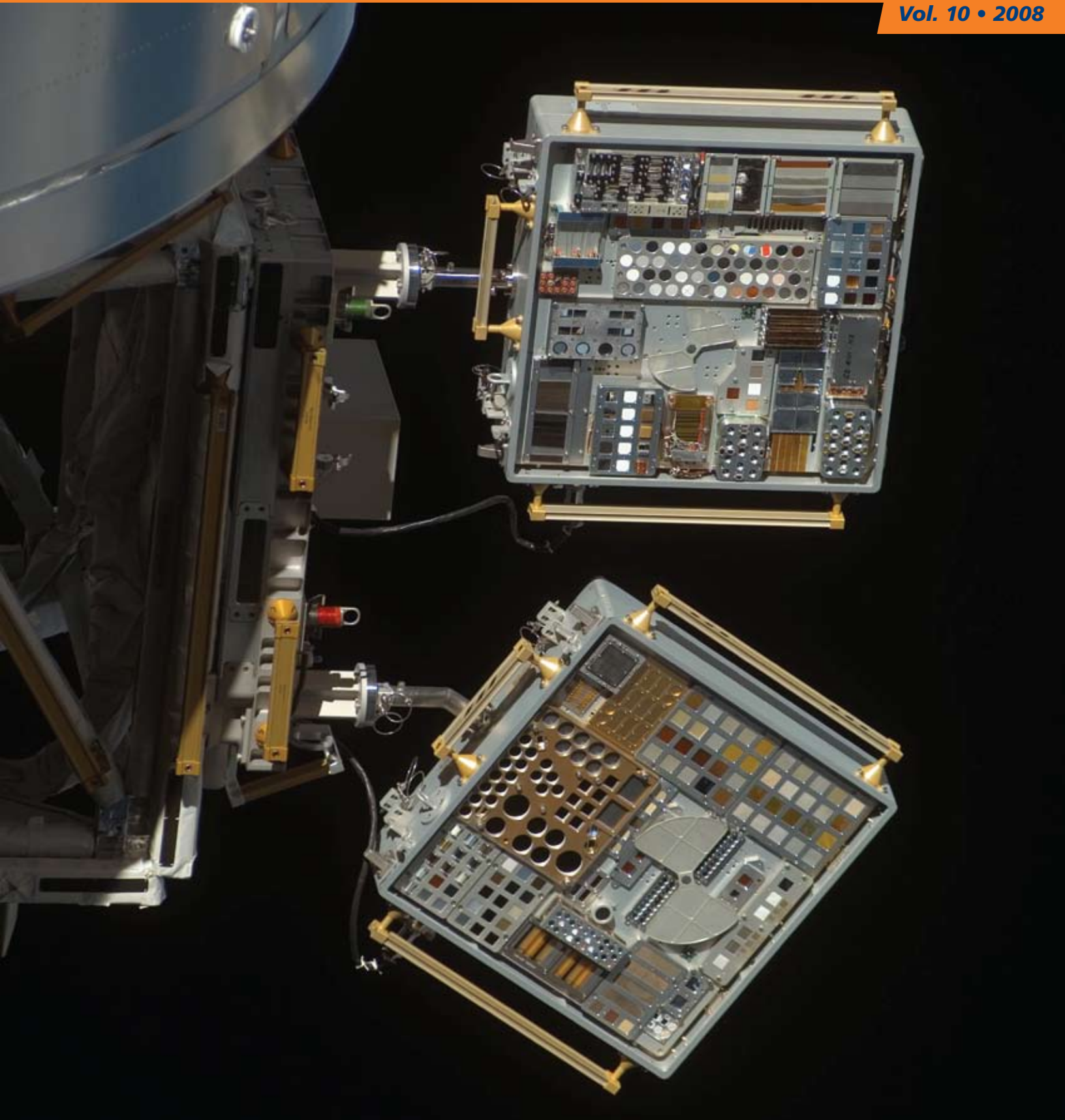


AE Illinois



Newsletter of the Department of Aerospace Engineering
University of Illinois at Urbana-Champaign

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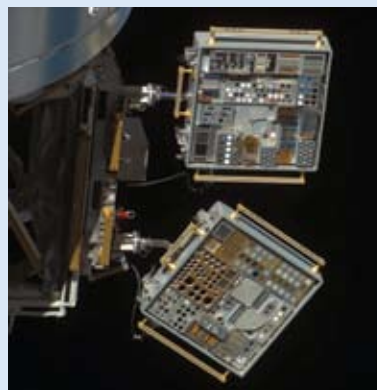
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Letter from the Department Head

I am very pleased to write to you in this, my first newsletter, since I became Head of the AE Department in September 2007. Indeed, the past year has been an exciting journey for me as I reflect upon all the happenings in this vibrant and ever-evolving Department.

One of our efforts has been to reach out across the nation to you, our alumni. In addition to the traditional Alumni Board meeting we hold in the fall, we also this year hosted alumni receptions in Houston and at the AIAA Aerospace Sciences Meeting in Reno, and participated in a College of Engineering alumni event in Seattle. We also met with many of you individually in Seattle, Chicago, Los Angeles, San Francisco, and Washington, DC. Wherever we go, it's great to hear your stories about the outstanding education you received and experiences you had during your days in AE at Illinois. It's particularly gratifying when you come full circle and choose to invest in future generations of graduates through participation in AE events and with financial gifts to the department. Our alumni and friends provide our programs with the "margin of excellence" that state educational and federal research funds cannot cover, so you continue to play a pivotal role in our success.

Just as AE did when you were here on campus, the department continues to draw topnotch students. We currently enjoy very strong enrollments with 418 undergraduate and 96 graduate students as of fall 2008. We are proud to report that our students are superbly qualified, with very high entering GPAs, high school percentage ranks, ACT, and/or GRE scores. Talented graduate students, such as Heather Arneson, winner of a highly-competitive NASA Aeronautics Scholarship (see page 22) and Manu Sharma, honored in the Boeing 2008 Student of the Year Awards (see page 21), form the core of our research programs. It is also a blessing to work with our outstanding undergrads, including the teams that swept the AIAA Space Design Competition this year (see page 19).



On the Cover

Space Station Carries AE Experiment; story on page 28.

Editor/Writer: Susan Mumm

Designer: Gretchen Wieshuber, Studio 2D



The following pages provide a glimpse of the most noteworthy accomplishments of our students, faculty, and alumni over the past year. So, read and enjoy.

We're also working to enhance our students' experiences. This year, we worked diligently to revise our undergraduate curriculum and streamline the total number of degree hours to 128, to create more flexibility for the students to study abroad, or participate in co-ops and internships. Our plan is to finish this revision and submit it for approval in the very near future. We're also working to improve upon our graduate and research programs, and will report on those efforts in future issues of *AE Illinois*.

Our research efforts also continue to flourish. In the last fiscal year, the research expenditures of our 20 fulltime equivalent faculty exceeded \$7 million, and were spread across our three major groups: aerodynamics/propulsion, controls/dynamical systems, and materials/mechanics. The addition of four new faculty members over the past two years (Dan Bodony, Tim Bretl, Cedric Langbort, and myself) has brought the Department new research emphases in robotics, motion planning, control systems, information technology, aeroacoustics, and high-speed flows. These new faculty add to the depth and diversity of our research efforts, and we look forward to their contributions.

The following pages provide a glimpse of the most noteworthy accomplishments of our students, faculty, and alumni over the past year. So, read and enjoy. We look forward to hearing from you; our contact information is readily available on our website at: <http://ae.engr.uiuc.edu/>.

Sincerely,

Craig Dutton
Bliss Professor and Head

Department of Aerospace Engineering

Tenured/ Tenure Track Faculty

Joanna M. Austin
Lawrence A. Bergman
Daniel J. Bodony
Michael B. Bragg
Timothy W. Bretl
Rodney L. Burton
Ioannis Chasiotis
Bruce A. Conway
Victoria L. Coverstone
J. Craig Dutton
Gregory S. Elliott
Jonathan B. Freund
Philippe H. Geubelle
John Lambros
Cedric Langbort
Ki D. Lee
Eric Loth
N. Sri Namachchivaya
Natasha A. Neogi
Michael S. Selig
Petros G. Voulgaris
Scott R. White

Emeritus Faculty

John D. Buckmaster
Harry H. Hilton
Allen I. Ormsbee
John E. Prussing
Lee H. Sentman
Kenneth R. Sivier
Wayne C. Solomon
Shee Mang Yen
Adam R. Zak

Affiliate/ Adjunct Faculty

Kenneth T. Christensen
Naira Hovakimyan
Thomas L. Jackson
Arif Masud
Karel Matous
George H. Miley
James W. Phillips
Srinivasa Salapaka
Nancy R. Sottos
Alexander F. Vakakis

Administrative Staff

Lori Ballinger-Pankau
Barb Bohlen
Brett Clifton
Kent Elam
David Foley
Diane Jeffers
Barbara Kirts
Kendra Lindsey
Greg Milner
Susan Mumm
Angie Pitard
Staci Tankersley
Jon Weber

AE Faculty Listed As Excellent

Six AE faculty members were included on the Spring 2008 List of Teachers Ranked as Excellent By Their Students, and four were on the Fall 2007 List. AE faculty members who made the Spring 2008 list were Daniel J. Bodony, Bruce A. Conway, Gregory Elliott, Philippe H. Geubelle, Natasha Neogi and John E. Prussing. On the Fall 2007 list were Bodony, Lawrence A. Bergman, Conway and Prussing.

Rolls-Royce Announces New Partnership with Illinois



Rolls-Royce executives hosted a banquet in March at the Alice Campbell Alumni Center for University of Illinois administrators and staff, including several from the Aerospace Engineering Department, to celebrate a new partnership with the University. From left are: John Gill of Rolls-Royce; Sam Truesdale of Rolls-Royce; AE Prof. Eric Loth; Molly Tracy of the College of Engineering Advancement Office; Kent Studer of the College of Engineering Advancement Office; Doug Dean of Rolls-Royce; Lisa Teague of Rolls-Royce; David Quick of Rolls-Royce; AE Prof. Dan Bodony; Norm Egbert of Rolls-Royce; AE Prof. Mike Bragg; Mechanical Science and Engineering Department Head Huseyin Sehitoglu; AE Department Head Craig Dutton; Gene Jend of Rolls-Royce; Joe Krok of Rolls-Royce; Todd Surinak of Rolls-Royce; and Dan Jensen of Rolls-Royce.

Rolls-Royce, a world-leading provider of power systems and services for use on land, at sea and in the air, this spring announced broad plans to grow its partnership with the University of Illinois. This new relationship, which could evolve into Rolls-Royce establishing a university technology center here, holds many opportunities for students and faculty in units across campus, including Aerospace Engineering.

To kick off this new era, Rolls-Royce provided two, \$10,000 annual scholarships for students studying in a science or technology-related field at the University of Illinois. The scholarships will recognize students of all backgrounds who demonstrate outstanding academic achievement and reflect the core values of Rolls-Royce: reliability, integrity and innovation.

A University of Illinois scholarship committee will select scholarship winners each year. The 2008 winners were Luis J. Mendez, a freshman studying computer science; and Ernest L. Baker, a sophomore studying accountancy.

Norm Egbert, Vice President of Engineering and Technology for Rolls-Royce Corporation said: "Our congratulations go out to Luis and Ernest for their academic success. These scholarships underpin our commitment to fostering an interest in science and technology in young people with a view towards opening the door on future careers in these areas."

"These scholarships are an example of the important relationship that exists between Rolls-Royce and the University of Illinois, who we've chosen to partner with because of their world-class research capabilities, effective training programs and talented students."

Mike Bragg, Aerospace Engineering professor and Executive Associate Dean in the College of Engineering, said of the new development: "Our growing relationship with Rolls-Royce has the potential to impact many students in Engineering and across campus. Research grants, scholarships and fellowships, internships and co-ops are all areas where we hope to increase our interaction."

Company executives shared their ideas for an expanded relationship with the University of Illinois during a banquet they hosted earlier this spring at the Alice Campbell Alumni Center. Among invited guests were Vice Provost Ruth Watkins and Vice Chancellor for Research Chip Zukoski, as well as several administrators from the colleges of Business and Engineering, including Aerospace Engineering faculty and staff. Joining the guests were company officials that included Egbert and John Gill, Vice President of Human Resources.

New Recipe for Self-Healing Plastic Includes Dash of Food Additive

BY JAMES E. KLOEPEL, PHYSICAL SCIENCES EDITOR,
UNIVERSITY OF ILLINOIS NEWS BUREAU

CHAMPAIGN, Ill.—Adding a food additive to damaged polymers can help restore them to full strength, say scientists at the University of Illinois who cooked up the novel, self-healing system.

The repair process, in which solvent-filled microcapsules embedded in an epoxy matrix rupture when a crack forms, is a major improvement over the original self-healing process first described in February 2001.

“While our previous solvent worked well for healing, it was also toxic,” said Scott White, a professor of aerospace engineering and a researcher at the university’s Beckman Institute. “Our new solvent is both non-toxic and less expensive.”

During normal use, epoxy-based materials experience stresses that can cause cracking, which can lead to mechanical failure. Autonomic self-healing—a process in which the damage itself triggers the repair mechanism—can retain structural integrity and extend the lifetime of the material.

Designed to mimic the human body’s ability to repair wounds, self-healing materials release a healing agent into the crack plane when damaged, and through chemical and physical processes, restore the material’s initial fracture properties.

In November 2007, White and collaborators reported the use of chlorobenzene, a common—but toxic—organic solvent, which in epoxy resins achieved a healing efficiency of up to 82 percent.

In their latest work, which combined a non-toxic and Kosher-certified food additive (ethyl phenylacetate) and an unreacted epoxy monomer into microcapsules as small as 150 microns in diameter, the researchers achieved a healing efficiency of 100 percent.

“Previously, the microcapsules contained only solvent, which flowed into the crack and allowed some of the unreacted matrix material to become mobile, react and repair the damage,” said graduate research assistant Mary Caruso. “By including a tiny amount of unreacted epoxy monomer with the solvent in the microcapsules, we can provide additional chemical reactivity to repair the material.”

When the epoxy monomer enters the crack plane, it bonds with material in the matrix to coat the crack and regain structural properties. In tests, the solvent-epoxy monomer combination was able to recover 100 percent of a material’s virgin strength after damage had occurred.

“This work helps move self-healing materials from the lab into everyday applications,” said graduate research assistant Benjamin Blaiszik. “We’ve only begun to scratch the surface of potential applications using encapsulated solvent and epoxy resin.”

In addition to White, Caruso and Blaiszik, the other co-authors of the paper were materials science and engineering professor and AE affiliate professor Nancy Sottos and chemistry professor Jeffrey Moore. The researchers reported their findings in the scientific journal *Advanced Functional Materials*.

The work was supported by the U.S. Air Force Office of Scientific Research and the U.S. Department of Defense. Some of the work was performed at the university’s Center for Microanalysis of Materials, which is partially supported by the U.S. Department of Energy.



U. of I. researchers have improved a self-healing process originally described in 2001. In the new repair process, solvent-filled microcapsules that are embedded in an epoxy matrix rupture when a crack forms. The new solvent is non-toxic and less expensive. Researchers: from left, Jeffrey Moore, a professor of chemistry; Nancy Sottos, a professor of materials science and engineering and AE affiliate professor; Scott White, a professor of aerospace engineering; and graduate research assistants Mary Caruso and Benjamin Blaiszik.