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Additive Manufacturing: Revolutionizing Connecticut Industry

Many of us have experienced the frustration of trying to assemble a piece of furniture at home. Perhaps, in your haste to complete the job, you break a support bracket. The good news is ... you have a 3D printer, and are able to find the design online for this particular bracket. Now, all you need to do is send the design to the printer, and within minutes, you have "printed" the piece you need to complete the assembly! This scenario is one posed by Louis Manzione, CASE president and dean of engineering at the University of Hartford, as he described the exciting opportunities offered by additive manufacturing, frequently referred to as 3D printing.

Additive manufacturing is not really new. According to David Bourell and Joseph Beaman, professors in the department of mechanical engineering at the University of Texas in Austin in their work, *The History of*

Laser Additive Manufacturing, "The roots of modern additive manufacturing trace back about 50 years, although preceding topographic and photosculpture methods share much in common with additive manufacturing and are over 100 years old." Present day additive manufacturing is a process that uses computer-generated information to add fine, powder-like materials layer by layer and fused by heat or laser to form an object without part-specific tooling. This process allows for the build-up of exactly what is needed, without the waste associated with traditional manufacturing that involves chipping away at material to form a product. The final product of additive manufacturing is very precise and developed for a specific use. According to Manzione, there are two key advantages with this type of manufacturing. First, parts can move to market very quickly as there is little lead time and no tooling costs. Secondly, since molds are not

a part of the process, products can be manufactured in a series of different sizes. This is particularly valuable for manufacturing medical devices that can be individualized for each patient. For example, a prosthetic or artificial hip constructed through the process of additive manufacturing can be made specific to a patient's anatomy, creating a far more comfortable and functional piece.

South Windsor's Oxford Performance Materials (OPM) announced in February that it had received federal approval for its OsteoFab™ Patient Specific Cranial Device (OPSCD), a cranial implant "grown" layer by layer directly from a computer-aided design file. Using a scan from a patient's skull, patient-specific implants can be produced to replace bony voids in the skull due to trauma or disease. Scott DeFelice, president of OPM, noted that "We see no part of the orthopedic

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Steitz Honored with Connecticut Medal of Science

Governor Dannel P. Malloy awarded the 2013 Connecticut Medal of Science to Yale professor Thomas A. Steitz at the 38th Annual Meeting of the Connecticut Academy of Science and Engineering, May 22, 2013, at Quinnipiac University in Hamden.



Governor Dannel P. Malloy presents Thomas A. Steitz with the 2013 Connecticut Medal of Science (Photo: Frank Labanca)

Steitz is the Sterling Professor Molecular Biophysics & Biochemistry and Professor of Chemistry at Yale, as well as a Howard Hughes Medical Institute Investigator. He shared the 2009 Nobel Prize in chemistry with Venkatraman Ramakrishnan and Ada Yonath, for the use of X-ray crystallography to map the position for each and every one of the hundreds of thousands of atoms that make up the ribosome. Steitz' research has focused on the molecular mechanisms by which the proteins and nucleic acids involved in the central dogma of molecular biology carry out gene expression from replication and recombination of the DNA genome, to its transcription into mRNA, followed by the various components associated with the translation of mRNA into protein. Not only are these processes fundamental to all life forms, but many of the macromolecules involved in these processes are known or potential targets for therapeutic drugs.

In 2001, Steitz, along with Susan Froshauer, Yale colleagues, CASE members Peter Moore and Bill Jorgensen, and others founded New Haven-based Rib-X Pharmaceuticals

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From the National Academies

The following is excerpted from press releases and other news reports from the National Academies (www.national-academies.org).

◆ Promoting Diversity in STEM Good for Science, Workforce

Greater diversity in the science, technology, engineering, and mathematics (STEM) fields not only contributes to a stronger US workforce but also creates educational and research environments that can lead to stronger science, according to the authors of "Promoting Access to Undergraduate STEM Education: The Legal and Policy Environment" in the Spring 2013 issue of the National Academy of Engineering's *The Bridge*. However, the authors also note that women and many racial and ethnic populations remain highly underrepresented in these fields. Higher education policies that have historically expanded access and opportunity for underrepresented minorities and women on college

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industry being untouched by this,” and sees enormous possibilities for replacing bones in all parts of the human body. His company has already begun preparing to submit other 3D-printed bone parts for FDA approval—a huge market worth as much as \$50 million to \$100 million for each bone replacement type. Scientists at Oxford University in the United Kingdom announced in April 2013 the development of a 3D printer that can create material which shares some of the same properties as living tissue. This material, which consists of thousands of water droplets encased in lipid films, can perform some cell functions. Researchers say these printed “droplet networks” could be used as the building blocks for delivering drugs to places they are needed, or to replace or repair damaged human tissue.

Mark Blik is the owner of Bolton Works, located on the Pratt & Whitney campus in East Hartford. His company is dedicated to 3D scanning for inspection and reverse engineering of complex aerospace components. Blik notes that the first commercially available rapid prototyping machines—another term for additive manufacturing—were developed in 1986 by 3D Systems of Rock Hill, SC, and were used to make prototypes of parts that were difficult to produce



At Bolton Works in East Hartford, a plaster rooster garden sculpture, left, was purchased online and 3D scanned. The scanned data was then printed on one of the company's 3D printers. The 3D printed version is on the right.
[Photo: Bolton Works]

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using other manufacturing techniques. He believes the current boom in interest is a product of President Obama’s Advanced Manufacturing Partnership Initiative “to create high quality manufacturing jobs and enhance our global competitiveness” as well as the Internet, which makes information about 3D printing broadly available. Furthermore patents for certain kind of additive manufacturing machines have expired, allowing companies to offer low cost alternatives.

Although he sees great potential for this technology in manufacturing of complex high-value parts or one-of-a-kind pieces, he does not see 3D printing replacing traditional methods on a wide-scale basis due to the high cost of materials and slow production rate associated with additive manufacturing techniques. Blik explained that additive manufacturing has a great fit with 3D scanners, like the eleven million pixel one operated by Bolton Works that can detect the smallest details from every perspective and translate that information into a digital file that then can be altered according to the goal of production. As Blik noted, with additive manufacturing, “complexity doesn’t come at a high cost” and its applications are limited only by one’s imagination. The notion of not being limited by traditional manufacturing techniques has not been lost on designers and sculptors, who use scanning to bring objects into the 3D world where they can use software to alter the data any way they see fit. The end result is then 3D printed. To illustrate this process, a plaster cast of a rooster was purchased on Ebay by Bolton Works and 3D scanned. The 3D data was enhanced by removing blemishes such as cracks, then printed on one of the company’s 3D printers.

In April, Pratt & Whitney announced that it had invested \$4.5 million in the Pratt & Whitney Additive Manufacturing Innovation Center and, over the next five years, will invest more than \$3.5 million more in the facility. The center is a partnership with UConn and is located at the university’s Depot Campus in Storrs. It will house the first of its kind training program in the United States. This project is aligned with the federal initiative. CASE member and Interim Dean of UConn’s School of Engineering Kazem Kazerounian is very excited by this initiative as it presents a “new model of a working industry and entails a significant investment from the university.” He notes that the machines used are state-of-the-art, including two Arcam A2X machines that use electron beam melting technology (EBM)—the only machines using EBM in the Northeast and the first Arcam A2X machines to be installed in North America. The combination of Pratt’s expertise in research, development and production with the university’s work with material genomics—the science of understanding how materials work at the atomic, molecular level—creates what can only be termed “an A Team” that in the long run will “significantly and substantially cut down on the time needed to do new development.”

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Science and Engineering Notes from Around Connecticut



Biomedical Research

IMSTEM JOINS UCONN TECH INCUBATOR. On February 18, **ImStem Biotechnology Inc.** announced it will join **UConn's** Technology Incubation Program (TIP). ImStem will commercialize the technologies developed by **Ren He Xu**, director of the UConn Stem Cell Core, and **Xiaofang Wang**, who joined the company as its chief technology officer. Xu has generated new human embryonic stem cell lines with support from the state's \$100 million stem cell program. ImStem seeks new approaches for using human embryonic stem cell lines for future applications, including a treatment for multiple sclerosis. The company now operates with financial support by investor and co-founder **Michael Men**. Another founder, **Xinghua Pan**, is researching stem cell genomics at **Yale**.

CT BIOMED RESEARCH FUND AWARDS GRANTS. On March 28, state officials in Hartford announced awards totaling \$3,010,611 from the state's **Biomedical Research Trust Fund**; the awards will support nine research projects conducted by researchers from the **UConn Health Center** and **Yale University**. Two UConn researchers and seven Yale researchers received grants. The fund was established in 2000 to redirect revenues from the state's tobacco settlements to biomedical research. With this eighth round of proposals, nearly \$14.5 million has been awarded to Connecticut research institutions for the purpose of funding biomedical research into heart disease, cancer and other tobacco-related diseases, as well as Alzheimer's disease and diabetes. In April, State Senator **Joseph J. Crisco, Jr.**, Chief Deputy President Pro Tempore, won unanimous Senate approval for his initiative to expand the fund to include grants for studying the cause and cure for strokes. "Researchers already know several risk factors with regard to stroke that include high blood pressure, atherosclerosis, and tobacco use, each of which aligns perfectly with the original purpose of the Biomedical Research Fund," Crisco said.

STEMCONN 2013 HELD IN NEW HAVEN. **StemCONN 2013**, a day-long symposium bringing together stem cell researchers, was held April 4 in New Haven. The event included a display of scientific posters featuring research ranging from the use of stem cells as therapeutic agents to the mechanisms regulating stem cell activity and their utility as models of disease. Other events included a panel discussion on "Realizing the Potential" that included CASE members **Edison Liu** of **The Jackson Laboratory** and Jonathan Rothberg. Connecticut research was presented by CASE member **Laura Grabel** of **Wesleyan University**, **Jonathan Covault** of **UConn Health Center** and **Jun Lu** of **Yale University**.

\$10M FOR YALE RESEARCH ON INFLAMMATION AND CHRONIC DISEASE. On April 8, **Yale University** announced that a \$10 million grant from the Blavatnik Family Foundation, a foundation dedicated to the advancement of breakthrough scientific discoveries, will be used to test a new theory of inflammation and chronic disease. The grant supports the work of two CASE members, immunobiologists **Ruslan Medzhitov** and **Richard Flavell**, who offer a unifying theory to describe how inflammation can impact the body's homeostatic control mechanisms triggering disease. Medzhitov is known for his role in furthering an understanding of the innate immune system and Flavell, who chairs Yale's Department of Immunobiology, has pioneered studies on the control of inflammation by the innate immune system. Yale President-elect and

CASE member **Peter Salovey** expressed Yale's gratitude, stating, "The research now underway in the Medzhitov and Flavell laboratories has the potential to transform our understanding of human biology and our approaches to the most intractable diseases. This grant will accelerate their work at Yale's Department of Immunobiology."



Business & Industry

QUANTUM ACQUIRES IMAGING TECH FIRM. **Quantum Discovery LLC**, a provider of electronic discovery services to law firms and corporations with headquarters in New London, announced in February the acquisition of Preferred Imaging headquartered in Indianapolis. Preferred Imaging has provided litigation support and e-discovery solutions to law firms and corporate legal departments in the Midwest for over fourteen years. Quantum Discovery offers electronic discovery solutions utilizing Viewpoint, an e-discovery platform developed by Lateral Data, a Xerox company.

UTC CLOSES SALE OF UTC POWER. Hartford conglomerate **United Technologies Corp.** closed the sale of its South Windsor fuel cell manufacturer, **UTC Power**, to Oregon's **ClearEdge Power** in February. ClearEdge is keeping its operations in South Windsor, with former UTC Power employees now with ClearEdge. ClearEdge's products are focused more on the homeowner and small business while UTC Power makes fuel cells for large industrial clients and power grids. While ClearEdge is relatively new to the market, UTC Power, along with Danbury-based **FuelCell Energy**, is one of the largest fuel cell makers in the world. The UTC Power employees are now ClearEdge employees. In April, ClearEdge announced landing part of a \$100M seven-state deal to power 19 Verizon facilities. It is the company's largest single-user project.

ENTERPRISE REGION ANNOUNCES FUNDING WINNERS. The **Southeastern Connecticut Enterprise Region** (SeCTer) announced February 21 that five businesses won more than \$600,000 in state funding to help purchase new equipment, build new facilities and launch new products. SeCTer, in partnership with the state **Department of Economic and Community Development's** Small Business Express program, said funding will go to **Marty Gilman Inc.** of Bozrah, a manufacturer of sports gear; **Seconn Fabrications Inc.** of Waterford, which does custom manufacturing, powder coating and screen printing; **StoryForge Labs LLC** of New London, a conceptual design, animation and visual effects studio; **AgroSci Inc.** of Colchester, which sells and distributes irrigation systems, and **Mystic Cheese Company LLC** of Franklin, which plans to build a cheese-making facility at the Hill Top Flex Park.

INNOVATION TRAINING PROGRAM LAUNCHED IN SW CT. In April, **The Stamford Innovation Center** launched **InnovationED**, a new program offering training in innovation skills to the southwestern Connecticut business community. Participants learned and applied skills for innovative business building, and received immediate feedback on their work. The InnovationED program offered varied topics and formats, including two-hour evening workshops and half-day "boot camps." The classes sought to elicit networking among students and instructors—enhancing a collaborative learning environment.

KAMAN ANNOUNCES \$120M DEAL. In May, **Kaman Corporation** finalized a \$120 million deal to supply New Zealand with 10 Super

Items that appear in the In Brief section are compiled from previously published sources including newspaper accounts and press releases. For more information about any In Brief item, please call the Academy at (860) 571-7143, or contact us at acad@ctcase.org.

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Seasprite helicopters, a flight simulator and spare parts as well as logistics support. The Seasprites replace New Zealand's current fleet of helicopters, providing the highest power-to-weight ratio of any maritime helicopter.



Communication

BBB WARNS MOBILE DEVICE USERS ABOUT HACKING. On April 4 **Connecticut's Better Business Bureau (BBB)** warned smart phone and tablet users that hackers can burrow into mobile devices via technology used for hands-free calling and wireless keyboards. "Bluebugging" is one way hackers can access personal information by tapping Bluetooth connections. "Access to your contacts, to your photos, to your texts, and to your telephone. In fact, someone who's bluebugging can actually place long distance phone calls, rack up your bills, and you won't even know about it until after it's done," said the BBB's **Howard Schwartz**. Bluetooth uses a low-powered transmitter and receiver allowing wireless handsets, keyboards and car stereos to interact with mobile devices. Hackers then use special software and antennas to intercept the signals of compatible devices.

MAXIMUS TO OPERATE CUSTOMER CONTACT CENTER FOR CT HEALTH INSURANCE EXCHANGE. MAXIMUS, a worldwide service provider, has signed a contract with Connecticut to operate the customer contact center operations for **Access Health CT**, the state's Health Insurance Exchange. The three-year, five-month contract begins March 1 and is valued at \$15 million. MAXIMUS will be the primary service center responding to inquiries, helping callers determine eligibility for, and enroll in, a qualified health plan. Operating under a no-wrong-door model, MAXIMUS staff will help consumers navigate health plan information to determine which health plan best meets their needs. Access Health CT is scheduled to open for enrollment October 1, 2013.



Education & Cognition

AUTISM STUDY IDENTIFIES PLACENTA ABNORMALITIES. The April 25 online issue of *Biological Psychiatry* reported that researchers at the **Yale School of Medicine** have identified placenta abnormalities evident at birth that measure an infant's risk of developing autism, allowing for earlier diagnosis and treatment. An autism diagnosis is usually made at 3–4 years of age or older, but senior author **Harvey Kliman**, research scientist in the Department of Obstetrics, Gynecology & Reproductive Sciences, and collaborators at the MIND Institute at the University of California, Davis, found that abnormal placental folds and abnormal cell growths called trophoblast inclusions are key markers to identify newborns who are at risk for autism. The at-risk placentas had as many as 15 trophoblast inclusions, while none of the control placentas had more than two trophoblast inclusions. Kliman said a placenta with four or more trophoblast inclusions conservatively predicts an infant with a 96.7% probability of being at risk for autism.

CT TEACHERS TO PARTICIPATE IN STEM FELLOWSHIP PROGRAMS. **Behn Sikora**, a technology and engineering education teacher at **Silas Deane Middle School** and **Wethersfield High School** and **James Brochinsky**, a technology and engineering education teacher at **Middlesex Middle School** in Darien, will participate in the **Siemens STEM Institute** fellowship program this July. Sikora will attend a professional development opportunity at the Discovery Communications headquarters in Washington, DC. Brochinsky will attend the Siemens Teachers as Researchers

(STARs) fellowship program this summer at Oak Ridge National Laboratory in Oak Ridge, TN, the US Department of Energy's multi-purpose national research laboratory. Their participation is designed to enhance their classroom experiences by inspiring students to pursue science, technology, engineering and math (STEM) education. The Siemens STEM Institute was developed by the Siemens Foundation, a division of the Siemens Corporation, in collaboration with Discovery Communications, Oak Ridge Associated Universities and the College Board.

3M GRANT TO HELP WALLINGFORD SCHOOLS DEVELOP STEM PROGRAMS. On April 16, **Dag Hammarskjold** and **Moran** middle schools in Wallingford each received a \$9,600 grant from 3M for developing next year's science, technology, engineering and mathematics (STEM) programs. Moran Principal **Joseph Piacentini** and Dag Assistant Principal **Nick DaPonte** worked with staff at the schools to write the grant applications. The grant will be used, in part, to bring the Connecticut Invention Convention to the middle schools. The convention is held annually for students in elementary schools, but materials are needed to bring the program to the middle schools. Both administrators also look forward to working with the **Connecticut Science Center** and bringing the NASA Explorer School to their schools.



Energy

BREAKTHROUGH COULD IMPROVE SOLAR ENERGY SYSTEMS. On February 4, **UConn** engineering professor **Brian Willis** announced his novel fabrication process called selective area atomic layer deposition (ADL), which has the potential to improve solar energy systems. ADL allows scientists to fabricate a working rectenna device maximizing electricity transfer. Because of their very small and fast tunnel diodes, rectennas—rectifying antennas used to convert microwave energy into direct current electricity—are capable of converting solar radiation in the infrared region through the extremely fast and short wavelengths of visible light. The ADL process is favored by science and industry because it is simple, easily reproducible, and scalable for mass production. Current silicon solar panels collect only about 20% of available solar radiation, with separate mechanisms needed to convert the stored energy to usable electricity for the commercial power grid, resulting in limited efficiency and high development costs.

ENERGY PLAN FOCUSES ON INCREASED USE OF NATURAL GAS. In February, **Governor Malloy** issued his final energy plan with an emphasis on increasing natural gas. The plan includes a \$500 tax credit to help residents switch to natural gas, a call to expand natural gas pipeline capacity, a further look at "large-scale hydropower," and a push to develop a cyber-security strategy for Connecticut's electric grid. In a written statement, Malloy said, "Focusing on innovative approaches to energy efficiency—cost effective renewable power, smarter building management, and expanded use of low-cost natural gas, we are reducing consumer costs, making the state more competitive, and creating good jobs with good benefits."

'TREMENDOUS' GROWTH IN ENERGY-SAVING PROGRAMS. Energy efficiency programs in Connecticut in 2012 saved residents, businesses and communities \$53.8 million according to the **Connecticut Energy Efficiency Board's 2012 Programs and Operations Report**, issued in March. More than 500,000 homeowners and renters participated in residential energy-saving programs, collectively saving themselves about \$27.9 million and over 4,500 Connecticut businesses and municipalities saved approxi-

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mately \$25.9 million, while efficiency measures prevented over 200,500 tons of carbon dioxide emissions. **Dan Esty**, state commissioner of the **Department of Energy and Environmental Protection** and chairman of the Energy Efficiency Board noted, "We saw a tremendous growth in the participation ... which means more money saved by our residents and businesses and a healthier environment for Connecticut."

HARTFORD HOSPITAL TO GET FUEL CELL UNIT. On April 17 it was announced that 1.4-megawatt alternative-energy power generator manufactured by Danbury's **FuelCell Energy Inc.** will be installed at Hartford Hospital. **Hartford Steam Company**, now a subsidiary of New Jersey's Energenic, purchased the fuel cell unit and will supply electricity and steam for heating the hospital, with excess steam piped to the **Learning Corridor** magnet school in Hartford's South End. It is expected that in one year, the fuel cell will prevent the emission of more than 57,000 pounds of nitrogen oxide, and offset the emission of more than 128,000 pounds of sulfur dioxide and more than 3,000 pounds of particulate matter.

AETNA INSTALLS SOLAR PANEL FIELD. In April, **Aetna** announced it had installed a new solar panel field in Windsor with a capacity to generate an annual production of 268,000 kilowatts per year. The installation was built on 56,000 square feet of an unused grass field. The solar panels will produce enough energy to power a major portion of the Aetna facility with environmental savings equivalent to 189 metric tons of carbon dioxide.



Environment

REHABILITATION OF HOUSATONIC FISH HABITAT PROPOSED. On February 13, the **Connecticut Department of Energy & Environmental Protection** proposed a \$2 million rehabilitation of the **Housatonic River** fish habitat and marshes. The funding comes from a \$9 million settlement with **General Electric** over environmentally detrimental releases from the GE facility in Pittsfield, MA that impacted the Housatonic downstream. The \$2 million will fund seven projects aimed at increasing habitat for fish, including river herring. The funded projects include removal of the Pinshop dam in Watertown, the construction a fish bypass at the Tingue dam in Seymour, and marsh revitalizations.

NSF GRANT TO FUND TREE RESEARCH. **Rachel Spicer**, assistant professor of botany at **Connecticut College**, was awarded a three-year, \$395,064 grant by the National Science Foundation to research how trees grow. The grant begins in fall 2013 and provides summer research opportunities for nine Connecticut College undergraduates and 5–10 students during the academic year. "Very little is known about how woody stems develop, and how connections are formed between the older portions of a stem and the young leaves," Spicer said. Her research will investigate how trees' vasculature, or conductive tissue, is established.

YEAR OF THE SNAKE IN CT. The **Connecticut Department of Energy and Environmental Protection (DEEP) Wildlife Division** is participating with Partners in Amphibian and Reptile Conservation (PARC) to declare 2013 as the Year of the Snake. This effort is to raise awareness for snake conservation by highlighting Connecticut's native snake species. "The DEEP Wildlife Division has made a commitment to inform Connecticut residents about the state's native snake species through regular press releases; informative articles and species profiles in issues of our bimonthly magazine, *Connecticut Wildlife*; a children's art contest; and related events," said **Rick Jacobson**, Director of the DEEP Wildlife Division. Fourteen snake

species occur in Connecticut with four (common ribbon snake, eastern hog-nosed snake, smooth green snake, and timber rattlesnake) on the state's List of Endangered, Threatened and Special Concern Species. Only two of Connecticut's snakes are venomous: the northern copperhead and the state-endangered timber rattlesnake.

NORWALK SHOPPING PLAZA GETS FIRST C-SPACE FUNDING. On April 1, a Norwalk shopping plaza became the first state project to be funded by the **Commercial & Industrial Property Assessed Clean Energy (C-PACE)** program that allows property owners to finance efficiency upgrades with little or no initial expenses, repaying the loan over time through the property tax bill. The plaza received a \$285,000 lighting upgrade expected to reduce electricity costs \$17,500 annually. The owners also plan to use C-PACE and other financing support to install a 100-kilowatt solar project.

ECSU NAMED 'ENVIRONMENTALLY RESPONSIBLE'. The Princeton Review's *Guide to 322 Green Colleges*, released in April, listed **Eastern Connecticut State University** as one of the 322 most environmentally responsible colleges in the United States and Canada. The selection is based on a 50-question survey conducted in 2012 of hundreds of four-year colleges. Eastern is noted for its Climate Action Plan, detailing a commitment to achieving a zero carbon footprint by 2050. The report also cited the university's effort to create a campus-wide culture of sustainability through green operational initiatives; green-minded education for first-year students; and its Environmental Earth Science and Sustainability Energy Studies majors.



Food & Agriculture

FEBRUARY BLIZZARD HITS CT FARMS. The February 8 blizzard inflicted havoc on many Connecticut farms. **David and Ty Zemelsky** of **Star Light Gardens** in Durham lost five of their six greenhouses. "We're devastated," David said. "This is like a family member dying, except it's like five of them dying." Since 2009, the state's farming industry struggled from prolonged rain; prolonged drought; storms Irene, Sandy and the October 2011 and February 2012 snowstorms. The US Department of Agriculture's Farm Service Agency Connecticut office anticipates using data gathered from this storm to request a disaster declaration. **Steven Reviczky**, Connecticut's agriculture commissioner, notes "These types of events should give us all a little pause to figure out whether the infrastructure we have is adequate."

DEEP CONTINUES RIVER HERRING FISHING BAN. The **Department of Energy and Environmental Protection** announced it is continuing to ban fishing for alewives and blueback herring from most of Connecticut's inland and marine waters. The prohibition was first put in place in April 2002 to remedy the species' population decline. The prohibition, which has been extended through March 21, 2014, continues because the population size has not increased. Alewives and blueback herring are more commonly known as river herring, hatching in freshwater and migrating to the ocean to grow and then return to freshwater to spawn.

MATCHING GRANTS TO EXPAND AG INDUSTRY ANNOUNCED. On April 17, **Governor Malloy** and **Department of Agriculture (DOAG) Commissioner Steven K. Reviczky** announced \$816,706 in matching grants to expand Connecticut's \$3.5 billion agricultural industry as part of the DOAG's Farm Transition Grant and Farm Viability Grant programs. The funds will help farms, agricultural nonprofits, and municipalities increase production, promote Connecticut Grown products, and create jobs.

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Health

'COMMUNITIES OF CARE' SAVE MEDICARE COSTS. On February 15, **Mary Cooper**, vice president and chief quality officer of the **Connecticut Hospital Association**, which partners with Connecticut's Medicare quality improvement organization, **Qualidigm**, announced that the state saved an estimated \$5.4 million in Medicare costs since 2010 by reducing re-hospitalizations of patients through a collaborative "communities of care" model that exists in 14 areas throughout the state, including Hartford, New Haven, Milford, Meriden and Torrington. This finding is consistent with a study published in the *Journal of the American Medical Association* showing a significant decrease in both hospitalizations and readmissions of Medicare patients where quality improvement organizations (QIOs) coordinate interventions that engage community partners to improve care after discharge.

GRIFFIN AWARDED BREAST CANCER SCREENINGS GRANT. It was announced April 3 that the **Connecticut Health and Educational Facilities Authority** awarded \$74,480 to **Griffin Hospital** to help uninsured and underinsured women receive breast cancer screenings. The grant allows The **Hewitt Center for Breast Wellness** at Griffin Hospital to provide approximately 150 free mammograms to women who have no health insurance or have insurance with a high co-pay or deductible for breast cancer screening services. Additionally, the grant will cover further testing if the mammogram reveals concerns as well as funding a Nurse Educator for Griffin Hospital's Community Outreach and Valley Parish Nurses Program to raise breast cancer awareness and provide breast screening education for women in the Greater Valley community.



High Technology

WATERBURY TO INSTALL 24/7 DOWNTOWN MONITORING SYSTEM. In February, **Waterbury's Board of Aldermen** approved a \$190,000 contract with Tyco Integrated Security to install 11 wireless and tamper-proof cameras to monitor the downtown area 24 hours a day, seven days a week, starting in July. The contract will be paid for with grants and assets seized from criminal investigations. Officials hope the cameras will prevent or help solve quality-of-life crimes like car break-ins and littering. **Mayor Neil O'Leary** believes the cameras also will be a homeland security asset.

WOMEN OF INNOVATION HONORED. On March 19, nine Connecticut women were honored at the Women of Innovation awards ceremony. The **Connecticut Technology Council** recognizes women innovators, role models, and leaders in technology, science and engineering. This year's winners include: **Lili Aramli**, Biology Teacher, Academy of Aerospace & Engineering/Greater Hartford Academy of Math and Science; CASE member **Carolyn Slayman**, Deputy Dean, Academic and Scientific Affairs, Yale School of Medicine; **Zhaohui Wang**, Graduate Student, University of Connecticut, School of Engineering; **Cynthia Barnett**, Program Founder, Saturday Academy; **Meghan Brunaugh**, CMO & co-founder, Combat2Career; **Maria Keilich**, Manager, Systems Engineer, United Technologies Aerospace Systems; **Yvonne Will**, Associate Research Fellow, Pfizer Inc.; **Kate Donahue**, President Hampford Research, Inc.; and **Shiyu Zhuang**, High School Student, Amity Regional High School.

NEW TRANSPORTATION TECHNOLOGY FIRM LAUNCHED IN SHELTON. A new technology company for transportation,

3GTMS, opened April 12 in Shelton. The company provides logistical software products for manufacturers, retailers and third-party truck brokers. The name—3GTMS—stands for third generation transportation-management systems. Mitch Weseley, the company's chief executive officer, said larger companies have been using the technology for years and he intends to bring it to the smaller firms. He expects it will create about 10 jobs in Connecticut and about 50 elsewhere in the next few years.



Transportation

PANEL VOTES TO PROTECT TRANSPORTATION FUND. On March 13, the General Assembly's transportation committee unanimously voted to "lockbox" the state's Special Transportation Fund, used for road and transit projects, calling for a constitutional amendment to further block use of the funds to cover general government expenses. The state **Department of Transportation** identified about \$16 billion in unfunded road and bridge repairs and improvements needed over the next 20 years, including \$7.5 billion during the next decade. State Sen. **David Scribner**, who sponsored the legislation (HB 6039), noted the uncertainty of federal funding for maintenance, highway and rail upgrades underscores the importance of preventing the Special Transportation Fund from being used for other operating expenses. As of press time, the bill was awaiting consideration by the House. If approved, it would go to the Senate for approval.

PUTNAM BRIDGE PROJECT BEGINS. A two-year project to rehabilitate the **Putnam Bridge**, which serves approximately 54,200 vehicles each day, began on April 1. The state **Department of Transportation** is spending more than \$30 million to upgrade the bridge over the **Connecticut River** between Wethersfield and Glastonbury. **Mohawk Northeast Inc.** will repair the bridge's steel and concrete, replace median barriers, and add a pedestrian sidewalk on the south side of the bridge with work expected to be completed by May 2015.

'GREEN' SAUGATUCK STATION HOUSE OPENS. On April 1, **Westport** celebrated the opening of its newly renovated pre-Civil War era **Saugatuck** train station house. The station is one of the state's largest, servicing nearly 2,500 customers a day. Renovations include energy efficient solar panels as well as electric vehicle charging stations, making the station the first in Connecticut to transition to the alternative energy source. The interior features polished wood floors and memorabilia, including a vintage clock and framed photos of trains.

FUEL CELL BUS PURCHASE PROCESS MARKS ADVANCE. On April 15, it was announced that Atlanta-based Center for Transportation and the Environment (CTE) finalized a contract with **Connecticut Transit** (CTTRANSIT) for a hydrogen fuel cell-powered, 40-foot transit bus in partnership with EIDorado National, BAE Systems, and Ballard Power Systems. In the past, fuel cell buses have been procured and built under various federally funded research programs, most notably the Federal Transit Administration's National Fuel Cell Bus Program (NFCBP); however, this fuel cell bus and associated support were procured as part of a standard process using transit industry defined specifications and terms. This is seen as a significant step towards commercializing the fuel cell bus industry. The bus is scheduled for delivery in 2014.

—Compiled and edited by Wendy Swift

campuses have included the consideration of race, ethnicity, and/or gender as an “affirmative” factor in admissions. These policies currently are the target of legal and public debate, requiring new strategies to help widen the pipeline of diverse students who will pursue STEM studies and careers. The article provides an overview of the current status of underrepresented minorities and women in US STEM higher education and of the “shifting legal and policy climates surrounding affirmative action policies at colleges and universities nationwide.” The authors conclude that if the nation is to continue to excel in STEM, American higher education must increase the representation of women and students of color in the STEM fields. Diversity policies and programs on two- and four-year campuses are necessary to ensure that more underrepresented students pursue STEM majors and graduate with STEM credentials.

A related article in the same issue of *The Bridge* noted that while investments have been made over the past several decades to broaden participation STEM and related fields, some groups—including women and African American, Latino, and American Indian men—are still highly underrepresented in many STEM disciplines. The authors argue that the lack of diversity in the engineering workforce arises from the experiences of these populations long before they enter college, including differences in access to appropriate coursework and quality education inputs (e.g., good teachers, laboratories); expectations, and career information and counseling; and engineering-related experiences outside of schooling.

<http://www.nae.edu/Publications/Bridge/69735/69745.aspx>
<http://www.nae.edu/Publications/Bridge/69735/69743.aspx>

◆ **Managing Flood Risk: FEMA Needs New Approach**

In administering the National Flood Insurance Program, the Federal Emergency Management Agency (FEMA) needs a more modern approach to analyzing and managing flood risk behind levees that would give public officials and individual property owners a clearer idea of the risks they face and how they should address them, says a new report from the National Research Council (NRC). Because levees can reduce but not eliminate the risk of flooding, the agency should also encourage communities behind levees to use multiple methods to reduce risk and increase awareness of these risks.

The NRC report found “no sound reason” to extend the mandatory purchase requirement—which requires property owners with a federally backed mortgage located in the 100-year floodplain to purchase flood insurance—to areas behind accredited levees. Once the modern risk analysis has been put in place, FEMA should study whether the mandatory purchase requirement is necessary throughout flood hazard areas and behind levees.

The report also concludes that the National Flood Insurance Program is using a sound actuarial approach for calculating rates for the flood insurance policies it issues. However, the program is financially unsound overall because it is legislatively mandated to offer discounts on about one-fifth of the policies it issues.

The report recommends that FEMA encourage communities to develop and implement multi-method strategies to manage flood risk, including non-structural techniques such as flood-proofing, elevating or relocating structures, evacuation planning, and the purchase of flood insurance. It also urges a comprehensive inventory of the nation’s levees.

www.nap.edu/catalog.php?record_id=18309

◆ **Evaluating Risks to Endangered, Threatened Species Posed by Pesticide Use**

A new report from the National Research Council examines how the US Environmental Protection Agency (EPA), National Marine Fisheries Service (NMFS), and Fish and Wildlife Service (FWS)

should determine the potential effects pesticides could pose to endangered or threatened species. Under the Federal Insecticide, Fungicide, and Rodenticide Act, before a pesticide can be sold, distributed, or used in the United States, EPA must ensure that it does not cause unreasonable adverse effects on the environment, which includes species that are listed as endangered or threatened. In addition, the US Endangered Species Act requires federal agencies, including EPA, to consult with FWS and NMFS when a federal action may affect a listed species or its habitat. Over the last decade, questions have been raised regarding the best approaches or methods for determining the risks pesticides pose to listed species and their habitats. EPA, FWS, and NMFS have developed different approaches to evaluating environmental risks because their legal mandates, responsibilities, institutional cultures, and expertise vary.

www.nap.edu/catalog.php?record_id=18344

◆ **Nanotechnology Initiative: Triennial Review**

The *Triennial Review of the National Nanotechnology Initiative* is the latest National Research Council review of the National Nanotechnology Initiative (NNI). The NNI is a multiagency, multidisciplinary federal initiative comprising a collection of research programs and other activities funded by the participating agencies and linked by the vision of “a future in which the ability to understand and control matter at the nanoscale leads to a revolution in technology and industry that benefits society.” The overall objective of the review is to make recommendations that will improve the NNI’s value for basic and applied research and for development of applications in nanotechnology that will provide economic, societal, and national security benefits to the United States. In its assessment, the committee found it important to understand in some detail—and to describe in its report—the NNI’s structure and organization; how the NNI fits within the larger federal research enterprise, as well as how it can and should be organized for management purposes; and the initiative’s various stakeholders and their roles with respect to research.

http://www.nap.edu/catalog.php?record_id=18271

Medal (from page 1)

to apply the research in the creation of new classes of antibiotics to treat multi-drug resistant infections like tuberculosis and E-coli. The company has attracted millions of dollars of investment and sustained a team of 45 full-time employees to date.

Steitz is also known for his astute mentoring of students and post-doctoral fellows, many who have become leaders in their institutions. He has been a member of Yale’s faculty since 1970 and a Howard Hughes Medical Institute Investigator since 1986. A graduate of Lawrence College in Appleton, WI, Steitz earned his PhD in molecular biology and biochemistry from Harvard. His other awards include the Pfizer prize from the American Chemical Society, the Rosenstiel Award for distinguished work in basic biomedical sciences, the AAAS Newcomb Cleveland Prize, the Keio Medical Science Prize, and the Gairdner International Award. He has been a member of the National Academy of Sciences since 1990 and the Connecticut Academy of Science and Engineering since 1991.

The Connecticut Medal of Science is the state’s highest honor for scientific achievement in fields crucial to Connecticut’s economic competitiveness. Modeled after the National Medal of Science, this award is made by the Connecticut Office of Higher Education, with the assistance of the Connecticut Academy of Science and Engineering, in alternate years with the Connecticut Medal of Technology.

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3D *(from page 2)*

CASE member Paul Adams, Pratt & Whitney's chief operating officer, agrees, stating, "The University of Connecticut's outstanding technical capacity complements our fundamental research needs and will help us continue to grow our additive manufacturing capabilities." He also notes that "Additive manufacturing is complementary to traditional methods by enabling new innovation in design, speed and affordability, and is necessary to build the next generation of jet engines. We are currently using additive manufacturing to build complex components with extreme precision for the flight-proven PurePower® commercial jet engine." Pratt & Whitney engineers and UConn faculty and students will use the center's resources to develop advanced fabrication techniques for complex production parts used in aerospace and biomedical science—"components" that Kazerounian believes "will be susceptible to high demand."

Agnes Klucha, an engineering manager at Pratt, offered this perspective: "We consider ourselves industry leaders certifying unique components, building up parts from powders, and allowing for the development of innovative designs that cannot be made through conventional methods. To remain competitive we must continue to advance our manufacturing technologies to enable better producibility, speed and affordability." She notes that Pratt is currently making use of some additive processes to make engine repairs, but additive manufacturing technologies are being used to accelerate the development of prototype production—making metal components that can be used for flight testing. "We have flight-tested PurePower PW1500G and PW1200G engine components on Pratt & Whitney's 747SP flying test bed. The PW1500G engine will power the Bombardier CSeries* aircraft and the PW1200G engine will power the Mitsubishi Regional Jet."

Regarding the partnership with UConn, Klucha observes that "through this collaboration agreement we are able to make use of

*[*Trademarks of Bombardier Inc. or its subsidiaries]*

UConn's facilities and services, including access to the Institute of Materials Sciences. Professors and students are working alongside Pratt & Whitney engineers to develop manufacturing science and materials science knowledge. UTC's Engineering Ambassadors program focuses on the development of leadership and communication skills for engineering students. This program enabled the UConn Engineering Ambassadors to take plastic 3D printers to middle and high schools, providing educational opportunities for the next generation of engineers. Middle and high school students engage in an open design forum, printing and gaining information about designs they are developing and making alongside the Ambassadors. As Klucha stated, "UTC and Pratt are very committed to the next generation."

According to a recent study by the global consulting firm Lux Research, estimates indicate "the overall market size of 3D printing in 2025 will be at \$8.4 billion—marking a significant growth curve for the upcoming years" particularly in the automotive, medical and aerospace industries. Manzione believes that the United States—and Connecticut in particular—is well positioned to take advantage of the economic opportunities this technology offers, noting that "Additive is amazingly labor unintensive. Where other countries have the advantage because of cheap labor, that advantage goes away." The US labor force is based on skilled labor and "our economy needs people trained in design. Less labor is required, but new jobs will be created," particularly as we look towards the future where there will be a proliferation of these machines.

Everyone agrees that the possibilities for additive manufacturing are just beginning to be realized. As Kazerounian reflected, "Additive manufacturing opens the door to new designs. When this technique becomes cost effective it will revolutionize the way mechanical components are used and designed."—**Wendy Swift**