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# TechTalk

SERVING THE MIT COMMUNITY

# MIT-trained economists bring pragmatic approach to Obama administration

PHOTO / UNIVERSITY OF CHICAGO

From top: Alumni Ben Bernanke PhD '79, Austan Goolsbee PhD '95, Christina Romer PhD '85 and Lawrence H. Summers '75.

**Stephanie Schorow**
News Office

American presidents have famously raided universities to build their policy teams. President John F. Kennedy sought foreign policy advisors from his alma mater, Harvard. President Ronald Reagan relied on economists steeped in the laissez-faire school of thought from the University of Chicago.

President Barack Obama has tapped a number of MIT-trained economists to craft a response to the worst economic downturn in generations. These economists represent no particular ideology or canon. Instead, they reflect the eclectic, practical approach of the Institute's Department of Economics.

James Poterba, the Mitsui Professor of Economics, former head of the MIT Economics Department, and president of the National Bureau of Economic Research, says the MIT crew is part of a "dream team of economic advisors" in the Obama administration.

"They are realists and pragmatists who are looking for what will work to address the particular problems we are facing," Poterba says. "I think these folks are very much problem solvers in the MIT tradition."

"Of course," he adds, "on the economic front, they have lots of problems to solve."

### 'Dream team'

MIT's Department of Economics has trained many leading central bankers. In addition to U.S. Federal Reserve Board Chairman Ben Bernanke PhD '79, the bankers with MIT ties include Mario Draghi PhD '77, governor of the Bank of Italy, Stanley Fischer PhD '69, an emeritus member of the MIT faculty and governor of the Bank of Israel, José de Gregorio PhD '90, governor of the Central Bank of Chile, and Athanasios Orphanides '85, PhD '90, governor of the Central Bank of Cyprus.

In Washington, Lawrence H. Summers '75, former secretary of the Treasury and Harvard University president, leads President Obama's National Economics Council. Christina Romer PhD '85 heads the Council of Economic Advisors while Austan Goolsbee PhD '95, who served as Obama's senior economics advisor during the campaign, has been nominated to serve as a member of the Council of Economic Advisers and is chief economist of the President's Economic Recovery Advisory Board. Harvard economics professor Jeremy Stein PhD '86 is a special advisor to the secretary of the Treasury. Additionally, Xavier de Souza Briggs, associate professor of sociology and urban planning in the Department of Urban Studies and Planning, has joined the administration as associate director of the White House Office of Management and Budget.

The MIT-trained economics appointees bring different skills and points of view, following no single "party line," says Robert Solow, Institute Professor emeritus. Their primary strength lies in their ability to deal with data without a lot of presupposition, he says.

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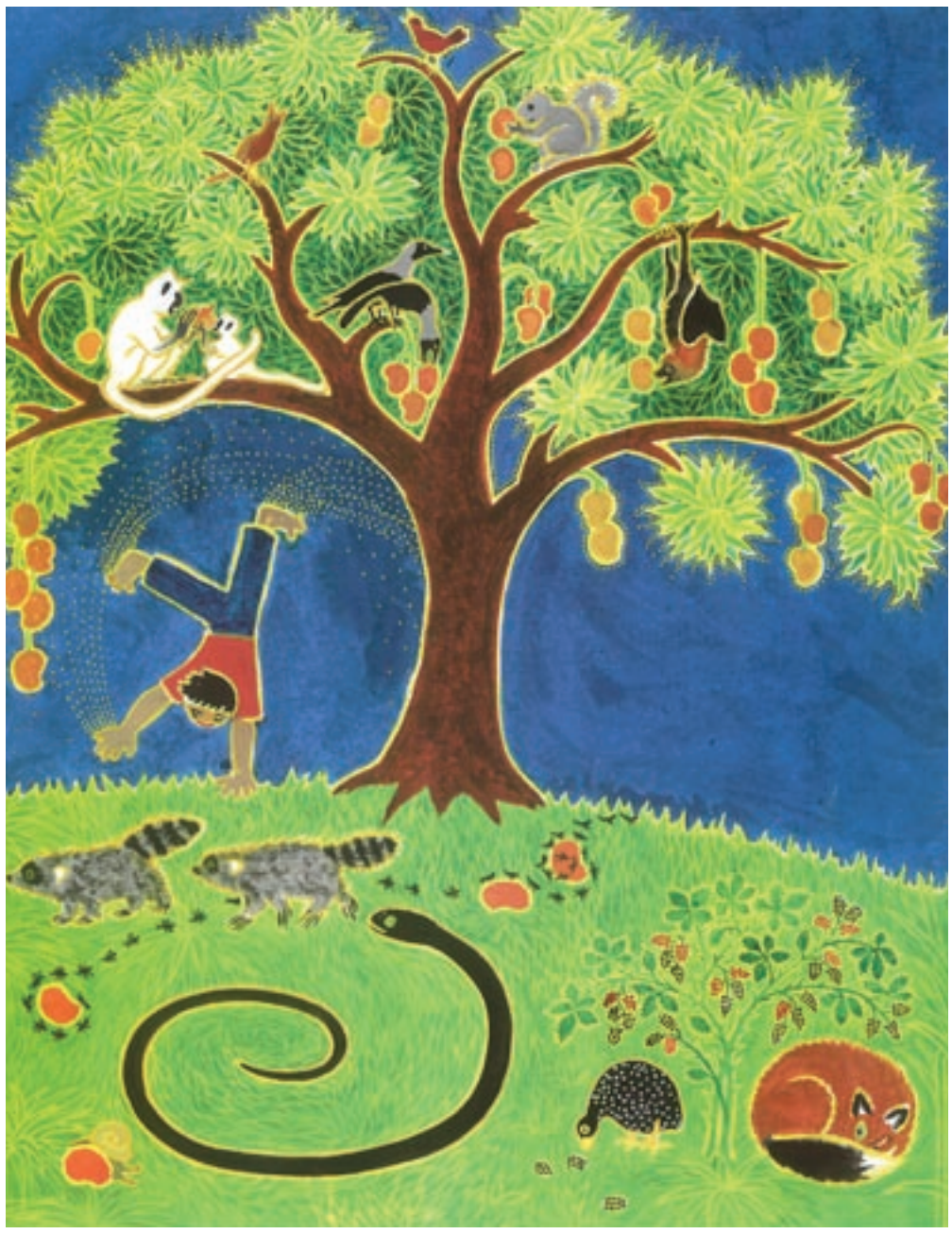

IMAGE / **MOLLY BANG**

**Drawn to science**

A page from 'Living Sunlight,' a children's book about photosynthesis that MIT ocean microbiologist Penny Chisholm co-authored. Read more on page 3.

# Rapid recharge

Re-engineered material could solve long-standing battery issues

**Elizabeth Thomson**
News Office

MIT engineers have created a kind of beltway that allows for the rapid transit of electrical energy through a well-known battery material, an advance that could usher in smaller, lighter batteries — for cell phones and other devices — that could recharge in seconds rather than hours.

The work could also allow for the quick recharging of batteries in electric cars, although that particular application would be limited by the amount of power available to a homeowner through the electric grid.

The work, led by Gerbrand Ceder, the Richard P. Simmons Professor of Materials Science and Engineering, is reported in the

▶Please see BATTERY, **PAGE 7**

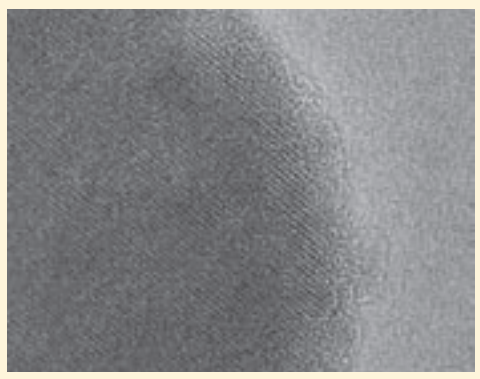

IMAGE COURTESY OF THE CEDER LAB

Scanning electron micrograph of a particle of the new battery material. Dark area indicates the inside of the particle surrounded by a lighter surface layer only five nanometers wide.

## PEOPLE

### Chandrakasan honored

MTL Director Anantha Chandrakasan wins SIA University Researcher Award.

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## RESEARCH & INNOVATION

### iGarden

In CSAIL project, robots do the gardening.

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## NEWS

### Happy Birthday, MITAC

MIT Activities Committee celebrates a quarter-century of events, tickets and fun.

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## Events at MIT

### Today

**• MITAC 25th Anniversary Open House.** 11 a.m.-4 p.m. in 32, Stata Center lobby and Student Street. MITAC celebrates 25 years!

**• "Techno-Blinders: How the Cult of Technology is Endangering U.S. National Security."** Speaker: Elizabeth Stanley, Georgetown University. Noon-1:30 p.m. in E38-615.

**• Tough Economy Series: The "Art" of Behavioral Interviewing in a Tough Economy.** Speaker: Bob Dolan - Career Development Center. 2:40-4 p.m. in 56-114. The MIT Career Development Center has planned special workshops covering all aspects of the job search given the current economic situation.

**• Institute Faculty Meeting.** 3:30-5:30 p.m. in 10-250.

**• Going Global: "Yes You Can!" — an informational panel.** 4-5 p.m. in 12-142. Are you intrigued by the thought of studying abroad or pursuing other global education opportunities but think they are impossible to actually pursue? A panel of MIT students and staff will be present to answer your questions and dispel myths about global education at MIT.

### Thursday, March 19

**• Women In Math Lecture Series.** Speaker: Angela Hicks (UC San Diego) on "Combinatorics of the Diagonal Harmonics." 2:30-3:30 p.m. in 4-149.

**• "Logical Relations: A Step Towards More Secure and Reliable Software."** Speaker: Amal Ahmed (Toyota Technological Institute at Chicago). 4-5 p.m. in 32-G449. Part of the EECS Special Seminar Series.

**• Rethinking Interactions — Discussions on Diversity.** 5-6:30 p.m. in 50-220. Robbin Chapman, Manager of Diversity Recruitment, School of Architecture and Planning, will speak.

**Submit your events!**

Log on to events.mit.edu to add your events to MIT's online calendar. Certain events will be selected from the online calendar to be published in Tech Talk each Wednesday.

**CORRECTION**

In the March 11 front-page story titled "Liskov wins Turing Award," Barbara Liskov was incorrectly described as "the first U.S. woman to earn a PhD in computer science." Liskov is the first U.S. woman to earn a PhD from a computer science department. Tech Talk regrets the error.

# 26,000 miles later, alumnus completes solo sail

**Liv Gold**
Alumni Association

Rich Wilson SM '76 piloted his 60-foot racing yacht, Great American III, across the finish line at Les Sables d'Olonne in France on Tuesday, March 10, after sailing nonstop for four months — and 26,000 miles — around the world.

Wilson, 58, took ninth place in the Vendee Globe solo sailboat race, making him the oldest skipper and only the second American in the race's 20-year history to finish successfully. Equipment failures and severe weather knocked out 19 of the 30 boats that initially set sail in November.

Race organizers praised Wilson's determination to complete the race, which had the highest-ever attrition rate: "[Rich's achievement] is a testament to his excellent seamanship skills, deep determination, careful planning and prudent execution."

To survive the journey, Wilson packed his monohull with a 120-day supply of food, including generous amounts of homemade granola, foil-packed tuna, and freeze-dried meals. He cluster-napped — a 40-minute sleeping technique that kept him in sync with his body's natural sleep cycle and allowed him to intermittently monitor the horizon for oncoming vessels.

Although he sailed alone, he was in touch with supporters and the world daily. You can relive his adventure virtually on his SitesAlive Foundation web site with daily blogs, podcasts, photos, a live map, and Q&As about sailing and oceanography answered by experts. He documented the challenge to share this learning experience with K-12 students around the world.

As Wilson, who has been a defense analyst, technical consultant, and investor, told his SitesAlive followers, he began sailing with his father at age three. The fresh air on the open ocean helped his asthma, and he liked learning about boat maintenance and sailing strategy. In 1980, he became the youngest overall winner of the prestigious Newport Bermuda Race as the skipper of Holger Danske, and in 2004 he won second place in the solo Transatlantic UK-USA. He also set three world records as skipper and navigator on clipper routes: San Francisco-Boston in 1993, New York-Melbourne in 2001, and Hong Kong-New York in 2003. Most recently, he completed the two-handed Transat Jacques Vabre in 2007 and the return solo race, the B2B from Brazil to France.

Wilson still enjoys learning and confronting obstacles — as he did during several storms, when mechanical and electrical failures forced him to make repairs while his boat rocked violently — but he also enjoys the ocean's wildlife. On his web site, he described sightings of albatross, flying fish, porpoises, and shooting stars.

Light rain and cloudy skies accompanied Wilson in his final stretch to the French port where he was greeted by thousands of onlookers, including his family who live in Marblehead, Mass.

"For me, this was not just a race, but something else too," he said after landing in France. "The difficulties were worth it for all the lessons and essays I sent back."

Wilson's final essay on SitesAlive recounts advice from one of his greatest teachers at MIT, Ray Pariser, who said, "You need to stretch your mind."

"For me, being at sea does that exactly," Wilson wrote.


PHOTO / **OLIVIER BLANCHET, VENDEE GLOBE**

Rich Wilson SM '76 aboard his 60-foot racing yacht, Great American III, as he finishes the Vendee Globe solo sailboat race.

## Obituaries

### Edward O. Vetter, Corporation life member emeritus, 88

Edward Oswald Vetter '42, a former commerce undersecretary in President Ford's administration and an energetic life member emeritus of the MIT Corporation, died March 9 at the age of 88.

Born on Oct. 20, 1920, in Rochester, N.Y., to German immigrant parents, Vetter graduated from MIT in 1942 with a degree in mechanical engineering. After graduation, Vetter joined the Army, where he was eventually promoted to major. His professional career took him to Standard Oil of California as a production engineer and then to Texas Instruments, where he retired in 1975 as the chief financial officer. He later entered government, serving as the undersecretary of commerce in the Ford administration, energy advisor to the governor of Texas and chairman of the Texas Department of Commerce.

Vetter was elected a term member of the MIT Corporation in 1973, reelected in 1978, and elected a life member in 1983. As president of the Alumni Association, he served as an ex officio member from 1976 to 1977. In 1977, he was a recipient of the Bronze Beaver Award, the highest honor bestowed by the Alumni Association for distinguished service.

Paul Gray, MIT president emeritus and professor emeritus in the Department of Electrical Engineering and Computer Science, remembered Vetter as someone fiercely loyal to MIT and possessing the fun-loving charm of his adopted state of Texas. "By the time I got to know him in 1971, you'd have thought he was a Texan all his life," Gray said.

Joseph G. Gavin Jr. '41, remembers rowing with Vetter when both were members of the varsity squad as undergraduates. A fellow life member emeritus of the Corporation, Gavin said the Dallas-based Vetter was a great supporter of MIT. "He was one of those forthright people who called a spade a spade. He was a real Texan and I remained a damn Yankee," he said. But "he was always there when the Institute needed something."

Vetter participated on numerous Corporation committees, including more than a decade of service on both the Executive and Membership Committees. He served as chair of the visiting committees for the Department of Materials Science and Engineering, the Department of Nuclear Engineering, and Sponsored Research; he was also a member of the visiting committees for the Department of Electrical Engineering and Computer Science and for the Libraries. Vetter was a member of the Development Committee, an ex officio member of the Corporation Joint Advisory Committee on Institute-Wide Affairs, and the chair of the Corporation's ad hoc Committee on Information Transfer.

"He certainly was a great addition to the corporation for his knowledge and insight," said Emily "Paddy" Wade '45, a Corporation life member emeritus.

Vetter is preceded in death by his wife, Mary Brite Vetter, and daughter, Mary Patricia. He is survived by his loving wife, Ann Wallace Vetter; his three daughters, Judy Vetter, Sally Vetter and Kathleen Jenkins; a grandson, Taylor Vetter Jenkins; and other extended family.

Contributions in his memory may be sent to Southwestern Medical Foundation to Support Research for Macular Degeneration, 2305 Cedar Springs Rd., Suite 150, Dallas, Texas 75201. Resolutions on his death will be presented at the meeting of the Corporation in June.

### Margaret Warner memorial service to be held March 24

A memorial service for Margaret (Peg) Warner will be held at 3:30 p.m. on Tuesday, March 24, in the MIT Chapel.

Warner, special assistant to the executive vice president and treasurer, passed away on Saturday, Feb. 7, at her Lexington home after a courageous battle with cancer. She was 67.

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# MTL Director Chandrakasan honored for semiconductor work

Anantha Chandrakasan, director of MIT's Microsystems Technology Laboratories, last week received the Semiconductor Industry Association (SIA) University Researcher Award.

Chandrakasan, the Joseph F. and Nancy P. Keithley Professor of Electrical Engineering, was honored for his work in micro-power design, wireless micro-sensor arrays and ultra-wideband radios.

Chandrakasan recently completed a joint project with Texas Instruments to design a micro-controller that uses only one-tenth the power of a conventional TI micro-controller. His group has also recently demonstrated ultra-low-power video architectures, energy-efficient ultra-wideband wireless circuits, energy scavenging systems and a sensor system using carbon nanotubes.

**Anantha Chandrakasan**

Hector Ruiz, chairman of SIA, said that Chandrakasan's work addresses the significant challenges faced by the semiconductor industry today.

"The 'crown jewel' in the U.S. innovation ecosystem is our network of world-leading research universities," Ruiz said in a statement announcing the award to Chandrakasan. "America's research universities attract the best and brightest students and teachers from around the world. University researchers do the fundamental research that has enabled U.S. chipmakers to lead the world in developing innovative products and solutions."

The SIA University Researcher Award was established in 1995 to recognize lifetime research contributions to the U.S. semiconductor industry by university faculty. This year, Kang Wang SM '66, PhD '70 was also honored. The awards were presented at the annual SIA conference in Washington.

# Children's book illuminates photosynthesis

**Denise Brehm**
Civil and Environmental Engineering

An MIT ocean microbiologist and a Caldecott Award-winning author and illustrator have teamed up to produce a lavishly illustrated children's book that explains how the sun creates life on Earth through photosynthesis.

Penny Chisholm, the Lee and Geraldine Martin Professor of Environmental Studies in the Department of Civil and Environmental Engineering, provided the science background for "Living Sunlight: How Plants Bring the Earth to Life," which was co-authored and illustrated by Molly Bang.

The book is designed to help children grow up with a better understanding of how plants use the sun's energy to photosynthesize, turning water and carbon dioxide in the air into carbohydrates and releasing the oxygen that makes it possible for humans — and countless other creatures — to exist.

"Photosynthesis is arguably the most important phenomenon on Earth," Chisholm says, "Yet few people understand it. I've been on a mission [to educate the public about] how life works for some time, and decided the best way to get the word out — besides teaching ecology at MIT — is through a set of children's books. Molly was eager to take on the challenge."

Chisholm is well known for the 1988 discovery, with colleagues from the Woods Hole Oceanographic Institution, of a tiny ocean microbe called Prochlorococcus, which is responsible for a significant fraction of the photosynthesis in the oceans.

Narrated by a wise and kindly sun, "Living Sunlight" explains photosynthesis in pictures and words simple enough for young children and their parents to understand. Notes at the back of the book add details about the images and scientific concepts that a teacher or parent could use to make the book a good primer for older children, as well. Additional notes clarify that a few oversimplifications were necessary to help young readers grasp the concepts.

Bang is author and illustrator of 30 children's books, including award-winning "The Grey Lady and the Strawberry Snatcher," "Ten, Nine, Eight" and "When Sophie Gets Angry — Really, Really Angry."

"Living Sunlight" is the second in a Scholastic series about the sun's energy. The co-authors plan at least two more books, which will focus on oceans and the Earth's carbon cycle.


IMAGES COURTESY OF MOLLY BANG

Pages from 'Living Sunlight,' a children's book on photosynthesis that MIT ocean microbiologist Penny Chisholm co-authored.

# A reminder on international travel this spring break

As spring break approaches and members of the MIT community make plans for international travel, MIT recommends that they review the MIT Travel Risk Policy at http://informit.mit.edu/epr/3.1travel_risk.html.

While community members are free to travel on personal business to any location they choose, the Institute restricts official MIT travel to certain countries based on the U.S. State Department's assessment of safety conditions. In addition, the State Department's web site provides extremely useful and specific information on conditions in every country of the world. See http://travel.state.gov/ for information on health risks, violence, political upheaval and security concerns, availability of consular assistance, and unusual visa or internal transportation issues.

Both the MIT policy and the State Department information are updated regularly in response to changing conditions. Currently, students on MIT business — those taking part in an MIT program or using MIT resources — are prohibited from traveling to 20 countries deemed high risk and face travel restrictions in 17 additional countries considered moderate risk. Faculty and staff are advised to consider the risks involved in these two sets of countries and to take appropriate precautions. MIT advises all members of the community to heed these warnings and to be as well-prepared as possible when undertaking international travel.

Medical and security evacuation services are available to faculty, staff and students traveling abroad on MIT business. MIT has contracted with International SOS, a travel assistance provider, to make available to MIT community members its 24-hour Alarm Centers, a listing of international clinics and remote-site medical facilities, and online resources. Travelers are encouraged to review the International SOS web site, https://vpf.mit.edu/site/insurance/policies_procedures/international_sos, prior to travel to obtain country-specific information and to register their trip. Prior registration is not required in order to obtain coverage but is useful in case of an emergency.

For further information, please contact Richelle Nessralla, associate counsel, at rness@mit.edu; Regina Dugan, insurance manager and associate counsel, at dugan@mit.edu; or Brian Wahl, assistant dean for global education, at bwahl@mit.edu.

# A near miss, but no threat

## Asteroid in close pass was smaller than thought, astronomer shows

**David Chandler**
News Office

On March 2, an asteroid whizzed past the Earth at a distance of just 41,000 miles — a near miss by cosmic standards (most communications satellites orbit at a distance of about 22,300 miles from Earth). Headlines around the world proclaimed that Earth had dodged a bullet, and many mentioned that if the space rock had hit our planet, it might have packed a punch comparable to the Tunguska impact in 1908 that flattened trees over an 800-square-mile area in Siberia.

But some fast-tracking observations by MIT Professor of Planetary Sciences Richard Binzel proved that this rock was actually much smaller than that. Likely just 19 meters (about 60 feet) across, it would probably have disintegrated high in the atmosphere, with only a few small fragments making it to the ground.

**Richard Binzel**

Discovered just two days before its closest approach to Earth, the asteroid, called 2009 DD45, was initially estimated as between 20 and 40 meters across. At the high end, that would have made it comparable to the devastating Tunguska bolide. Binzel, on sabbatical at the Paris Observatory, decided to try to make observations of the fast-moving asteroid, aided by MIT planetary science alum Francesca DeMeo '06, SM '07 who is currently completing her doctoral research in Paris on a Fulbright scholarship.

The asteroid's close pass was on the opposite side of the planet from Paris — over the Pacific Ocean. No problem for Binzel: He and his students have routinely made observations using a remotely controlled telescope in Hawaii. The telescope can be run from a number of different locations, including a control room on the MIT campus and one at the Paris Observatory.

But following such a nearby encounter with a large telescope is a technical challenge. "The object was moving about 100 times faster than the 'normal' rate of objects we track as they cross the Earth's orbit, all on account of its very close passage," Binzel explains.

Despite that challenge, Binzel says, "All told, we stayed on the target for about two hours, before sunrise in Hawaii brought our observations to a close." And it was well worth it, because this enabled detailed spectroscopic measurements that determined the object's composition, which matched that of an S-type asteroid — the most common type. That, in turn, allowed a more accurate estimate of how reflective it was, essential to being able to determine its actual size based on measurements of its apparent brightness.

After completing the observations at the observatory's facility in the Paris suburb of Meudon, Binzel headed back in to the city.

"Final calculations for the size were made on the train ride home," he says, "where it occurred to me that the 19 meter size was about the same as the train car I was riding in, except the asteroid was going much faster."

*See http://web.mit.edu/newsoffice/2008/asteroids-tt0319.html for more on remote observing at MIT.*

# MANUFACTURING INEFFICIENCY

## Study sees 'alarming' use of energy, materials in newer manufacturing processes

**David Chandler**
News Office

Mechanical Engineering Professor Timothy Gutowski led a study showing that modern manufacturing methods are highly inefficient in their use of energy and materials.

PHOTO / **DONNA COVENEY**

Modern manufacturing methods are spectacularly inefficient in their use of energy and materials, according to a detailed MIT analysis of the energy use of 20 major manufacturing processes.

Overall, new manufacturing systems are anywhere from 1,000 to one million times bigger consumers of energy, per pound of output, than more traditional industries. In short, pound for pound, making microchips uses up orders of magnitude more energy than making manhole covers.

At first glance, it may seem strange to make comparisons between such widely disparate processes as metal casting and chip making. But Professor Timothy Gutowski of MIT's Department of Mechanical Engineering, who led the analysis, explains that such a broad comparison of energy efficiency is an essential first step toward optimizing these newer manufacturing methods as they gear up for ever-larger production.

"The seemingly extravagant use of materials and energy resources by many newer manufacturing processes is alarming and needs to be addressed alongside claims of improved sustainability from products manufactured by these means," Gutowksi and his colleagues say in their conclusion to the study, which was recently published in the journal Environmental Science and Technology (ES&T).

Gutowksi notes that manufacturers have traditionally been more concerned about factors like price, quality, or cycle time, and not as concerned over how much energy their manufacturing processes use. This latter issue will become more important, however, as the new industries scale up — especially if energy prices rise again or if a carbon tax is adopted, he says.

Solar panels are a good example. Their production, which uses some of the same manufacturing processes as microchips but on a large scale, is escalating dramatically. The inherent inefficiency of current solar panel manufacturing methods could drastically reduce the technology's lifecycle energy balance — that is, the ratio of the energy the panel would produce over its useful lifetime to the energy required to manufacture it.

The new study is just "the first step in doing something about it," Gutowski says — understanding which processes are most inefficient and need further research to develop less energy-intensive alternatives. For example, many of the newer processes involve vapor-phase processing (such as sputtering, in which a material is vaporized in a vacuum chamber so that it deposits a coating on an exposed surface in that chamber), which is usually much less efficient than liquid phase (such as depositing a coating from a liquid solution), but liquid processing alternatives might be developed.

The study covered everything "from soup to nuts" in terms of standard industrial methods, Gutowski says, "from heavy-duty old fashioned industries like a cast-iron foundry, all the way up to semiconductors and nanomaterials." It includes injection molding, sputtering, carbon nanofiber production and dry etching, along with more traditional machining, milling, drilling and melting. There were some boundaries on the processes studied, however: The researchers did not analyze production of pharmaceuticals or petroleum, and they only looked primarily at processes where electricity was the primary energy source.

The figures the team derived are actually conservative, Gutowski says, because they did not include some significant energy costs such as the energy required to make the materials themselves or the energy required to maintain the environment of the plant (such as air conditioning and filtration for clean rooms used in semiconductor processing). "All these things would make [the energy costs] worse," he says.

The bottom line is that "new processes are huge users of materials and energy," he says. Because some of these processes are so new, "they will be optimized and improved over time," he says. But as things stand now, over the last several decades as traditional processes such as machining and casting have increasingly given way to newer ones for the production of semiconductors, MEMS and nano-materials and devices, for a given quantity of output "we have increased our energy and materials consumption by three to six orders of magnitude."

One message from the study is that "claims that these technologies are going to save us in some way need closer scrutiny. There's a significant energy cost involved here," he says. And another is that "each of these processes could be improved," and using the analytical tools developed by the MIT team for this study would be a useful first step in such a detailed analysis.

In addition to Gutowski, the study was done by current and former MIT mechanical engineering students Matthew Branham, Jeffrey Dahmus, Alissa Jones and Alexandre Thiriez, and Dusan Sekulic, professor of mechanical engineering at the University of Kentucky. It was funded by the National Science Foundation.

## Q&A with Richard Hynes

*MIT Professor Richard Hynes discusses the impact of President Barack Obama's recent announcement that the federal government will expand its funding of certain types of embryonic stem cell research. Hynes, the Daniel K. Ludwig Professor for Cancer Research at the David H. Koch Institute for Integrative Cancer Research at MIT and a Howard Hughes Medical Institute Investigator, served on the National Academy of Science committees that established the current Guidelines for Human Embryonic Stem Cell Research.*

**Richard Hynes**

**Q.** What will be the most immediate impact(s) of the new stem cell rules for scientists, including those at MIT?
**A.** The Obama announcement will allow many more researchers, including some at MIT, to conduct research on well-characterized human embryonic stem (hES) cell lines. The 20 or so lines on which the Bush administration allowed NIH funding are early lines prepared and maintained in ways that leave much to be desired, both scientifically and ethically, but they were until now the only ones on which most people could work. Since 2001, researchers with access to non-federal funding have developed many new lines using improved techniques and better and more ethical informed consent procedures. There are estimated to be hundreds of such lines. Once the NIH has reviewed which of those lines are deemed acceptable for distribution and for federal funding of research using them, many of them will become available to all scientists to study. MIT scientists are working on methods to develop hES cells for therapeutic purposes, and they will now have more and better lines to analyze.

There is a great deal of research needed to work out how to coax hES cells into different cell types and how to use them for research and therapy — that necessary research has been impeded by the Bush administration policy and will now be much enhanced. What the Obama announcement does not do is allow federal funding for the development of any new hES cell lines. That is precluded by current congressional legislation and will require action by the House and Senate to change the law. Such a change seems rather unlikely in the near future. However, development of new lines can continue with non-federal funding and they can presumably be made available for NIH-funded research.

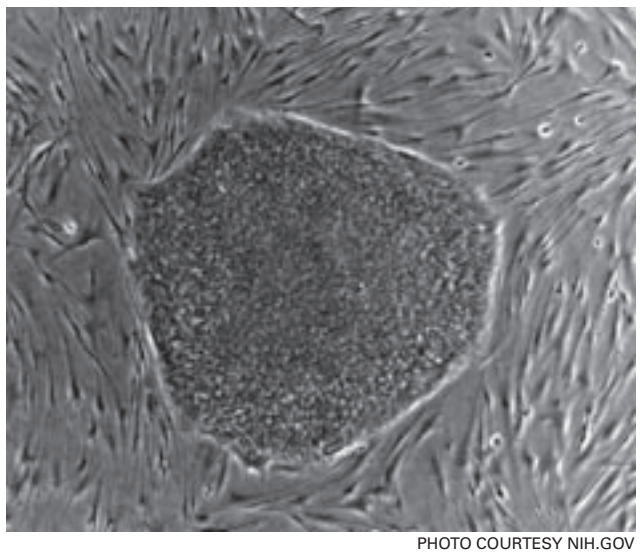

PHOTO COURTESY NIH.GOV

A human embryonic stem (hES) cell colony on a mouse embryonic fibroblast (MEF) feeder layer.

**Q.** How will your own research be affected?
**A.** My own research will not be affected — I do not work on human ES cells. That is one of the reasons I was able to serve on the National Academy of Science committees that established the current Guidelines for Human Embryonic Stem Cell Research. Some of those guidelines (the ones concerning use of existing lines) will presumably be incorporated into the NIH regulations. However, the NAS guidelines will still be needed to guide research practices on aspects not eligible for federal funding such as making new lines from IVF embryos or by nuclear transfer.

**Q.** What potential long-term impacts do you see, in terms of better understanding and/or treatment of human disease?
**A.** The promise of human stem cells will only be realized after a lot of hard work by many scientists. The pace of research has been slowed by the Bush-era restrictions — the new rules will allow more research to be done by more people on more and better hES cell lines. That will undoubtedly speed the development of our understanding and applications of stem cells. Stem cells offer promise both for deeper understanding of disease processes and for the testing of drugs that may ameliorate such diseases, as well as the prospects for actual therapeutic applications of stem cells and of cells and tissues derived from them.

**Q.** Have recent advances in reprogramming adult stem cells to an embryonic state made embryonic stem cell research less important? Or is it important to pursue both areas of research?
**A.** The recent advances on reprogramming of adult cells to a pluripotent state (capable of developing into many cell types) are very exciting and there is hope that they may eventually be an alternative source. However, we do not yet understand reprogramming and it is very inefficient. So we currently need to pursue investigation of multiple approaches — both embryonic and adult stem cells as well as induced pluripotent stem cells. The chances are that each will have some applications and we cannot be sure yet which will prove the most useful in the long run.

# A human failure... ...seen at face value

## Research probes why we have difficulty recognizing faces in photo negatives

**Anne Trafton**
News Office

Humans excel at recognizing faces, but how we do this has been an abiding mystery in neuroscience and psychology. In an effort to explain our success in this area, researchers are taking a closer look at how and why we fail.

A new study from MIT looks at a particularly striking instance of failure: our impaired ability to recognize faces in photographic negatives. The study, which appeared in the Proceedings of the National Academy of Sciences last week, suggests that a large part of the answer might lie in the brain's reliance on a certain kind of image feature.

The work could potentially lead to computer vision systems, for settings as diverse as industrial quality control or object and face detection. On a different front, the results and methodologies could help researchers probe face-perception skills in children with autism, who are often reported to experience difficulties analyzing facial information.

Anyone who remembers the days before digital photography has probably noticed that it's much harder to identify people in photographic negatives than in normal photographs. "You have not taken away any information, but somehow these faces are much harder to recognize," says Pawan Sinha, an associate professor of brain and cognitive sciences and senior author of the PNAS study.

Sinha has previously studied light and dark relationships between different parts of the face, and found that in nearly every normal lighting condition, a person's eyes appear darker than the forehead and cheeks. He theorized that photo negatives are hard to recognize because they disrupt these very strong regularities around the eyes.

To test this idea, Sinha and his colleagues asked subjects to identify photographs of famous people in not only positive and negative images, but also in a third type of image in which the celebrities' eyes were restored to their original levels of luminance, while the rest of the photo remained in negative.

Subjects had a much easier time recognizing these "contrast chimera" images. According to Sinha, that's because the light/dark relationships between the eyes and surrounding areas are the same as they would be in a normal image.

Similar contrast relationships can be found in other parts of the face, primarily the mouth, but those relationships are not as consistent.

"The relationships around the eyes seem to be particularly significant," says Sinha.

Can you tell who this person is? No? You are not alone. Research from MIT shows why it is harder to recognize people in photo negatives. Still wondering who it is? See page 6 for the answer.

Other studies have shown that people with autism tend to focus on the mouths of people they are looking at, rather than the eyes, so the new findings could help explain why autistic people have such difficulty recognizing faces, says Sinha.

The findings also suggest that neuronal responses in the brain may be based on these relationships between different parts of the face. The team found that when they scanned the brains of people performing the recognition task, regions associated with facial processing (the fusiform face areas) were far more active when looking at the contrast chimeras than when looking at pure negatives.

Other authors of the paper are Sharon Gilad of the Weizmann Institute of Science in Israel and MIT postdoctoral associate Ming Meng, both of whom contributed equally to the work.

The research was funded by the Alfred P. Sloan Foundation and the Jim and Marilyn Simons Foundation.

# As planet warms, poor nations face economic chill

## Climate change may widen gap between rich and poor, study finds

**Stephanie Schorow**
News Office

A rising tide is said to lift all boats. Rising global temperatures, however, may lead to increased disparities between rich and poor countries, according to a recent MIT economic analysis of the impact of climate change on growth.

After examining worldwide climate and economic data from 1950 to 2003, Benjamin A. Olken, associate professor in the Department of Economics, concludes that a 1 degree Celsius rise in temperature in a given year reduces economic growth by an average of 1.1 percentage points in the world's poor countries but has no measurable effect in rich countries.

Olken says his research suggests higher temperatures will be disproportionately bad for the economic growth of poor countries compared to rich countries.

The precise reasons why higher temperatures lower economic output are likely to be complex, but Olken's results suggest the importance of temperature's impact on agricultural output. His data also provide evidence for a relationship between temperature and industrial output, investment, research productivity and political stability.

"The potential impacts of an increase in temperature on poor countries are much larger than existing estimates have suggested," Olken says. "Although historical estimates don't necessarily predict the future, our results suggest that one should be particularly attentive to the potential impact of climate change on poorer countries."

Olken's analysis is contained in "Climate Shocks and Economic Growth: Evidence from the Last Half Century," a paper co-authored by MIT economics graduate student Melissa Dell and Benjamin F. Jones, associate management professor at Northwestern University. The paper is currently under review for publication. Olken, who has been researching issues of growth and temperature for about two years, presented some of the findings at a recent conference of the American Economic Association.

### Growing hot-cold divide

It has long been observed that hotter countries, such as those in sub-Saharan Africa and parts of Latin America, tend to be poorer than cooler countries in North America and Europe; the main exceptions are hot, rich Middle East countries with oil reserves and cold, poor Communist or former Communist states like North Korea and Mongolia. What contemporary scholars have debated, however, is whether climate has a significant effect on a country's economy today or whether it is institutions and policies that now solely drive prosperity.

To conduct their research, Olken and his co-authors used existing data sets of economic growth and productivity — everything from gross domestic product to the rate of publication of scientific papers — and combined them with country-by-country temperature and precipitation data from 1950 to 2003.

Olken and his co-authors conclude that rising temperatures do substantially reduce economic output and growth rates in both agricultural and industrial sectors, but only in countries that are already poor. Higher temperatures also reduce investment and innovation but, again, only in poor nations.

Rising temperatures may also have political consequences, the authors found. A one-degree rise in temperature in poor countries raises the likelihood of a so-called irregular leader transition (i.e., a coup) by 3.9 percentage points.

PHOTO / **DONNA COVENEY**

Associate Professor of Economics Benjamin Olken

Olken acknowledges that the long-term impact of temperature change might be different from the short-term effect since countries may adapt to a particular climate over time. But his research found no such adaptation over a 10-year time horizon.

Should the future effects mirror recent history, world policy makers should be prepared for a widening gap between rich and poor countries as the globe continues to warm, he says.

# Power down

## IS&T recommends ways to save electricity

**David Chandler**
News Office

*GreeningMIT is an occasional series focusing on the broad efforts to improve energy efficiency on campus.*

With more than 20,000 personal computers and thousands of servers on campus, saving even a small amount of energy on each could make a significant impact.

Toward that end, Information Services and Technology (IS&T) has made recommendations about buying energy-efficient computers, enabling energy-saving settings and consolidating underused servers by using virtualization.

With community adoption of these guidelines, MIT would save about 8 million kilowatt-hours of electricity annually — enough to power 1,000 Cambridge homes — says Laxmi Rao, IS&T's energy coordinator.

For example, IS&T recommends powering down most computers when they're not being used and buying energy-efficient models when replacing computers and monitors. IS&T provides detailed information on its web site about the energy management features that are built into Windows and Macintosh operating systems. One action everyone can take now is to disable screen savers; they don't save screens, but they do waste power.

But there's a catch: IS&T is aware that its recommendation to power down computers when idle is not feasible for everyone at this time. Turning off your computer when you head home at night sounds like a no-brainer — but it is not a viable option for about one-quarter of all MIT's personal computers because they are set up for automatic nightly backups or remote access.

IS&T and members of the community are pursuing solutions. One possible approach would allow a computer that is powered down to wake up, complete a scheduled backup and then return to a low power mode.

"We know this has to be done," says Jonathan Hunt, IS&T senior manager for software services. "The necessary solution is being tested and enhanced to ensure it will work reliably across different types of computers."

IS&T has also asked its computer vendors to improve the efficiency of computer power supplies. A few years ago a typical computer power supply was around 60 percent efficient, with the remainder being dissipated as waste heat. IS&T Departmental IT Resource Manager Chris Lavallee worked with MIT Procurement to set a standard for at least 80 percent efficient power supplies on all new computers bought on campus or recommended to students. Major vendors took notice. Dell, for example, became the first vendor to meet the 80-plus requirement for personal computers in 2007. They are continuing to make improvements and hope to meet 90-plus certification for their server line in the near future.

IS&T's energy-saving efforts go beyond recommendations for personal computers. It is implementing virtualization software for servers in MIT's data centers. Virtualization enables one server to consolidate the functions of several separate servers, and thus reduce the total number of servers and the energy required to run them. Savings achieved in the data centers will supplement savings from the recommended measures for personal computers.

IS&T is also looking at the environmental impacts of printing. A student-led effort supported by IS&T has resulted in the promotion of double-sided printing. Since spring of last year, it has been the default setting for all new Athena accounts — thus reducing the use of paper and the energy required to manufacture it.

The list of energy-saving guidelines from IS&T can be found at http://web.mit.edu/ist/initiatives/it-energy/guidelines.html.

# **ECONOMY:** MIT-trained economists bring pragmatic approach

Continued from **Page 1**

"They have all been very productive in research and every one has been concerned with economic problems that are closely related to policy issues," Solow says.

**Problem solvers**

Romer, an economic historian and macroeconomist, has studied the causes of the Great Depression and the effect of U.S. monetary and tax policies on the recovery from that economic disaster. "Her research positions her very well to tackle the problem of designing an economic stimulus package for an economy that is sputtering," Poterba says.

Summers' research spans both microeconomics and macroeconomics, which gives him a broad range that is especially helpful in handling the many issues that come before the NEC. More importantly, as Treasury secretary under the Clinton administration and as a World Bank economist, Summers has had a hands-on role in addressing world economic crises, such as the Mexican monetary crisis of 1984 and the Russian market crises of 1998, Poterba says. "He has a tremendous amount of experience at trying to fashion policy remedies for the kind of crises we're experiencing."

Goolsbee is known for his research on how tax policy affects the behavior of high-income households — a topic likely to be central to tax and budget discussions after the current economic downturn abates. Stein's academic research focuses on corporate finance and financial intermediation.

While some observers have characterized the Obama economists' ideology as Keynesian (in reference to John Maynard Keynes, who championed greater government spending as a way to lift an economy out of recession), Solow says that is only because the economic field has been almost monolithically anti-Keynesian in recent decades. He prefers to characterize the group as "eclectic Keynesians."

Certainly, most economists have some ideological tilt, Poterba says. "There are some people who would never, ever consider nationalizing a bank. There are others who are prepared to consider that," he says. "I don't think [the MIT-trained economists] are going to stand on ideological principle. If they think something is going to work, they're going to try it."

Which is, he notes, no guarantee of success in the face of tough economic problems that have caught many economists by surprise. "This is not like baking a cake where if you just follow all the recipe directions, it is supposed to turn out perfectly," Poterba says. "We're not quite sure what works in this situation."

## Awards Convocation deadline is this Friday, March 20

Nominations for MIT's annual Awards Convocation are being accepted now through Friday, March 20.

Encompassing more than 30 awards across many areas and departments, the Awards Convocation honors those — including students, faculty and staff — who have made special contributions to the life of the MIT community. The winners will be announced during the convocation, which will be held at 4 p.m. on Tuesday, May 5, in 10-250.

For more information, and to browse the awards descriptions and previous recipients, see http://web.mit.edu/awards/.

## WIN AN IPHONE! There's still time to enter our photo contest

Don't forget, the first-ever Sustainability at MIT Photo Contest is going on through March 31, so there's still time to submit your photos. Show us what you see and what your aspirations are as MIT launches its greeningMIT campaign to help the Institute walk the talk on energy and the environment.

The grand-prize winner will receive an iPhone and have his or her winning entry published on the MIT home page and in MIT's official newspaper, Tech Talk. Prizes will also be awarded to the first- and second-place finishers.

For complete rules, including how to enter, please visit web.mit.edu/newsoffice/2009/photo-contest-rules.html.

### No Tech Talk next week

Because of spring break, there will be no Tech Talk next Wednesday, March 25. Tech Talk will resume on April 1. For up-to-date news and information, go to web.mit.edu/newsoffice.

PHOTO / **JOHN TYLKO**

## MIT alum lifts off

Space shuttle Discovery lifts off from Kennedy Space Center on March 15 with pilot Dominic Antonelli '89 at the controls. Discovery's crew will deliver and assemble the final solar array to the International Space Station. Antonelli will join fellow classmate Michael Fincke '89, who is commander of the Expedition 18 crew already on board the space station.

**ANSWER FROM PAGE 5:** THE IMAGE IS OF FRANKLIN D. ROOSEVELT

# BATTERY: New material could solve issues

Continued from **Page 1**

March 12 issue of Nature. Because the material involved is not new — the researchers have simply changed the way they make it — Ceder believes the work could make it into the marketplace within two to three years.

State-of-the-art lithium rechargeable batteries have very high energy densities — they are good at storing large amounts of charge. The tradeoff is that they have relatively slow power rates — they are sluggish at gaining and discharging that energy. Consider current batteries for electric cars. "They have a lot of energy, so you can drive at 55 mph for a long time, but the power is low. You can't accelerate quickly," Ceder said.

PHOTO / **DONNA COVENEY**
Gerd Ceder

Why the slow power rates? Traditionally, scientists have thought that the lithium ions responsible, along with electrons, for carrying charge across the battery simply move too slowly through the material.

About five years ago, however, Ceder and colleagues made a surprising discovery. Computer calculations of a well-known battery material, lithium iron phosphate, predicted that the material's lithium ions should actually be moving extremely quickly.

"If transport of the lithium ions was so fast, something else had to be the problem," Ceder said.

Further calculations showed that lithium ions can indeed move very quickly into the material but only through tunnels accessed from the surface. If a lithium ion at the surface is directly in front of a tunnel entrance, there's no problem: it proceeds efficiently into the tunnel. But if the ion isn't directly in front, it is prevented from reaching the tunnel entrance because it cannot move to access that entrance.

Ceder and Byoungwoo Kang, a graduate student in materials science and engineering, devised a way around the problem by creating a new surface structure that does allow the lithium ions to move quickly around the outside of the material, much like a beltway around a city. When an ion traveling along this beltway reaches a tunnel, it is instantly diverted into it. Kang is a coauthor of the Nature paper.

Using their new processing technique, the two went on to make a small battery that could be fully charged or discharged in 10 to 20 seconds (it takes six minutes to fully charge or discharge a cell made from the unprocessed material).

Ceder notes that further tests showed that unlike other battery materials, the new material does not degrade as much when repeatedly charged and recharged. This could lead to smaller, lighter batteries, because less material is needed for the same result.

"The ability to charge and discharge batteries in a matter of seconds rather than hours may open up new technological applications and induce lifestyle changes," Ceder and Kang conclude in their Nature paper.

This work was supported by the National Science Foundation through the Materials Research Science and Engineering Centers program and the Batteries for Advanced Transportation Program of the U.S. Department of Energy. It has been licensed by two companies.

# MIT Activities Committee celebrates 25 years

## Open houses planned this week in Stata, Lincoln Lab

The MIT Activities Committee (MITAC) is celebrating its 25th anniversary this week with open houses on both MIT's main campus and at Lincoln Laboratory.

MITAC began in 1984 with a simple mission: to offer cultural and recreational events to the MIT community at a fair and affordable cost. Conceived of by the Working Group on Support Staff Issues as a way to raise community spirit and employee morale, the committee has since offered nearly 4,000 events to the community. MITAC estimates that its customers have saved close to $100,000 annually on theatre shows, concerts, sports games, lectures and bus trips — not to mention discounted tickets to cinemas and theme parks.

MITAC Coordinator Diane Betz Tavitian noted that among the group's most memorable activities was the trip it organized to Ground Zero to help New York firefighters in the wake of the Sept. 11 attacks.

"We're very grateful to the hundreds of MITAC committee members over the years who have inspired creative and memorable events for the MIT community," she said.

Notable upcoming MITAC events include the annual Red Sox Lottery, for which online registration will be held between March 24 and April 3. For further information about the lottery and other MITAC events, please visit the committee's web site at http://web.mit.edu/mitac.

Members of the MIT community are invited to join MITAC's 25th anniversary celebration open house from 11 a.m.-4 p.m. on March 18 in the Stata Center Lobby and from 11:30 a.m.-1:30 p.m. on March 19 at Lincoln Laboratory.

PHOTO / **MITAC**

A sleighride was one of the first MIT Activities Committee (MITAC) events. MITAC is celebrating its 25th anniversary this year with a party in the Stata Center on March 18.

# Awards&Honors

## Bartolotta wins Jostens Trophy

MIT senior guard Jimmy Bartolotta added more hardware to the most decorated basketball season in Institute history as he was selected as the 2009 recipient of the highly coveted Jostens Trophy. The annual award recognizes outstanding student-athletes in NCAA Division III basketball for excellence in the classroom, on the playing court and in the community.

The winners are chosen by a national selection committee that consists of college coaches, former athletes, college administrators and selected members of the media. The members of the national selection committee cast their votes based on three criteria: basketball ability, academic prowess and community service.

Bartolotta will be presented with the Jostens Trophy on March 19.

**James Bartolotta**

**Kenneth Hewitt**

## Hewitt, 45-year MIT employee, honored for work with Brockton youth

Kenneth "Sonny" Hewitt, the assistant director for human resources and facilities at the Lab for Nuclear Science and a 45-year employee of MIT, was honored on March 15 by the Brockton Youth Foundation for his ongoing leadership in supporting the city's youth.

Hewitt, who has served as a Brockton Community Basketball official for 24 years, began his career at MIT on April 16, 1964, and has had various titles at the Institute throughout the years, including coach of the junior varsity basketball team.

The Brockton Youth Foundation was recently established by parents and civic leaders to provide funding, leadership and programs for youths in the city, and the event honoring Hewitt and five other residents — titled "Breakfast with Champions" — was its first fundraiser.

## MIT E-Team participating in March Madness for the Mind

The MIT E-Team, "Affordable Solar Thermal Microgenerator Technology for Rural Cogeneration in Southern Africa," has been selected to participate in the National Collegiate Inventors and Innovators Alliance's (NCIIA) annual "March Madness for the Mind" exhibition on March 20.

March Madness for the Mind is an opportunity for the nation's top Excellence and Entrepreneurship Teams (E-Teams) — collaborating groups of college students, faculty and industry mentors who have received NCIIA grants — to unveil their inventions to the public, many for the first time.

MIT's team is working on developing a novel solar thermal technology that lowers up-front and fuel costs while decreasing the risk of theft. The turbine uses parabolic concentrating solar collectors and a heat engine constructed from mass-manufactured HVAC and automotive parts. The technology can affordably supply both electricity and hot water/heating to rural institutions such as primary schools or health clinics.

## RSI students take $100K, $25K science prizes

Two students from MIT's Research Science Institute (RSI) summer program won top prizes at the Intel Science Talent Search on March 10. Eric Larson won the top prize ($100,000) and Noah Arbesfeld ranked sixth ($25,000). They were mentored by mathematics professor Pavel Etingof and graduate student David Jordan.

# CLASSIFIED ADS

**Members of the MIT community may submit one ad each issue. Ads should be 30 words maximum; they will be edited. Submit by e-mail to ttads@mit.edu or mail to Classifieds, Rm 11-400. Deadline is noon Wednesday the week before publication.**

## HOUSING/RENTALS

Somerville: Condo/Townhouse for rent $1600.00 per month - no utilities. End unit - 2 bedrooms - 2 full baths - Kitchen, Dining room and Large living room. Air/cond units in wall, pergo floors, security alarm, near transportation. Washer, dryer, refrigerator, microwave. Location: 77A Mt. Vernon Street. 1 car garage & 1 outside parking space deeded, private back yard—move in condition. Please call: (781) 820-2121 or (617) 253-3038 for appointment. Available immediately.

Eco-escape! Cape Breton, Nova Scotia rental. 3 BR oceanfront farmhouse on historic Cabot Trail with 100 acres field and forest. $725/wk, June-Oct. (Roger, rgmark@mit.edu)

Ocean front summer cabin, Mount Desert Island, ME: 2BD/1BA w/living/kitchen area; picture windows, deck overlooking water; stairway to beach. Mins from Acadia National Park, Bar Harbor. $1,000/week June-Sept. Steve at 253-5757 or chorover@mit.edu.

North End 1 Bedroom, 1 Bath, on the quiet side of Hanover Street. 819 square feet. Available April 1st. 1650 a month. zorar@aol.com

Resource Development officer looking for simple accommodations during the week - bed, bath, parking - at reasonable price. Cambridge/Arlington preferred. Respond to rratwood@mit.edu.

Fabulous, light-filled loft w/expansion possibilities at 243 Bent St. - Unit 8, Cambridge. High ceilings, skylight, south-facing windows. Walk to Kendall Square. Deeded parking outside your door. Low condo fees, taxes. Beautiful courtyard. $579K. Contact Cynthia Cronin 617.796.2476.

## FOR SALE

2004 Pontiac Vibe GT(1.8L) Hatchback $7,995.00 Royal White, Man_Trans, 26,900 mi, Ex Cond with New Battery, Brake Pads, and a Xm Satellite Radio. Contact Bob, via RvarSpace@alum.mit.edu

Each robot — one of which is shown here picking fruit — is outfitted with a robotic arm and a watering pump, while networked sensors help the plants 'request' water or nutrients from their robotic gardeners. The bases of the robots are re-imagined versions of iRobot's Roomba.

PHOTO / **DONNA COVENEY**

# GARDEN **variety**

IN CSAIL's indoor tomato garden, robots have supplanted humans. Could this be the future of agriculture?

LEFT: The idea for the project came from work done by Nikolaus Correll, a postdoctoral assistant working in the Distributed Robotics Lab of EECS Professor Daniela Rus. Rus, shown here in the garden, refers to the system as precision agriculture because of the way robots distribute resources and care on demand.

PHOTO / **DONNA COVENEY**

PHOTO / **JASON DORFMAN, CSAIL**

LEFT: Mechanical engineering senior Luke Johnson, left, and EECS senior Samuel Dyar work on programming one of the robot's arms to find select fruit.

RIGHT: Lauren White, a senior in electrical engineering and computer science, demonstrates how the camera on an autonomous robotic gardener's arm works.

PHOTO / **JASON DORFMAN, CSAIL**