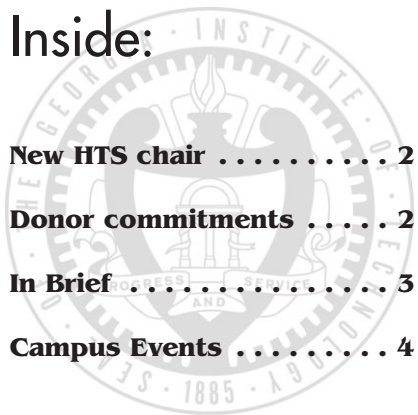


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THE WHISTLE

FACULTY/STAFF NEWSPAPER

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THE GEORGIA INSTITUTE OF TECHNOLOGY

New device burns fuel with nearly zero emissions

Simple design makes ultra-low emission combustion efficient, affordable and stable

Megan McRainey
 Institute Communications
 and Public Affairs

Georgia Tech researchers have created a new combustor designed to burn fuel in a wide range of devices with lower emission of nitrogen oxide (NOx) and carbon monoxide (CO), two of the primary causes of air pollution. The device, a combustion chamber where fuel is burned to power an engine or turbine, has a simpler design than existing, state-of-the-art combustors and could be manufactured and maintained at a lower cost, making it more affordable in everything from jet engines and power plants to home water heaters.

"We must burn fuel to power aircrafts and generate electricity for our homes. The combustion community is working very hard to find ways to burn the fuel completely and derive all of its energy while minimizing emissions," said Ben Zinn, Regents' professor in the School of Aerospace Engineering and a key collaborator on

the project. "Our combustor has an unbelievably simple design; it would be inexpensive to make and inexpensive to maintain."

Attaining ultra-low emissions has become a top priority in combustion technology as federal and state restrictions on pollution continuously reduce the allowable levels of NOx and CO produced by engines, power plants and industrial processes.

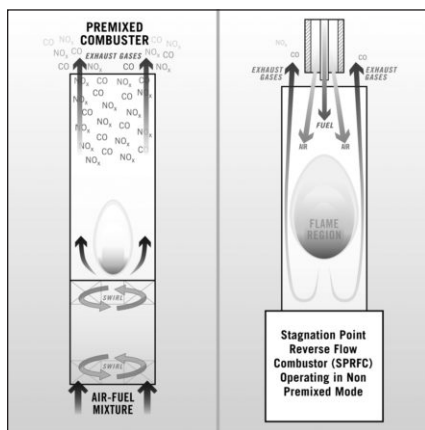
Called the Stagnation Point Reverse Flow Combustor, the Georgia Tech device significantly reduces these emissions in a variety of aircraft engines and gas turbines that burn gaseous or liquid fuels. It can burn fuel with NOx emissions below 1 ppm (parts per million), and CO emissions lower than 10 ppm, amounts significantly lower than emissions produced by other combustors.

Funded by the NASA University Research Engineering Technology Institute Center on Aeropropulsion and Power and Georgia Tech, the project's initial goal was to develop a low-emissions combustor for aircraft engines and power-generating gas turbines to burn large amounts of fuel in a small volume over a wide range of power settings. But the design can be adapted for use in a variety of applications.

"We wanted to have all the clean-burning advantages of a low temperature combustion process while burning a large amount of fuel in a small volume," Zinn said.

The combustor burns fuel in low temperature reactions that occur over a larger portion of the combustor — unlike a thin "concentrated" high temperature flame — while still releasing a comparable amount of energy. By eliminating all high-temperature pockets through better control of the flow of the reactants and combustion products within the combustor, the device produces far lower levels of NOx and CO and avoids acoustic instabilities that are problematic in current low emissions combustors.

To reduce emissions in existing combustors, fuel is premixed with a large amount of swirling airflow prior to injection into the combustor. This requires complex and expensive designs, and the combustion process



A comparison of Georgia Tech's combustor with a traditional combustor: (Left) A traditional combustor mixes fuel and air before they are injected into the combustion chamber. (Right) Tech's combustor injects the fuel and air separately into the combustor, while its shape forces them to mix with one another and with combustion products before ignition occurs.

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GTRInternational



Georgia Tech Research Institute (GTRI) Director Steve Cross, IDA Ireland CEO Sean Dorgan, President Wayne Clough and GTRI Deputy Director David Parekh at the official opening of Georgia Tech Ireland, a new research enterprise that will focus on four technology areas that mirror Ireland and Georgia Tech's research strengths — digital media, radio frequency identification (RFID), biotechnology and energy. It is GTRI's first applied research facility outside the United States.

Tech tests transistor at record 500 GHz

250 times faster than chips in use today

John Toon
 Research News

A research team from IBM and Georgia Tech has demonstrated the first silicon-germanium transistor able to operate at frequencies above 500 gigahertz (GHz). Though the record performance was attained at extremely cold temperatures, the results suggest that the upper bound for performance in silicon-germanium devices may be higher than originally expected.

Ultra-high-frequency silicon-germanium (SiGe) circuits have potential applications in many communications systems, defense systems, space electronics platforms and remote sensing systems. Achieving such extreme speeds in silicon-based technology — which can be manufactured using conventional low-cost techniques — could provide a pathway to high-volume applications. Until now, only integrated circuits fabricated from more costly semiconductor materials have achieved such extreme levels of transistor performance.

"For the first time, Georgia Tech and IBM have demonstrated that speeds of half a trillion cycles per second can be achieved in a commercial silicon-based technology, using large wafers and silicon-compatible low-cost manufacturing techniques," said John D. Cressler, a professor in the School of Electrical and Computer Engineering, and a researcher in the Georgia Electronic Design Center (GEDC). "This work redefines the upper bounds of what is possible using silicon-germanium nanotechnology techniques."

The accomplishment is reported in the July issue of the journal IEEE Electron Device Letters.

'More fruit available' from SiGe

"This groundbreaking collaborative research by Georgia Tech and IBM redefines the performance limits of silicon-based semiconductors," said Bernie Meyerson, vice president and chief technologist at the IBM Systems and Technology Group.

The silicon-germanium heterojunction bipolar transistors built by the

Record continued, page 3



"The industry always wants more. People are always wondering how far silicon can take us, and this should show there's a lot of mileage left to go."

—John Cressler, a professor in the School of Electrical and Computer Engineering, on his research team's recent announcement that they had clocked a silicon-based computer chip at 500 gigahertz, the fastest speed on record.
(Associated Press)

Bayor named chair of School of History, Technology and Society

Elizabeth Campell
Institute Communications
and Public Affairs

Citing his scholarly reputation and administrative experience, Georgia Tech has named Professor Ronald Bayor chair of the School of History, Technology and Society (HTS) in the Ivan Allen College, effective July 1.

"I am pleased to announce that Ron Bayor will serve in this new capacity," said Sue Rosser, dean of Ivan Allen College. "Ron's body of scholarly work in ethnic history and his ability to work with the faculty to expand its research and build its undergraduate and graduate programs are assets for Georgia Tech."

Bayor, who joined the faculty in 1973, said, "I am excited about this opportunity to lead the School of History, Technology and Society and look forward to making scholarly connections with other Georgia Tech schools and departments. The School has an outstanding reputation as a leader in the field of science and technology history and sociology, and we will work to further expand that

reputation as well as continue our significant contribution to other aspects of historical and sociological research and teaching."

Bayor has been the recipient of several teaching awards at Georgia Tech, including the 2006 Geoffrey G. Eichholz Faculty Teaching Award. He is the past recipient of the School of Social Science Excellence in Teaching and the Georgia Tech Outstanding Teacher Awards. Recently, Bayor received the Association for Asian American Studies 2006 Lifetime Service Award for his dedication as editor of the Journal of American Ethnic History and his support of scholars in the field of Asian American Studies.

Bayor, a historian specializing in urban, ethnic, immigration and race relations history, is frequently invited to speak at academic conferences and historical society events and to consult on community projects. He has served as the lead historian for the NAACP Legal Defense and Education Fund and on the City of Atlanta advisory committee for a past planned PBS series about Atlanta neighborhoods.



A specialist in the history of American race relations, Bayor joined the faculty in 1973.

Bayor received his doctoral degree in American urban history from the University of Pennsylvania. He completed his master's degree in American history from Syracuse University and his bachelor of arts in history from City College of New York.

Bayor fills the position previously held by Willie Pearson, who is stepping down from the chair position and will remain on the faculty.

For more information...

School of History,
Technology and Society
www.hts.gatech.edu

Donor commitments support new faculty positions

Professorship seeks to improve health care system

Dramatically rising costs and millions of uninsured Americans paint a bleak picture of the U.S. health-care system. An important element of the complex set of forces that have created this situation is operational inefficiency in the health care delivery system. The need for drastic improvement in operational efficiency is driving the work of Georgia Tech's newly created Health Systems Institute (HSI), a collaborative and interdisciplinary effort between Tech and Emory University.

"Our mission with the new Institute is to develop and implement novel multidisciplinary and collaborative programs to transform our nation's health care delivery systems," said François Sainfort, director of the Health Systems Institute and professor in the Department of Biomedical Engineering. "Our central purpose is to help lead the nation away from an ineffective, reactive, disease-focused system to achieve a cost-effective, proactive, health- and wellness-focused system."

A major step in reaching this goal was recently taken with the creation of the Joseph C. Mello Professorship in Health Systems, HSI's first endowed faculty position.

The new professorship was created by a lead commitment from alumnus Joseph C. Mello, chief operating officer of DaVita Inc., which provides dialysis services for those diagnosed with chronic kidney disease.

"The U.S. health care system is broken," Mello said. "In my view, part of the reason it is stems from the lack of linkage between cost, quality and outcomes. It is my wife Ginny's and my hope that our support of the Health Systems Institute through the Joseph C. Mello Professorship will foster the interdisciplinary approach necessary to make a difference for the entire health care system. At the same time, we want to support Georgia Tech's thought leadership in this area, which has been so articulately expressed by François Sainfort. I am excited about the prospect of working with him for many years to come on the challenges ahead."

Mello, who graduated with a bachelor's degree in health systems, has served as DaVita's COO since 2000. Previously, he was president and CEO of the leading practice management company in the asthma/allergy field.

Ernie Scheller honors Terry Blum's service

If you ask Ernest "Ernie" Scheller Jr., IM 1952, the most important lesson he learned from being a Tech student, he will quickly tell you it was "perseverance."

"I've been asked many times over the years what is the secret of my success," said Scheller, chairman of Silberline Manufacturing Company. "I always give Georgia Tech the credit for teaching me the importance of perseverance and persistence, which were very important factors. What really set Silberline apart, though, were innovation and a determination to respond quickly to the needs of the marketplace."

When Scheller was a Tech student in the late 1940s and early 1950s, innovation and entrepreneurship were not exactly hot topics of classroom discussion. More than fifty years later, these are key topics of study for all Management students and many others at Tech. To further strengthen the College of Management's offerings in these areas, Scheller has made a seven-figure commitment to endow the Ernest Scheller Jr. Chair in Innovation, Entrepreneurship and Commercialization (IEC).

Scheller said that aside from the obvious goals of making the College of Management a renowned leader in education and research related to IEC, his commitment is also intended to honor the work of Terry Blum, who after seven years as dean of the College of Management is stepping down as dean to create and direct a new Georgia Tech Interdisciplinary Institute for Leadership and Entrepreneurship.

"I am so deeply touched by this wonderful gesture of support and friendship from Ernie and Roberta Scheller," she said. "This commitment was not only a pleasant surprise for me personally, but more importantly a truly visionary investment in the long-term vitality of the College."

In recognition of a portion of the Schellers' past philanthropy, the Roberta and Ernest Scheller Jr. Lobby and Auditorium in the Management Building were named in their honor. They also previously established a discretionary endowment fund in the College of Management and have supported Tech's golf program and the Alexander-Tharpe Fund and Roll Call for many years.

Georgia
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System of Georgia.

Chevron forms research partnership with Tech

\$12 million to create alternative fuels

The Chevron Corporation and Georgia Tech have formed a strategic research alliance to pursue advanced technology aimed at making cellulosic biofuels and hydrogen viable transportation fuels.

Chevron Technology Ventures, a subsidiary of Chevron, plans to collaborate with Georgia Tech's Strategic Energy Institute and contribute up to \$12 million over five years for research into and development of these emerging energy technologies.

The focus of the joint research is to develop commercially viable processes for the production of transportation fuels from renewable resources such as forest and agricultural waste. This is viewed as an important advancement over first-generation biofuels such as ethanol and biodiesel, which are made from agricultural crops such as corn, sugarcane and soybeans.

"Once developed, second-generation processing technology will allow waste products to be converted into renewable transportation fuels, opening the door to a new phase in alternative energy," said Rick Zalesky, vice president of

Biofuels and Hydrogen, Chevron Technology Ventures (CTV).

Chevron and Georgia Tech formed the alliance because their research and development goals related to emerging energy technologies are closely aligned.

"This collaboration fits well with Georgia Tech and its Strategic Energy Institute's goal to help develop energy technologies that both industry and consumers can embrace. We look forward to working with Chevron to create effective and economical fuel alternatives," said Roger Webb, director of the Strategic Energy Institute.

The alliance will focus its research on four areas: production of cellulosic biofuels, understanding the characteristics of biofuel feedstocks, developing regenerative sorbent materials and improving sorbents — used to remove gases such as carbon monoxide, carbon dioxide and nitrogen — to produce high-purity hydrogen.

For more information...

Strategic Energy Institute
www.energy.gatech.edu

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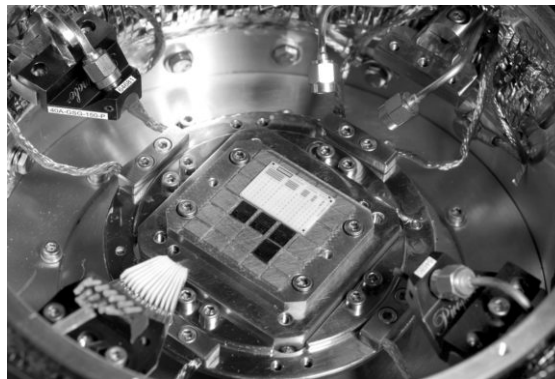
IBM-Georgia Tech team operated at frequencies above 500 GHz at 4.5 Kelvins (451 degrees below zero Fahrenheit), a temperature attained using liquid helium cooling. At room temperature, these devices operated at approximately 350 GHz. Performance measurements were made using a specialized high-frequency test system in the GEDC.

The next step in this research will be to understand the physics behind the silicon-germanium devices, which display some unusual properties at these extremely low temperatures.

"We observe effects in these devices at cryogenic temperatures which potentially make them faster than simple theory would suggest, and may allow us to ultimately make the devices even faster," said Cressler, who heads the world's largest university-based silicon-germanium research team at Georgia Tech. "Understanding the basic physics of these advanced transistors arms us with knowledge that could make the next generation of silicon-based integrated circuits even better."

Silicon-germanium technology has been of great interest to the electronics industry because it allows substantial transistor performance improvements to be achieved while using fabrication techniques compatible with standard manufacturing processes. SiGe boosts performance and reduces power consumption in chips that go into cellular phones and other advanced communication devices.

"We are happy to see that the GEDC's



Close-up of cryogenic test station in the Georgia Electronic Design Center. The facility is capable of cooling electronic devices to temperatures near absolute zero. The black squares in the center are silicon-germanium chips.

continuing support of research in high-speed mixed-signal technologies and other device research is leading to more cost-effective solutions for commercial applications," said GEDC Director Joy Laskar.

"This new speed record provides encouragement to keep pushing forward on silicon-germanium devices," Cressler said. "There is a lot more fruit available from silicon-germanium technology if we invest the effort to get there."

For more information...

Georgia Electronic Design Center
www.gedcenter.org

Emission, cont'd from page 1

often excites instabilities that damage the system.

But Georgia Tech's design eliminates this complexity by injecting the fuel and air separately into the combustor while its shape forces them to mix with combustion products before they come into contact inside the combustor.

Other investigators on the project were Yedidia Neumeier, Jerry Seitzman and Jeff Jagoda from the School of Aerospace Engineering, and visiting research engineers Yoav Weksler and Ben Ami Hashmonay.

IN BRIEF:

Export controls

Compliance with federal laws related to export controls and embargoes require that all faculty and staff planning international travel and international collaborations be made aware of these regulations. Travelers must ensure that any information that will be discussed or any items that accompany the traveler are either not controlled, or if controlled, proper licenses are in place.

More information regarding export controls and how they relate to employee travel is at www.export.gatech.edu/?section=travel.

Eight named to GT Hall of Fame

Legendary basketball coach Bobby Cremins and All-American point guard Travis Best headline the 2006 induction class into the Georgia Tech Sports Hall of Fame, which includes eight inductees representing six sports.

Women's basketball star Karen Lounsbury Russell, volleyball All-American Cris Omiecinski Leone, baseball All-American Brad Rigby, track and field All-American Octavius Terry, football standout Kent Hill and football manager Gus Georgeton also will be officially inducted Oct. 6 during the annual Hall of Fame Dinner at the Georgia Tech Hotel and Conference Center.

"These men and women were highly successful in their sports during their days at Georgia Tech and continue to represent the Yellow Jackets well to this day," said Athletics Director Dan Radakovich. "Their entry into the Hall of Fame is well-deserved, and we look forward to honoring them in October."

Students visit EU Parliament

Students enrolled in international business and marketing classes at the Georgia Tech Lorraine campus in France recently had the opportunity to visit the European Union (EU) Parliament, enriching their classroom learning about what an integrated market economy means for business.

During the June 12 trip, students got to evaluate first-hand how EU members address many cultural, economic and legal differences as they develop common legislation that impacts all member countries of the union.

"The visit was a memorable experience for the students, helping them to relate cultural, social, and economic issues to the challenge of developing business strategies across diverse yet integrated markets," explains Alka Citrin, assistant professor of marketing at Georgia Tech, who organized the trip at the invitation of Natalie Griesbeck, a member of EU Parliament representing eastern France.

In addition to a tour of the Parliament building in Strasbourg, France, students attended a plenary session where forthcoming legislation was discussed by Parliament members. After the session, students had the opportunity to ask questions about the role and future of the EU in the international business environment.

Alumnus named to shuttle crew

NASA has assigned crew members, including Georgia Tech alum Douglas Wheelock, to the space shuttle flight that will launch an Italian-built U.S. module for the International Space Station.

Wheelock, a native of Windsor, N.Y., earned a master's degree from Tech's School of Aerospace Engineering in 1992. Mission STS-120 will be his first spaceflight.