efficiency to Solar Decathlon

A group of students from Rutgers, the State University of New York and the New Jersey Institute of Technology (NJIT) comprise what is known as Team New Jersey. Together they are one of twenty college teams competing in the 2011 Solar Decathlon, sponsored by the U.S. Department of Energy (DOE). The aim of the competition is to build the most cost-effective, energy-efficient and attractive house using optimal energy production. This year, Team New Jersey constructed the first precast concrete sandwich panel house, dubbed the ENJOY house, ever to be entered into the competition. By using precast concrete sandwich panels with less steel and more fiberglass products, the team wants to highlight the use of composites in their energy efficient, “passive” house design.

Unique to the Team New Jersey design, the passive strategy focuses on using basic architectural design techniques to reduce thermal transmissibility through insulative materials. “By strategically using fiberglass in the windows and reducing transmissibility in the frames, we actually ultimately do less work to keep a constant temperature in the house,” says Richard Garber, NJIT associate professor and Team New Jersey faculty leader.

Concrete was chosen for its thermally efficient properties such as its ability to retain heat absorbed during the day and effectively release it at night. “We were trying to stay away from using steel because it expands and contracts differently than concrete, causing steel connectors to crack the concrete and transmute heat into the house,” says Garber. The concrete walls are framed with steel rebar to withstand the heavy weight of the concrete roof and solar panels instead of using an earlier proposal for an epoxy carbon fiber grid for reinforcement. However, some of the panels were intentionally designed with less steel to reduce thermal transmission, the window frames were designed with pultruded fiberglass and the team used fiberglass connectors from Hughes Brothers in Seward, Neb., in the wall, roof and floor panels.

The Anatomy of the Concrete Sandwich Panels

The design of the concrete sandwich panel for the Solar Decathlon house was developed by John Ruga, president of precast concrete manufacturer, Northeast Precast in Millville, N.J. In order to cast the walls, first the team set up the rebar in the formwork. Next, they poured a three-
inch layer of precast concrete. Then they laid out six inches of polystyrene insulation mixed with Nuopor, a new insulation solution from BASF that includes graphite, and placed Aslan 700 fiberglass connectors on top. Another layer of rebar was then applied along with floor connections before another three-inch layer of concrete was poured into the formwork. So, as opposed to traditional precast concrete panels manufactured with concrete on the exterior and traditional mortar and wood on the interior, the groups’ panels use the fiberglass ties to assemble concrete panels on the interior and exterior of the house, increasing the properties of concrete and fiberglass to insulate the house.

Compared to similar one-story houses, these sandwich wall panels have an R-value, or a measure of thermal resistance, of 30.0 when traditional wood frame houses have an approximate R-value of 21.0.

One challenge the team faced when building the concrete panels was fulfilling the stipulation that the building solutions had to be front loaded and integrated into the precast sandwich panels by the students. Professionally, a fabricator would design the shop drawings, including a layout of the house systems such as plumbing, electrical and fumigation. But since Northeast Precast was donating its time and services, the students were left to integrate the building systems.

Jen Switala, a recent master’s graduate from NJIT and the student leader for Team New Jersey, says that the significance of using precast concrete in the house design will make more people aware of what sustainable really means. “The housing industry feels to be sustainable is to put solar panels on the house and use green materials. I would like to see the housing industry move to make the whole house sustainable,” she says.

Garber agrees, “There is more sway of public mindset that needs to happen and we think our little house will be a part of that,” he adds. “I actually think that this kind of home material science is going to develop so quickly that it will beg consideration in building products. I would like to see more cost-effective, maintenance free and energy efficient technology in U.S. houses. Not to mention, it looks cooler.”

Team New Jersey will ship their entry to Washington, D.C. to display on the National Mall from September 23 – October 2, 2011. They expect that their design, which also includes a solar panel roof and water runoff to recycle rain water, to be very competitive in the Solar Decathlon.

Angie McPherson is the communications coordinator at ACMA. Email comments to amcpherson@acmanet.org.
The astronaut Neil Armstrong once said, “Research is creating new knowledge.” Think about all the innovative ideas and applications that have revolutionized the composites industry in the past five, 10 and 20 years. Many of them began with basic science in a university laboratory, and then blossomed into applied science and ultimately a technology transfer.

Research and development in higher learning institutions around the globe is critical. It leads to breakthroughs that benefit industry and humanity. Composites Manufacturing did some research of its own to present a sampling of noteworthy achievements from various universities. Their research has led to new knowledge about nanocomposites, bomb-proof containers, fire-safe structures and more.
Proponents of composite materials know the benefits of FRP composite bridge decks: They are resistant to corrosion and fatigue, lightweight and strong. Composite bridge decks can be installed rapidly and require significantly lower maintenance compared to steel grating. The catch is convincing civil engineers that FRP composite bridge decks are right for rehabilitating existing bridges and constructing new ones. Engineers want proof of the structural properties. A research team from Bristol University is providing it—on a large scale.

Wendel Sebastian, a senior lecturer in civil engineering at Bristol, built and tested a prototype of a full-scale bridge at the university’s structures lab. The bridge, which is 8 meters long and 3.65 meters wide, comprises glass fiber triangulated composite decking and prestressed concrete beams. The joints are bonded solely by adhesives, between adjacent advanced composite deck modules as well as between the composite deck and concrete beams.

“Bonded composite-to-concrete joints have been investigated previously, but not in the context of strengthening existing concrete beams where thin composite strips are attached to cracked concrete,” says Sebastian. “In our project, the entire structure is new. The flanges of the composite units are thick and the prestressing should strongly inhibit cracking of the concrete.”

A team of practitioners serves as advisors on the project, including structural engineers, a contractor, bridge owners and composite materials suppliers (Fiberline Composites in Denmark and Weber Saint-Gobain in France). They are interested in how the test bridge reacts when subjected to millions of cycles of realistic car loading.

“By using high cycling rates, millions of car passages can be simulated in reasonable time frames in the lab,” says Sebastian. “Also, the external actions on the bridge can be carefully monitored and quantified, enabling reliable assessment of both the actions on the bridge and the response of the bridge to those actions.”

Using the prototype is a great alternative to testing a real road bridge (that would require considerable time for the passage of millions of cars) or testing individual joints, which lack the interface between the joints and the remaining structure. In addition, testing full-scale decking and beams is advantageous. “Scaled-down specimens notoriously introduce unrealistic factors into the resilience of materials such as concrete, which fail in a brittle manner,” says Sebastian.

The university lab relies on state-of-the-art strain, pressure and load sensors to quantify the response of the bridge to the applied loads. It uses vertical servo-hydraulic actuators to simulate loads from the tires of cars rolling along the composite deck. Researchers are performing tests with and without anti-skid surfacing on the deck. Future work includes simulating the combined effects of weathering and car loads. Sebastian says results will be incorporated into design guidelines for the composites and engineering communities.
Nanocomposites Have Big Potential

**Project:** Nanocomposites made from cellulose  
**School:** University of Maine  
**Location:** Orono, Maine  
**Director:** Douglas J. Gardner

While most researchers think big, Douglas Gardner thinks small—really, really small. The professor of wood science and technology leads the Nanocomposites Research Group at the Advanced Structures & Composites Center at the University of Maine (AEWC). Nanocomposites are composites with dimensions less than 100 nanometers. Just how little is that? The average width of a single human hair is approximately 50 micrometers: One nanometer is 1/50,000 the width of a human hair.

The focus of the research group is to utilize lower-cost nanocomposites made from cellulose (the main part of plant cell walls) to develop the next generation of lightweight, high-performance, bio-based materials for a variety of defense, infrastructure and energy applications. “Cellulose derived from wood—Maine’s most abundant natural resource—is a promising source for low-cost, renewable nano-structured materials,” says Gardner. He envisions new applications for automobile components, additives in paint and coatings, aerogels, barrier coatings, water filters, tissue scaffolds, scaffolds for catalysts and more.

Adding small amounts of cellulose-based fillers to thermoplastic matrix polymers to create nanocomposites can enhance the mechanical, thermal and barrier properties, says Gardner. Cellulose fibers exhibit low density, low damage during processing, biodegradability, low energy on processing equipment, high stiffness and a relatively low price compared to inorganic fillers, he adds.

Gardner and his fellow researchers received a boost recently when AEWC added a new, world-class nanocomposites laboratory to manufacture and test nanocomposites on a pilot scale. The research group has manufactured cellulose nanofibril-filled thermoplastic composites and characterized those materials using mechanical tests and thermal analysis. It’s currently examining the drying of cellulose nanofibrils via spray drying in a pilot program at the university’s Forest Bioproducts Research Institute. In addition, The University of Maine has a cooperative research agreement with the U.S. Forest Service Forest Products Laboratory to produce nanofibrillated cellulose on a pilot scale.

Though Gardner is unaware of any significant commercial applications, there are scale-up activities to produce considerable quantities of cellulose nanofibrils in Canada, Europe and Japan.

These scanning electron micrograph are examples of cellulose nanofibrils at 200x the actual size.
**From Research to Reality**

**Bomb-proof Solution is in the Bag**

**Project:** The Fly-Bag  
**School:** University of Sheffield  
**Location:** Sheffield, United Kingdom  
**Director:** Jim Warren

As terrorists increasingly targeted airlines by planting bombs in passenger luggage, Jim Warren turned his attention to preventing catastrophic damage to planes. Warren and his research team in the University of Sheffield’s Department of Civil and Structural Engineering developed the Fly-Bag, a flexible container to hold passenger luggage. It features multiple layers of fabrics, composites and coatings designed to absorb a bomb blast.

“The Fly-Bag works like a high-strength balloon,” says Warren. “In the event of an explosion, it stretches slightly, holding the explosive gas and fragments inside. Then it gradually allows the gas to escape into the hold at a rate the vent valve in the plane can deal with.”

The Fly-Bag is an alternative to hard luggage containers, which are expensive and heavy. In addition, they don’t fit in many narrow-body aircrafts. “Hard luggage containers give airlines a large capital and ongoing fuel cost,” says Warren. “We saw a need for a low-weight, lower-cost solution.”

The proprietary Fly-Bag uses several different high-strength, Aramid-based fabrics, some of which have yarns coated with shear thickening fluid. The inside of the bag is coated with a high-strength elastomer that acts as a gas seal and the floor is constructed of a glass fiber sandwich. “The floor plate had to be stiff enough to accept bags and workers, but lightweight and able to decouple the blast shock,” says Warren.

The researchers tested several sandwich architectures by detonating explosives on a standard fabric pack on the sandwich and comparing the performances. “We required something that spreads the load temporally and spatially,” says Warren. “From the lessons we learned in the tests about fiber concentrations, resin types, resin process, foam infill and relative sandwich thickness, we honed in on what we wanted.”

The team designed two rigs for testing multiple layers of various materials—one small and one large. In small-scale tests, Warren’s team assessed the stiffness and burst strengths of fabrics under high-rate loading and quasi-static pressure loading. They used a small-volume pressure chamber venting into a similar chamber, closed at its free end with fabric. Based on those results, the team selected materials for a large-scale test in a 1 x 1 x 1-meter steel box open on one side. The opening was covered with the composite fabric and explosives were detonated beneath it.

A prototype of the full-size Fly-Bag has been tested using actual luggage. “It worked as planned!” says Warren. The University of Sheffield is now working to produce the Fly-Bag, either by licensing the technology or partnering with a consortium of European companies.

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A prototype of the Fly-Bag is attached to the hold of an Airbus A319.
Imagine if something goes wrong with a military ground vehicle during a mission in the Iraqi deserts. Should the tank commander abort the mission or continue? Researchers at the Composite Vehicle Research Center (CVRC) at Michigan State University are working on self-diagnostic composites to help the U.S. Army make such decisions. “Having embedded sensors in these vehicles would allow the military to evaluate the vehicle’s condition immediately without getting out,” says Nicholas J. Gianaris, director of the CVRC.

Under the direction of Soonsung Hong, assistant professor of mechanical engineering, a research team is developing fiber-optic sensors embedded in smart composites as well as laser-optic diagnostic tools to detect very small flaws in composite structures, such as the chassis or body panels of a military ground vehicle. The goal is to prevent catastrophic failures of composite structures in ground, air and marine vehicles without expensive tear-down inspections, says Hong. The structure would diagnose its own health and residual life through real-time monitoring.

The work on self-diagnostic composites is just one project conducted at the CVRC, which was founded in 2007 in partnership with the U.S. Army and Navy. “The mission of the center is to support composites research and implementation of that technology on any type of vehicle for the air, ground and sea,” says Gianaris. Other areas of focus at CVRC include multi-functional composites, composite joining, design and manufacture, biomimetics, structural integrity and impact resistance.

Hong’s research applies to commercial vehicles as well as military ones. “Self-diagnostic composites can be used with intelligent vehicle dynamics systems engineered by companies such as Ford and General Motors,” says Gianaris. “Systems such as GM’s StabiliTrak and other traction control systems depend heavily on sensors to keep the car stable on a curvy and slippery road. Our research can reduce the weight and complexity of passenger vehicles that use these safety systems.”

The CVRC is forming an industrial collaboration center to help grow its applied research and technology projects. “We want to take the results of the work we are doing and transfer it to companies,” says Gianaris. Having tested its capabilities on smaller components in the lab, the CVRC wants to build a full-scale vehicle and demonstrate the potential of composites, including self-diagnostic techniques.

Soonsung Hong hopes his research on self-diagnostic composites will lead to vehicles with smart-sensory systems to detect damage or maintenance needs.
Traveling by train between Rome and Naples, Italy provides breathtaking views of the Mediterranean coast. Halfway between the two cities is the ancient city of Formia, and the Rome-Formia-Naples Railway stops in all three cities. Built in the 1920s, the railway requires maintenance and renovations to ensure it’s safe.

Ruredil, an Italian construction chemical and building materials company, recently worked on a project to upgrade a concrete railway bridge in Formia. The original arch was not reinforced with steel, so the bridge underwent seismic retrofitting to strengthen and protect it against damage from earthquakes, which are prevalent in central Italy. The repairs utilized a fiber-reinforced cementitious system developed by Ruredil’s research partner, the University of Edinburgh.

The university’s Building Research Establishment Centre for Fire Safety Engineering researches structural strengthening systems to improve traditional and new building materials and methods of building repair, particularly at elevated temperatures and in fire. “We are studying the mechanical and bond performance of various proprietary systems consisting of either carbon or PBO fiber open-weave textiles that are adhered to the exterior of structural elements using modified cementitious mortars,” says Luke Bisby, a senior research fellow in structures and fire at the Centre for Fire Safety Engineering at the University of Edinburgh.

The systems are installed using traditional plastering techniques and can be as little as four to six millimeters thick, says Bisby. The external surface looks like concrete. First, a thin layer of cement mortar is applied to the structure’s surface, then the fiber-reinforced textile is laid into the mortar. Afterward, a top coat of mortar is applied. Bisby says the process is similar to the wet layup application of CFRP and GFRP fiber wraps used around the world.

Bisby’s laboratory is currently testing small-scale, reinforced concrete beams, strengthened with carbon or PBO fiber systems, in flexure at room temperature and elevated temperatures up to 392 degrees Fahrenheit (200 degrees Celsius).

“If they can be shown to perform the required structural functions at ambient temperature, then cementitious-based systems may be superior in applications where fire safety considerations cause problems for FRP systems,” says Bisby. He adds that FRP systems suffer reductions in strength, stiffness and adhesion at temperatures approaching the glass transition temperature of the polymer. This either prevents the use of externally-bonded FRP strengthening systems or necessitates the addition of costly external fire protection to the outside of the FRP.

“Polymers are generally combustible and can have poor flame spread and smoke generation characteristics, which can cause problems with respect to fire-safe design goals,” says Bisby. The cementitious matrix/adhesive is inherently non-combustible, eliminating smoke generation and toxicity concerns in many cases, he says.

Other advantages of the fiber-reinforced cementitious system make it an ideal solution for repair of concrete and unreinforced masonry, such as the railway bridge in Italy. It’s thin, lightweight and non-toxic, and it’s fast and easy to apply. The system is widely used in Italy, Turkey and Greece, where there are many old structures and the aesthetics lend themselves to plastered finishes. Structures that have been strengthened with a fiber-reinforced cementitious system include bridges, roofs, domes, tunnels, columns, slabs and beams.
Let Fly with Morphing Technology

Project: Morphing aircraft wings  
School: University of Maryland  
Location: College Park, Md.  
Director: Norman M. Wereley

In an attempt to make aircraft safer, more efficient, and versatile, the aerospace industry introduced morphing technology. Using advanced materials and technologies, morphing aircraft can change from one configuration to another. They can maneuver much like birds. Birds use camber and twist for flight control. In essence, they can alter their wings to switch between cruise and attack mode. The idea of morphing aircraft wings is to mimic this flexibility, thus allowing planes to reduce drag, improve range, reduce vibration, control flutter and expand the flight envelope.

Morphing technology has been implemented in military aircraft such as the F-14 Tomcat, F-111 Aardvark and B-1 Lancer. “The morphing aircraft fielded to date all employ discrete, single-point morphing mechanisms, such as wing sweep, that limit the changes in aircraft performance due to limited changes in vehicle shape,” says Norman M. Wereley, techno-sciences professor and associate chair of the Department of Aerospace Engineering at the University of Maryland. “This approach also creates weak points in the wing structure, which require significant reinforcement and thus incur a substantial weight penalty.”

The University’s Composites Research Laboratory (CORE) is currently developing composite materials capable of large shape changes for use in morphing aircraft wings. Instead of the usual rigid resin, these composites use a flexible elastomeric matrix that has been dubbed elastomeric matrix composite (EMC) skins. The fiber in the EMC is unidirectional, so the skins are very rigid when pulled in the fiber direction. However, they are compliant when pulled perpendicular to the fiber direction.

“Our unidirectional EMCs combine the stiffness of carbon fiber with the compliance of an elastomer, making it capable of supporting aerodynamic loads and deforming when desired,” says Wereley. Previous morphing technologies rely on rigid sliding structures, which can be heavier and less efficient than a continuous aerodynamic surface made of EMC skin, he says.

The CORE lab is developing advanced EMC morphing aircraft skins that combine the high-elongation capability of rubber-like materials with the high-strength and stiffness of advanced fiber reinforcements. The lab also is working on high strain-capable morphing core structures that stretch the skin to allow for transfer of air loads into the primary structures. “Combining these technologies allows for replacement of discrete mechanical morphing structures, such as the F-14 wing sweep, with continuous and integrated morphing mechanisms,” says Wereley.

Recently, the CORE lab successfully wind tunnel tested a working model of a morphing wing capable of a complete change in area.

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The U.S. recreational boat industry took a Titanic-sized hit in 2005, which continues to roil through the nation. In the aftermath of an epic wave of red ink arising from the nation’s floundering housing sector, an anemic recovery has left retail boat sales in the doldrums. Polyester resin shipments to the marine sector have “plunged to horrendous levels,” says Ray MacNeil, owner of Composites Consulting, in Wexford, Pa. Shipments from U.S.-based American Composite Manufacturers Association (ACMA) members dropped from 322 million pounds in 2005, to 86 million pounds in 2009, says MacNeil. Figures for 2010 rose slightly to 120 million pounds.

**Taking Stock and Moving Forward**

Following an onslaught of bankruptcies, consolidations, and downsizing, a tepid recovery portends more pain for the industry.

Boating and housing are inextricably linked, says Phil Keeter, president of the Marine Retailers Association of America (MRAA), in Boca Grande, Fla. “Dealers are holding on tight. I am concerned that 2011 will be no better than 2010, and it could be even worse. Plumbers, electricians, and contractors; those people are highly paid, housing employees who spend their discretionary money on boats. That same holds true for the auto industry. They are our prime buyers,” says Keeter. “I don’t think boating is going to grow in the near future.”

Keeter says the size of the industry is in jeopardy, and thinks it unlikely that U.S. boat manufacturing will return to annual production levels equivalent to the 400,000 boats produced before the economic recession. “I’m not normally a pessimistic person, but it’s been a tough year for dealers. I don’t hear much good news from our members now. It’s not a pretty picture. When business is bad, daily calls from the members get to be kind of a pattern.”

Brock Elliott, general manager and founder of Campion Boats, Inc., in Kelowna, B.C., says his U.S. market sales have nearly dried up. “We’re doing 10 percent of what we used to do in the U.S.” He says his 2011 sales through the end of May hit a record low. “We’re doing 10 percent of what we used to do in the U.S.” He says his 2011 sales through the end of May hit a record low. “It’s been consolidation after consolidation after consolidation.”

Elliott adds that his firm stayed afloat due to his extremely conservative management of the family-owned business. “We sell boats in 30 countries worldwide, and just issued

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**Marine Market Trending Forward**

The American Composites Manufacturers Association (ACMA) Chief Staff Executive Tom Dobbins discusses his view of the marine market moving forward.

**What trends have you noticed in the marine manufacturing sector?**

Those companies unable to build boats are looking to other markets such as wind energy because they have experience in making large quality structures. Also, Europeans are seriously looking into designs that lower the carbon footprint of marine manufacturing such as using bio-resins, epoxy prepreg materials and utilizing carbon fiber composites.

**Are there certain sectors you see more effected than others?**

The entire boat market is depressed and will take a long time in the recovery phase. However, according to Lucintel’s recent Marine Market Report, there is an ongoing shift in product mix toward larger and more expensive boats.

**What is your outtake for the marine market throughout 2011 and moving into 2012?**

Stability, slow and steady. Like all industries, the composites industry needs to stay on a slow steady course yet be flexible to market shifts.

*To read this Q&A in its entirety, visit compositesmanufacturingblog.com*
a press announcement on our first shipment to China,” says Elliott. The company is shipping boats to buyers in New Zealand, Switzerland, and Canada. In contrast, the eco-focused boat manufacturer shipped just one boat to New Jersey in a recent shipment. “We don’t make any money on it, not with one at a time,” he says.

Roch Lambert is group president for Rec Boat Holdings LLC, a subsidiary of Platinum Equity Affiliates’ PBH Marine Group LLC, in Cadillac, Mich. He is now at the helm of the subsidiary of the same company that acquired most of the assets of Genmar Holdings, Inc., in early 2010, following the Minneapolis-based company’s bankruptcy filing in 2009. These assets include boat brands Ranger, Glastron, and FourWinns.

“Some days it’s a little depressing,” says Lambert. “To look at the numbers in aggregate, it’s very bad.” He says when people feel good about their assets, boating is not an obsolete activity. “When the U.S. economy stabilizes, we are going to see a significant increase in volume.” In the interim, he says consumers have responded to a constrained U.S. economy with a huge migration to smaller boats. He says boats larger than 30 feet are a tough sell, resulting in slimmer margins that place additional financial pressure on dealers.

**Crunching Numbers**

Thomas Dammrich, president of the National Marine Manufacturers Association (NMMA), in Chicago Ill., says retail sales of new and pre-owned powerboats fell 3.8 percent from 2009 to 2010, with the average retail price of new traditional powerboats declining 5.8 percent in the same time period. “As for 2011, initial reports show that for the first quarter we’re down about 10 percent. We anticipate that we’ll close out 2011 flat with 2010. Aluminum boat sales are leading the recovery for recreational boat sales, and for the first quarter of 2011 are flat to slightly up — about one percent,” Dammrich said.

“Marine is a big portion of our business and I have a pretty good perspective,” says David Scott, national marine accounts manager for Composites One, in Rock Hill, S.C. “You go back to 2009 — that was the horrific year. That was the year that very few boats were built. However, last year business popped back nicely. There are still a lot of used boats on the market.”

The industry has also responded to the greatly decreased demand by lowering price points, and, at the same time strategically adding touches of luxury, predominately in smaller, leaner boats.

Scott says 2010 was the inflexion point. “This year it’s about how to maintain. There are some hurdles still — financing, and consumer confidence, along with the banking
industry and the debt ceiling — for customers to buy or not to buy. Last year was the recovery year. This year, the first half of this year looks pretty good, although some segments are still struggling,” he says. “Those manufacturers that have survived did so by consolidating and diversifying in manufacturing, selling more skiff-type boats. They are also ratcheting down on the price point and offering new products.”

**Diversifying and Finding Success**

Steve Wetzel is national sales manager for Interplastic Corp., in St. Paul, Minn. “We’ve had to look at other markets to fill in,” he says. “Yet, the big markets for composite companies — building construction, marine, and transportation — all of these took huge hits,” he says. Still, Wetzel says in 2011 the companies that have survived are doing fairly well. “For the people we deal with, sales are up 10 to 25 percent for composite materials purchases in the past 24 months,” he says.

Matt Dunham, owner of Clear Carbon and Components, in Bristol, R.I., says 15 percent of his business is making components for yachts. “I make the jewelry that goes on high-end yachts all out of carbon fiber.” Previously a racing boat manufacturer, he says he has not built boats for years. “I took that technology and made an effort to move into other industries, because the marine industry is a very volatile business. I diversified, and it was an excellent decision,” he says. Yet, Dunham cautions those thinking of a similar strategy that during an historic downturn is not the time to try it. “Those who deleveraged are in a better position now. The companies that have survived are doing well. There’s been a lot of consolidation. In places where there were two producing factory lines, one was weeded out and is now used for storage. The volume is much less than it was. Consolidation cut costs, plus brands have been consolidated too, with one location making multiple brands,” says Wetzel. “I think there’s a feeling from a lot of people that it may never get back to those historical levels again.”

Many firms have clung to proverbial lifeboats through these consolidations. “Surprisingly, there have not

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“When the U.S. economy stabilizes, we are going to see a significant increase in volume. In the interim, consumers have responded to a constrained U.S. economy with a huge migration to smaller boats.”

Roch Lambert, Group President
Rec Boat Holdings LLC, Cadillac, Mich.

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been too many manufacturers that went out of business,” Lambert says. “Even with the Genmar liquidation, the brands survived. Fundamentally I do not see that the structure of the industry has changed, but the depth has changed. At the end of the day, the size of the pool is so many units. Even for suppliers, the business has become more complex for dealers, as each transaction is smaller than it used to be. That’s not a recipe for a successful turnaround in the marine industry. The volume is not going to come back to anywhere near where it was.”

Dustan E. McCoy, CEO of Brunswick Corp., said during the firm’s earnings call on April 28, 2011, the significant decline in the marine retail demand hit bottom in 2010. “But at this early point in the season, we are unable to determine if 2011 marine retail demand will match our plan for a flat market.” He told the company’s investors that smaller boats continue to sell, but that larger fiberglass boats continue to show signs of softness.

McCoy cited statistics indicating a continuing slump into 2011, with first-quarter sales year over year of fiberglass stern-drive and inboard boats declining 25 percent — an improvement from the company’s reported decline of 34 percent in the fourth quarter, year over year.

There is definitely a disparity in sales among different boating segments, says Keeter. “It’s virtually the same story all around the country. You can sell less expensive boats, and to some degree, aluminum boats, but business is down in fiberglass,” he says. “That’s always been the sweet spot.”

**Full ‘Green’ Speed Ahead**

“We’re actually seeing a comeback, and sales are going strong,” says Alan Lang, national-international sales manager for Scout Boats, in Summerville, S.C. His company sells composite sport-fishing boats. “In June, we sold 100-plus boats. As far as we can see, it’s definitely an uptick.” The company, which eliminated wood components in its boats, replacing them with composite stringers and transoms, recently launched a new inshore/offshore 25-foot fishing-boat model.

Pontoon single engine boats — that’s what’s really selling,” says Elliott. “That’s why the market is shifting. Baby boomers demographically are 50 to 65 years old, and they want a big deck, with a big space. They want to go slow, have a barbecue, and put 12 to 13 friends on board. Anything with twin engines, such as luxury yachts, is just about dead.”

Keeter agrees. “The pontoon boat business seems to be the only bright spot. All around the country, we’re seeing some sales in the inexpensive aluminum boat products. The fiberglass market in 18-foot to 30-foot is just deader than a doornail. Anything over 30-foot is down.”

Lambert says he’s steering his company into investing in research on developing new products. “I’m
Fishing Boat Manufacturer Making a Comeback

By Angie McPherson

After three years behind closed warehouse doors and disconnected phone lines, Warrior Boats, once a renowned fiberglass fishing boat manufacturing company, announced they are back in business. This new venture is surfacing questions within the marine industry on how safe the economic waters are for new investments.

Re-spooling the Warrior ownership

In 2008, Warrior Boats ceased operations after previous Owner Dan Klimek’s intentions to purchase the company from Founder Tom LaTour fell through, leaving the company without a unified leadership to continue production. The Warrior website went offline and rumors began to circulate that rival boat company Yar-Craft may step in to buy the Warrior name. However, during this same time, professional walleye fisherman Chuck Barth and Dave Andersen discussed a prospective partnership to keep the Warrior brand in business. “Barth and I have been trying to get the company running for the past year and a half,” says Andersen, 2005 Pro Walleye Tournament (PWT) Championship winner and Warrior customer. When the opportunity to purchase Warrior Boats came to market early this year, Andersen, Barth, and two other fishing fans Joe Hellerman and Al Leinen, entered a bid to secure the future of the company.

Old charm hooks new owners

The new owners are confident in the success of the company because they believe in the Warrior product. According to the group, the Warrior boats, known throughout the fishing world for their successful patented steering technology, run unprecedented horsepower compared similar boat designs. “One of the first things people ask me when they get on my boat is, ‘225 horsepower? Is the sticker on your motor right?’ I get a lot of looks,” laughs Andersen. The Pro-Tiller Hydraulic Remote Steering System allows Andersen’s boat to have quicker, more precise responses compared to that of many other console boats. He attributes his success in the 2005 PWT Championship to his Warrior despite the “nasty, snaggy bottom” and wind he struggled with that day. “I sold Warrior boats for a number of years,” says investor Joe Hellerman, who studied as a marine technician and now works as a dealer at Melrose Marine & Sports. He bought into the company because he liked the design of the boat and the ride. “The hull design, constructed using traditional open molding lay-up with unidirectional layers of Knytex, is arguably one of the best built-in features,” he says. Warrior also employs fiberglass stringers, uncommon in most fishing boats, to provide support to the straight bottom V-hull, and plywood laminated with fiberglass transoms that run the length of the boat. “I know composites are the wave to the future. They have lightweight properties and offer boat rigidity,” says Hellerman.

A new day dawning for fishing boat industry

The group fundamentally came together for one purpose: To bring back a proven fishing boat and make it successful once again. “It was too good of a product to lose,” says Andersen. They each bring separate Warrior perspectives to the newly reformed company, including former dealers, workers, boat dealership owners and pro walleye champion customers.

This year the four owners will be using the same designs with minor cosmetic changes and expect to do more modifications for the 2013 line up. They will offer six of the top-selling models, including the V1890, an 18-foot tiller; the V2090, 20-foot tiller; the V203, which is a 20-foot console boat; the V2121, a 21-foot console boat; and the V177, which is a 17-foot starter boat.

The men expect the new Warrior and its products to increase competition and push fishing boat technology to the next level. “Warrior was the leader in the industry for a number of years because it was the only one where you could install more than a 125 horsepower motor. The company previously impacted the industry and we believe it will continue to do so in the future,” says Andersen. Having a company like this back in the market is a sign there is positive change on the horizon.

“I’ve done some investigating into other boat companies and it seems that even though the economy is bad, the marine industry is still doing well. I talked to the head of Alumacraft in St. Peter, Minn., and they’re on the way to the best season they’ve ever had. Fishing boats must be one of the things people are still spending money on,” says Andersen. “We’re still going out and going fishing, enjoying life a little. I think it will continue.”

The newly relaunched company expects to employ 10 members from the old staff and move the manufacturing plant to a nearby town, presumably in central Minnesota. With new feet in the door and busy phones in their hands, the proud new owners announce, “We’re back.”
a very strong believer that we have to figure out a way to reignite the appetite of the consumer. The sales of used products have been good, but the sales of new products have not,” he says. It’s been a decade since significantly new designs hit the marketplace. To force consumers to step up buying, the company plans to craft new visual designs in the company’s brands.

“Frankly, there are some who shouldn’t be in the boat business. When you look at the infrastructure they have in place to bring a very expensive product to the market, you wonder if they’re going to be here six months from now. It’s complicated building a boat,” says Lambert.

Even pontoon manufacturers are focusing more on leanness. “We’re leaner – especially in regards to our suppliers,” says Greg VanWagenen, director of Marketing and Communications, for Triton Industries, Inc., in Lansing, Mich. “I believe that’s an industry-wide goal. I think procurement is another area where we worked with lesser demand and survived by not stocking much inventory in bulk.”

For Elliott, his company’s relationship as a bio-resin tester with Ashland Chemical, in Covington, Ky., helped define a marketing niche among female buyers, which he says are more interested in eco-friendly products. “My goal is to be the greenest boat builder in the world, to be the environmentally friendly leader in the boat industry and in boat manufacturing,” says Elliott. His move to eco-friendly products began over three years ago, when Ashland Chemical asked Elliott to be a tester. “We built two boats,” he says, “and the lab results show the elongation in bio fibers, which increases the composite’s tensile strength, is better.” In stepwise fashion, the company is going from making foam for upholstery that is soy based, to adopting eco-friendly coatings and resins, says Elliott.

Following the first test, Elliott’s company expanded the use of alternative materials, switching to Ashland’s Maxguard low-emission gel to make the company’s floatation foam. “Under lean manufacturing, it’s an exercise in every step of the product to eliminate waste,” says Elliott. “Our next step is to put resin down for the skin coat.”

Despite the extra costs for bio-resin products, Elliott says these products appeal to 25 to 35-year-old women, a key demographic. “The husband wants a boat, and hopefully the wife will say yes, but, she’ll say, ‘you will buy it from an environmentally-friendly seller.’ That’s our strategy. This is who is buying the Prius.”

Jan Fletcher is a freelance writer based in Spokane, Wash. Email comments to jan.fletcher@me.com.

For more stories like this, visit www.compositesmanufaturingblog.com and search using keyword "boat industry"
ACMA’s GAC Keeps an Eye on OSHA

In a January 2010 Federal Register notice, OSHA noted that its effort in the 1980’s to update the PELs (worker exposure limits for hazardous substances) was unsuccessful, and asked for input and suggestions on the need for updating PELs.

OSHA Chief David Michaels observed that the agency needs to “move forward on a number of difficult issues, including Permissible Exposure Limits.” He also observed that OSHA had not decided whether to move forward on these issues through “regulatory activity, Congressional action, or some other means.”

OSHA held a Web forum to solicit nominations on the top chemicals of concern and received more than 130 nominations. Among those, 11 nominations included styrene.

The current styrene PEL is 100ppm, but the styrene industry supports compliance with a voluntary 8-hour-average exposure limit of 50ppm to prevent mild reversible effects such as drowsiness and delayed response time. California OSHA, which currently enforces the 50ppm level, is expected to review recent styrene data and consider revising the state PEL next year. Styrene and composite-resin suppliers in Europe, under the REACH chemical risk management program, have recommended an 8-hour workplace exposure limit for styrene of 20ppm.
Resin Spray Fire Safety

The Problem:
Composite open molding operations are required to comply with the OSHA fire safety standard for operations using spray application of flammable liquid. However, the OSHA standard is based on spray painting, a process that is much more hazardous than resin and gel coat spray.

The Solution:
Following a multi-year program with the National Fire Protection Association (NFPA), the composites industry was able to secure a chapter in the NFPA spray application standard (NFPA 33) especially for composite resin applications. The action then moved to OSHA, and in a December 2006 Federal Register notice, OSHA invited submission of information that could be used as the basis for updating the flammable liquid spray standard. The industry submitted an extensive collection of fire test and plant inspection reports in support of an updated NFPA 33 Standard adoption.

The industry also sponsored a Fire Hazard Analysis by a fire safety engineer, who found that NFPA 33-compliant composite resin and gel coat spray operations provided a reasonable and adequate level of protection against fire and explosion. A separate vapor concentration test found that even under worst case conditions, composite spray operations do not generate flammable vapor concentrations exceeding the OSHA trigger for risk of fire and explosion.

Moving Forward:
Successful completion of these major projects resulted in an informal opinion by the OSHA Standards Branch that the industry has demonstrated both the adequacy of NFPA 33 in protecting against fire and explosion, and the equivalence in protection of NFPA 33 and the OSHA standard when applied to composite operations. In early 2010 this was followed by issuance of an interpretation letter, clarifying that the agency’s de minimis policy applies to NFPA 33 for composite operations — specifically, employers do not need to comply with the OSHA regulation provided that they are in full compliance with the provisions of NFPA 33.

Combustible Dust
Many dusts generated in composite product finishing operations are combustible when tested using OSHA-approved methods. According to OSHA’s National Emphasis Program, dust generating operations must comply with the NFPA 654, and later this year OSHA will propose its own standard for operations generating combustible dust. The standard is expected to require periodic inspections and housekeeping to prevent dangerous dust accumulations. OSHA is expected to open a formal process to obtain input from small companies later this year.

As part of a 2010 ACMA webinar on combustible dust hazards, OSHA engineer Sanji Kanth provided data in the table below, showing OSHA citations for establishments with NAICS codes 3363, 3369 and 3261. These NAICS codes represent a large proportion of composite manufacturers. The table includes citations for October 2007 through April 2010. According to Kanth, many of the "general duty clause" violations were related to combustible dust.

<table>
<thead>
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<td>Spray Finishing</td>
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<td>Personal Protective Equipment</td>
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<td>Respiratory Protection</td>
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<td>Lockout/Tagout</td>
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<td>Electrical General Requirements</td>
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<td>1910.305</td>
<td>Electrical (Wiring Methods, Components and Equipment)</td>
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<td>1910.307</td>
<td>Electricals, Classified (hazardous) Locations</td>
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<td>1910.95</td>
<td>Occupational Noise</td>
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<td>OSHA Act of 1970 Sect. 5(a)(1)</td>
<td>General Duty Clause</td>
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</tr>
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</table>
October 2010
In a Federal Register notice, OSHA proposed to issue an interpretation of the term “feasible administrative or engineering controls” as used in the general industry and construction occupational noise exposure standards and to amend its current enforcement policy to reflect the interpretation. This change was intended to better protect the hearing of approximately 30 million workers who are exposed to hazardous noise each year.

What does that mean?
OSHA’s noise standards specify that feasible administrative or engineering controls must be used to reduce noise to acceptable levels and that personal protective equipment such as ear plugs and ear muffs must be used only as supplements when administrative or engineering controls are not completely effective. Under the agency’s current enforcement policy, the agency issues citations for failure to use engineering and administrative controls only when they cost less than a hearing conservation program or such equipment is ineffective.

Industry Response
ACMA participated in a multi-industry effort to respond to OSHA’s proposed enforcement policy change. After being bombarded with complaints about the high cost and lack of any demonstrated improvement in worker health, OSHA abandoned the proposed change.

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Injury and Illness Prevention Program

There are approximately 5,000 workplace fatalities and 3.5 million serious workplace injuries each year. There are also many workplace illnesses caused by exposure to common chemical, physical, and biological agents. OSHA believes an injury and illness prevention program is a universal intervention that can be used in workplaces to dramatically reduce the number and severity of workplace injuries.

Currently OSHA is developing a rule requiring employers to implement an Injury and Illness Prevention Program. It involves planning, implementing, evaluating, and improving processes and activities that protect employee safety and health—and it has substantial data on reductions in injuries and illnesses from employers who have implemented similar processes. An injury and illness prevention rule would build on current guidelines as well as contain lessons learned from successful approaches and best practices under OSHA’s Voluntary Protection Program Safety and Health Achievement Recognition Program and include similar industry and international initiatives such as American National Standards Institute/American Industrial Hygiene Association Z10 and Occupational Health and Safety Assessment Series 18001. Currently twelve States have similar rules.
Advancing Composites through Education

One thing all strong companies have in common is their demand to be at the forefront of technological development. This is especially true in our industry where new innovations lead to newer products, manufacturing techniques and advantages over the competition. Regardless of the continued economic ebb and flow, advancement begins with education. It is important that as an industry we continue to create opportunities for composite products to be built better, faster, safer and cheaper.

I encourage you to get involved in ACMA committees, events and conferences to ensure that your company stays informed of industry trends and events. The best way to ensure your employees know the ins and outs of composite manufacturing techniques is by getting them certified through our Certified Composites Technician (CCT) programs. Take advantage of our exclusive webinars conducted by industry leaders, and make sure to carve out time for COMPOSITES 2012 educational sessions. There are huge opportunities ahead of us, don’t miss your chance to be part of industry advancement! For more information on the opportunities that await, visit www.acmanet.org.

Tom Dobbins, CAE

Relaunch of The Automotive Composites Alliance

The ACA will meet at the SPE ACCE Conference on September 12. Chaired by Mark Murfitt, Core Molding Technologies, it is an open meeting to all members and non-members interested in composites within the automotive industry. To learn more, contact Mike Dunn at mdunn@acmanet.org.

CGI Committee Spearheads new ANSI Standard

The ACMA Pultrusion Industry Council (PIC) developed a new industry document titled: Code of Standard Practice for Fabrication and Installation of Pultruded FRP Structures, To learn more, contact John Busel at jbusel@acmanet.org.

Can You Answer These Questions about Closed Molding?

1. What are the primary means for controlling the resin flow and fill rate?
2. On average, how many parts does it take to recuperate the cost of the silicone bag used in CCBM?
3. What is the purpose of the vacuum bowl assembly?
4. What is the function of a flange cavity in the LRTM process?

Certified Composites Technicians (CCTs) can.

Learn more about the American Composites Manufacturers Association’s new CCT-VIP and CCT-LRTM programs (and see how you scored) at www.compositescertification.org

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Geneva, Ohio
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Kelowna, British Columbia, Canada
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Kurt Neher, CCT
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Bradenton, Fla.
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Michael Steckelberg, CTC-VIP
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“We need to increase our technical knowledge to support future hypersonic technology development.”

Dave Neyland, director of U.S. Defense Advanced Research Projects Agency’s Tactical Technology Office, on the launch of the world’s fastest aircraft manufactured using carbon composite materials.

“I’m not some heavy environmentalist; I do this because it’s good business.”

Andy Cukurs, CEO of Suzlon North America, announcing the new S9X turbine that will make it cheaper to produce electricity from less wind.

“This is not just another microfluidic device. It’s not just a widget on a chip. It’s a structural material that’s capable of many functions that mimic biological systems. That’s a big jump.”

Nancy Sottos, professor of Materials Science and Engineering and a professor of Aerospace Engineering at the University of Illinois, on new biological vascular composite technology.

“Fiber composites, on their own and in combination with traditional construction materials, will have a big part to play in the successful rebuild and restoration of Christchurch.”

Bobbie Mortensen, president of Composites Association of New Zealand (CANZ), during a seminar showcasing composites technologies useful in rebuilding cities after natural disasters.

“This vehicle will mark the launch of the first volume-produced car featuring bodywork largely made of carbon. It’s a revolution in automotive design.”

Klaus Draeger, member of the Board of Management of Development and Purchasing at BMW AG, on the all-electric BMW i3 scheduled to launch in 2013.

“If we can get whole assemblies that are made out of recycled material then it’s easier to get that incorporated in the airplane. We’ve cracked that nut.”

Bill Carberry, program manager of Composite Recycling at Boeing. Boeing is nearing the implementation of its composite recycling effort for its 787 program.

To read these and other composites breaking news, visit compositesmanufacturingblog.com and click on “Composites in the News.” For daily composites updates, follow us on Twitter @cmmagazine.
Lockheed Martin’s Future Composites Strategy

Mike Packer is vice president of Manufacturing Strategy and Technical Integration for Lockheed Martin Aeronautics. He is responsible for modernization initiatives, production engineering and technology, industrial engineering and workforce development across all company programs at seven production facilities. He previously served as director of F-22 productions, director of Joint Strike Fighter manufacturing and key positions for the company.

The Growing Role of Composites in Offshore Energy

Nick Murphy is the commercial manager for OpenHydro in Dublin, Ireland, which manufactures and installs tidal energy-generation systems. The company’s next major project is to deploy an array of 13 feet x 52.5 feet open-centre turbines in the Paimpol-Bréhat (Côtes d’Armor) region of Brittany, off the coast of France. This will be the first project featuring OpenHydro’s 52.5-meter turbine.

Lexus’s Last Minute Switch to Composites

Paul Williamsen is the national manager at the Lexus College, a Lexus division of Toyota Motor Sales, U.S.A., Inc. He has worked for Toyota since 1989 and is currently responsible for the education and development for Lexus sales associates in the U.S. Most recently, Williamsen has helped develop a number of programs in support of the 2012 composite Lexus LFA supercar.

Ways Composites Can Create a Win-Win

J. Frank Crane is founder and president of JFCI Composites Group, with locations in Tampa, Fla., and Washington, N.C. Crane’s name is well recognized in the marine composite field, as he has been a go-to person for many years, pulling together teams for a variety of marine composite projects. Crane’s organizational skills in project management were tapped in the manufacturing of the composite superstructure for the Swift 141.

To read the interviews with these and other leading members of the composites industry, visit www.compositesmanufacturingblog.com and click on “Q&A Interviews.”
Confounded Composites!

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

The world’s longest composite bridge now connects Barter’s Island Road from Hodgdon Island to the coastal town of Boothbay, Maine. This bridge, named the Knickerbocker Bridge, includes 64 award-winning hybrid composite (HC) beams and is anticipated to last over 100 years.

To read more about the Knickerbocker Bridge, turn to page 6.
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Composites bridge photo courtesy of Harbor Technologies
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