



TOP STORY

COMPOSITES TEAM RECOGNIZED FOR INNOVATIVE TECHNOLOGY

The Hybrid Composite Beam (HCB®) sounds almost too good to be true—it's lightweight, strong, corrosion resistant, simple to fabricate, and inexpensive to transport and erect. But thanks to a collaboration between the inventor and a team of researchers at UD-CCM, hundreds of cars, trucks, and trains are traveling over bridges made with these novel beams every day.

ASCE AMERICAN SOCIETY
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Presentation of the 2013 Charles Pankow Award for Innovation for Hybrid-Composite Beam (HCB®). Left to right are: Executive Director Patrick J. Natale, P.E., F.ASCE; Nick Shevchenko, Steve Millsap, Duane Otter, John Hillman, Jack Gillespie, Bob Skinner, and ASCE President Gregory E. DiLoreto, P.E., P.L.S., D.WRE, F.ASCE (right). ASCE's 14th Annual OPAL Awards Gala, March 21, 2013.

University of Delaware
Center for Composite Materials

COMPOSITES

UPDATE

April 2013

The university-industry-government team that collaborated on the project recently received the 2013 Charles Pankow Award for Innovation from the [American Society of Civil Engineers](#). The selection committee was “most impressed that HCB offers an important development in structural members for a broad array of uses.”

Along with HCB inventor John Hillman, the team included three CCM members: director Jack Gillespie, bridge engineer Dennis Mertz, and associate scientist Nick Shevchenko. The team was honored at the Outstanding Projects and Leaders Gala on March 21, 2013, in Arlington, Va.

In his acceptance speech, Hillman said UD-CCM “truly stands out as a unique research institution dedicated to bringing innovation to fruition.”

The center's expertise in composites manufacturing, Mertz's experience in bridge design, and the Department of Civil and Environmental Engineering's large-scale testing capabilities turned out to be the combination needed to take the beam from concept to construction.



TOP STORY

Continued



[Click HERE](#)

to watch the Hybrid Composite Beam Video - ASCE 2013 OPAL Gala

The HCB comprises a fiber-reinforced polymer shell with concrete for compression reinforcement and carbon, glass, or steel fibers for tension reinforcement. Because the shells are transported empty and the concrete is pumped in on site, as many as eight beams can be shipped on a truck that can carry only one precast concrete beam. Another advantage is that the composite exterior significantly extends the service life of HCBs beyond that of beams made with traditional concrete or steel—they're expected to last 100 years or more.

"The Pankow Award is especially meaningful because it recognizes the collaboration that's necessary to bring a new technology to fruition and commercialize it," Hillman says. "Awards are usually given to individuals, and what gets lost are all of the others who contributed to the success."

"I knew that Delaware was the only university that had strong capabilities in bridge engineering and every facet of composites characterization, design, analysis, and manufacturing," he adds.

The partnership was a success. In November 2007, more than a decade after the idea for the hybrid beam was conceived, a full-size Norfolk Southern Locomotive pulled 26 loaded coal cars across an HCB bridge at the Federal Railroad Administration's Facility for Accelerated Service Testing near Pueblo, Colo. A little less than a year later, the first highway application of the technology was implemented on a bridge in Lockport, Ill. Since then, HCB bridges have been installed in eight other states, from Maine to Utah.

OPAL
OUTSTANDING PROJECTS AND LEADERS

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THE OPAL AWARDS GALA 2013
MARCH 21, 2013 • RENAISSANCE CAPITAL NEW HOTEL • ARLINGTON, VIRGINIA

AWARD WINNERS
Charles Pankow Award for Innovation

ASCE's 14th Annual OPAL Awards Gala, March 21, 2013
Left to right are: Executive Director Patrick J. Natale, P.E., F.ASCE; Nick Shevchenko, Steve Millsap, Duane Otter, John Hillman, Jack Gillespie, Bob Skinner and ASCE President Gregory E. Diloreto, P.E., P.L.S., D.WRE, F.ASCE (right).

Hybrid-Composite Beam (HCB®)
HC Bridge Company, LLC
Transportation Research Board - IDEA Program
The University of Delaware Center for Composite Materials and Department of Civil and Environmental Engineering, Transportation Technology Center, Inc.

- LIGHTWEIGHT - 1/10th the weight of concrete
- SAFER - capacities exceeding code requirements
- REDUCED CARBON FOOTPRINT - up to 60% less cement than a concrete beam
- CONGESTION RELIEF - through "Accelerated Bridge Construction"
- SUSTAINABLE - 100+ Year Service Life

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About the Charles Pankow Award for Innovation

The Pankow Award for Innovation was established in 1996 to complement existing industry awards. Named for industry visionary Charles J. Pankow, the award recognizes organizations working collaboratively to bring innovative civil engineering ideas into practice.



Bridge 1-351 on Business Rt. 896 in Glasgow DE (above) is one of the first state-owned all-composite bridges in the U.S.

“We launched our initiative to use advanced composites for infrastructure applications in the early 1990s,” says Gillespie. “The challenge has always been to exploit the advantages of these materials—their light weight, strength, and corrosion resistance—while containing costs and automating fabrication.”

CCM’s work in this area was part of a major national initiative launched at that time to marry bridge engineering and composites technology. With funding from the State of Delaware and several federal agencies, the UD team worked on bridges across the nation in the late 1990s.

The work culminated in the design, manufacture, and installation of an all-composite deck on a one-way bridge on Business Route 896 in Glasgow, Del., which was opened to traffic on Nov. 20, 1998. One of the first state-owned bridges in the country, the bridge was selected as the Project of the Year by the Delaware Section of ASCE in 1999.

“The key to using composites in infrastructure applications is finding ways to exploit the inherent benefits of each material in a way that optimizes the overall performance of the combination of materials,” Gillespie says. “The HCB does exactly that, and I’m glad we had the opportunity to contribute to making it a success. Technologies like this can pave the way for broadening the use of advanced composites in highway and railroad bridges as well as marine structures.”

Mertz agrees. “More than a quarter of the bridges in the U.S. are either structurally deficient or functionally obsolete,” he says. “The HCB is an innovative alternative for rebuilding our nation’s infrastructure with state-of-the-art sustainable structures.”

For Shevchenko, the real reward was seeing the CCM effort put into practice. “Our hard work wasn’t just a stepping stone,” he says. “The process we used to infuse the resin into the beam was actually used in production.”

Article by Diane Kukich



Composites center at UD works with Navy, industry

By

Aaron Nathans

The News Journal

Consumers are mostly familiar with composites from the gear found at the local sporting goods store, like batting helmets, bicycles, golf clubs and small boats.

But these days, researchers at the University of Delaware are finding ways to use the material to make the warship of the future, as well as aviation and other industrial applications.

Composites are made from polymers, combined with some type of fiber, most often glass and carbon.

Researchers at the Center for Composite Materials are looking to do more than simply make the ship stronger and lighter, a traditional application of composites. They're looking to create a material that will allow antennas on Navy ships to send and receive the desired signals, and keep out the wrong kind – enemy radar, for instance.

It's part of the second three-year, \$500,000 grant from the Navy to the center, and it's only the latest in a long series of joint ventures with industry and the military. Roughly 300 companies have collaborated with the center over the last 30 years.

The basic research into composites at UD began in the mid-1970s, and it's generally acknowledged today as one of the top composites labs in the country.

Lately, the center has also been working with a major manufacturer to build sensors into the body of aircraft, to obtain more information if a portion of the plane is damaged. The center is also working with the firm to allow composites, which are increasingly being used in aircraft construction, to better handle a lightning strike.



Mark Mirotznik, an associate professor of Electrical and Computer Engineering in the University of Delaware Center for Composite Materials, works with a spool of glass fiber to be made into fabric for customizing. / ROBERT CRAIG/THE NEWS JOURNAL

OTHER NEWS

The center has also worked with sporting goods and medical device companies to make devices that are lighter and stronger.

And the center has worked with the military to make gun platforms that are lighter, so the armored vehicles upon which they are installed are easier and more fuel efficient to move around in a theater of combat.

The first grant, carried out in conjunction with the Naval Surface Warfare Center, Carderock Division, paid for work on a supercomputer, which builds codes to create patterns to weave glass and carbon together.

The second grant, which started this year, is paying to study the electromagnetic properties of the materials woven together on a loom, paid for by the Office of Naval Research and which arrived at the lab about six months ago.

Even though they're not made of cotton, the materials woven together are called fabrics, said Mark Mirotznik, an associate professor in UD's Department of Electrical and Computer Engineering.

Add resin, and the material becomes hard and stronger per pound than steel, and lightweight, he said. That's why it's used in cars, motorcycles and sporting equipment, he said. "How do we redesign these fabrics? We're essentially weavers," Mirotznik said.

Traditional antennas on ship masts are easily detectable by radar, said Shridhar Yarlagadda, assistant director for research at the center, and research professor of electrical and computer engineering. Composites can surround antennas that are instead shaped like an octagonal pyramid, which can be attached to a mast, Yarlagadda said.

But the composites need not be limited to the antennas, he said; they can be used all over the ship.

"Our goal is not to create a single application. We're really creating a toolbox" that will let the Navy and ship designers show what it is they need, so a solution can be developed, Yarlagadda said. There are a few Navy employees working part-time in the lab, seeking their doctorates in electrical engineering at UD, he said. "Anything we can dream of, we can fabricate and test," Mirotznik said. "It's a bit of a Disneyland for a geek."



Glass fiber is woven into fabric at the UD composites center. / ROBERT CRAIG/THE NEWS JOURNAL



The composites center has a computerized loom that allows researchers to build custom fabrics tailored to characteristics of a final product. / ROBERT CRAIG/THE NEWS JOURNAL

EMPLOYMENT

UD-CCM

Positions Available

The Center for Composite Materials in the College of Engineering at the University of Delaware is currently recruiting applicants for the following positions:

Postdoctoral Researcher

This position is in the area of electrical conductivity modeling of carbon composites. Qualifications include a PhD in engineering, physics, materials science or related field with an emphasis in electromagnetic and/or composites. Research work will be aimed at the development of a modeling foundation to capture the fundamental electrical transport mechanisms for CFRP materials. The conduction physics will be developed initially for unidirectional prepreg and extended for other material forms. The influence of high electric currents due to high intensive electrical field will be evaluated. The position requires a good understanding of FEA and multi-physics modeling. Hands on experience in fabricating and testing of composites are also a plus. Good written and oral communication skills are required, as well as the ability to interact effectively with industrial/government sponsors and other CCM staff and students

[To apply for this position, please go to the UD JOBS website.](#)

Postdoctoral Researcher

This position is in the area of thermoplastic process modeling. Qualifications include a PhD in engineering or related field with an emphasis on polymer composites. Applicants are required to be knowledgeable in thermoplastic processing (PEEK, PEKK, PEI), first principle process modeling and finite element analysis. Hands on experience in fabricating and testing of composites is required. Good written and oral communication skills; ability to interact effectively with industrial and government sponsors, as well as other CCM staff and students.

To apply for this position, submit a cover letter and resume to Corinne Hamed at hamed@udel.edu

Postdoctoral Researcher

This position is in the areas of numerical analysis & design and/or process modeling and manufacturing science of composite materials structures. Qualifications include a PhD in engineering or related field with an emphasis on polymer composites. Applicants are required to be knowledgeable in finite element analysis and current state-of-the-art FEA software, possess a solid understanding of the basic principles of structural mechanics and be able to apply these principles to composite structures. Hands on experience in fabricating and testing of composites are also a plus. Good written and oral communication skills are required, as well as the ability to interact effectively with industrial/government sponsors and other CCM staff and students. To apply for this position, submit a cover letter and resume to Corinne Hamed at hamed@udel.edu

EMPLOYMENT

UD-CCM

Limited Term Researcher

This position is in the areas of numerical analysis & design and/or process modeling and manufacturing science of composite materials structures. Qualifications include a Masters in engineering or related field with an emphasis on polymer composites. Applicants are required to be knowledgeable in finite element analysis and current state-of-the-art FEA software, possess a solid understanding of the basic principles of structural mechanics and be able to apply these principles to composite structures. Hands on experience in fabricating and testing of composites are also a plus. Good written and oral communication skills are required, as well as the ability to interact effectively with industrial/government sponsors and other CCM staff and students To apply for this position, submit a cover letter and resume to Corinne Hamed at hamed@udel.edu

INDUSTRIAL AND GOVERNMENT SPONSORS**Engineer, Oxford, PA****[Leading Edge Composites](#)**

Requirements:

- Minimum 2 years experience with a 3D CAD design software package
- Experience in creation, modification, and interpretation of technical engineering drawings
- Basic knowledge of composites manufacturing techniques, materials, and terminology
- Experience with shop tools and measurement equipment commonly used in composites fabrication
- Detail oriented and self motivated, ability to be productive with little or no supervision
- Strong written communication and organizational skills
- Ability to effectively communicate with customers and various shop personnel
- Willingness to learn and research current and future technologies related to composites
- Ability to work well under pressure and short timelines when necessary

Additional Qualities Preferred:

- Experience in composite tooling design
- Knowledge of ISO9001 and AS9100 quality control practices
- Knowledge of FAA – PMA and STC procedures
- Experience with CNC operation and/or programming
- Experience with process engineering and documentation

We encourage skilled and motivated professionals to submit their resumes.

Please send to Sue Corby: scorby@lec-composites.com

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EMPLOYMENT

UD-CCM

Early-Stage Researcher Position, RWTH Aachen University

[3T TextilTechnologie Transfer GmbH](#)

In close collaboration with the Institut für Textiltechnik of RWTH Aachen University, the new employee will work on methodical approaches to analyse and increase energy efficiency in textile machines. The job includes the enrollment in the doctoral programme of the faculty of mechanical engineering at RWTH Aachen University.

[Click here for details.](#)

Employment opportunities are posted on the CCM website as a benefit offered to consortium and affiliated members only.

An Equal Opportunity/Affirmative Action Employer: The University of Delaware is committed to assuring equal opportunity to all persons and does not discriminate on the basis of race, color, gender, religion, ancestry, national origin, sexual orientation, veteran status, age, or disability in its educational programs, activities, admissions, or employment practices as required by Title IX of the Education Amendments of 1972, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, the Americans with Disabilities Act, other applicable statutes and University policy.

Inquiries concerning these statutes and information regarding campus accessibility should be referred to the Affirmative Action Officer, 305 Hullihen Hall, (302) 831-2835 (voice), (302) 831-4552 (TDD).

PUBLICATIONS

NEW

Conferences

Abu Obaid, A., G. Pandey, J. W. Gillespie, Jr., D. Heider, E. T. Thostenson, M. J. Deluca, and C. J. Felker, "Characterization of the Mechanical and Electrical Properties of Carbon Nanotube Yarns," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Chowdhury, S. C., B. Z. (Gama) Haque, and J. W. Gillespie, Jr., "Study of the Mechanical Properties of the Carbon Nanotubes Junction using Molecular Dynamics Simulation," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Chowdhury, S. C., B. Z. (Gama) Haque, and J. W. Gillespie, Jr., "Study of the Stress Wave Propagation in Carbon Nanotubes using Peridynamics Simulation," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Haque (Gama), B. Z., I. Biswas, and J. W. Gillespie, Jr., "Modeling the Depth of Penetration of Very Thick Composites," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

PUBLICATIONS

NEW

Conferences

Haque (Gama), B. Z., R. J. Stanton, and J. W. Gillespie, Jr., "Perforation Mechanics of Thin Composites," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Khattra, N. S., J. J. Tierney, S. Yarlagadda, N. Shevchenko, J. W. Gillespie, Jr., E. S. Schrank, and S. J. Stanhope, "Carbon Fiber Based Custom Orthoses for Augmenting Net Ankle Moment in Gait," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Mueller, J. E., J. W. Gillespie, Jr., and S. G. Advani, "Diffusion as a Bonding Mechanism for Ultrasonically Consolidated Metal Matrix Composites," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Sockalingam, S., M. Keefe, and J. W. Gillespie, Jr., "Detailed Modeling and Analysis of Single-Fiber Microdroplet Test Using Cohesive Zone Approach," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Walter, M. S., S. E. Boyd, T. A. Bogetti, B. A. (Gama) Haque, S. Yarlagadda, S. Sharma, and J. W. Gillespie, Jr., "Modeling Four Quadrant Low Velocity Impact on Thick-Section Composites With and Without Interlayers," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

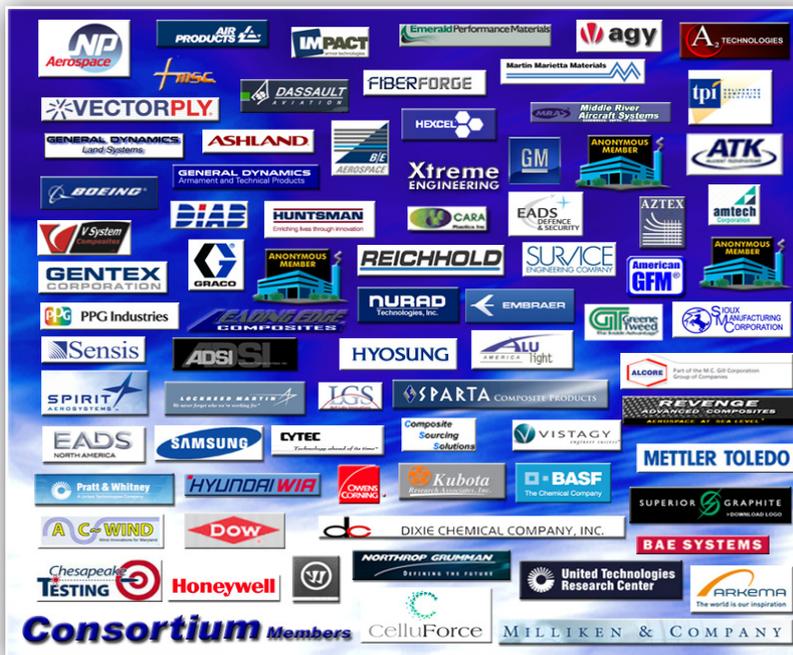
Yarlagadda, S., C. Scott, M. J. Dempah, J. J. Tierney, J. W. Gillespie, Jr., E. Schrank, and S. J. Stanhope, "Rapid Prototyping of Composite Orthoses," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

Zhang, D., D. Heider, S. G. Advani, and J. W. Gillespie, Jr., "Out of Autoclave Consolidation of Voids in Continuous Fiber Reinforced Thermoplastic Composites," SAMPE 2013, Long Beach, CA, May 6-9, 2013.

CONSORTIUM MEMBER NEWS

We would like to thank [Kubota Research Associates, Inc.](#), Hockessin, DE, and [Mettler-Toledo, Inc.](#), Columbus, OH, for the recent renewal of their memberships. We also wish to thank our many other consortium members for continuing to participate in CCM's research and development activities.

To learn more about the benefits of becoming a member, please visit us on the web at www.ccm.udel.edu/Consortium/benefits.html



Celebrating 40 years of significant contributions to composites science and technology, the education of students, and the creation and transfer of technology to industry.

Please visit us on the web at <http://www.ccm.udel.edu>

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CELEBRATING 40 YEARS OF SIGNIFICANT CONTRIBUTIONS TO SCIENCE AND TECHNOLOGY, THE EDUCATION OF STUDENTS, AND THE CREATION AND TRANSFER OF TECHNOLOGY TO INDUSTRY