



RENSSELAER
DEPARTMENT OF
MECHANICAL,
AEROSPACE, AND
NUCLEAR ENGINEERING

annual report
2012



Rensselaer

DEPARTMENT SNAPSHOT

STUDENTS

1,126

UNDERGRADUATES

151

GRADUATE

95%

OF CURRENT FULL-TIME DOCTORAL
STUDENTS RECEIVED FINANCIAL ASSISTANCE

DEGREES



279 BACHELORS

37 MASTERS

19 PH.D.'S

FACULTY

48

FACULTY WORKING ACROSS
16 MAJOR RESEARCH AREAS

RESEARCH

6

AFFILIATED RESEARCH CENTERS

- ▶ Center for Automation Technologies and Systems
cats.rpi.edu
- ▶ Center for Flow Physics and Control
www.scer.rpi.edu/cefpac
- ▶ Center for Modeling, Simulation and Imaging in Medicine
www.scer.rpi.edu/cemsim
- ▶ Computational Center for Nanotechnology Innovations
ccni.rpi.edu
- ▶ Center for Engineering-based Patient Modeling
cepm.rpi.edu
- ▶ Scientific Computation Research Center
scorec.rpi.edu

RESEARCH AREAS

AEROSPACE SCIENCE AND ENGINEERING

- ▶ Fluid Dynamics/Aerodynamics
- ▶ Advanced Structures/Materials
- ▶ Optimization
- ▶ Space
- ▶ Combustion/Propulsion

MECHANICAL SCIENCE AND ENGINEERING

- ▶ Mechanics and Materials
- ▶ Thermal and Fluids Engineering
- ▶ Design and Manufacturing
- ▶ Dynamics and Controls

NUCLEAR SCIENCE AND ENGINEERING

- ▶ Nuclear Power Systems
- ▶ Applied Radiation Technologies
- ▶ Radiation Protection, Medical and Industrial Uses of Radiation
- ▶ Nuclear Materials

CROSS-CUTTING RESEARCH AREAS

- ▶ Energy Science and Engineering
- ▶ Materials, Materials Processing and Controls
- ▶ Human Health and Safety

MESSAGE FROM THE DEPARTMENT HEAD

This is the most exciting time in the history of MANE. In the past year, some of the best and brightest scholars have joined our faculty ranks. Faculty and students continue to be recognized for their outstanding accomplishments through external and internal honors and awards. We have excelled in attracting top class graduate and undergraduate students. Research productivity is at an all time high, while classroom teaching has reached new levels of innovation and popularity.



Thierry Blanchet,
Professor, Associate
Head for Faculty
Affairs

Catalin Picu, Professor,
Associate Head
for Undergraduate
Studies

Yoav Peles, Professor,
Associate Head for
Graduate Studies

Michael Amitay,
James L. Decker
'45 Endowed Chair
in Aerospace
Engineering, Program
Director, Aerospace
Engineering Program

Xie (George) Xu,
Professor, Program
Head, Nuclear
Engineering Program

"We have assembled an outstanding leadership team—faculty working towards our common goals of enhancing student programs, expanding cross-cutting research and nurturing large-scale research programs."

*— Dr. Suvranu De, Department Head,
Professor and Director, CeMSIM*

I am honored and humbled to serve Rensselaer's Mechanical, Aerospace and Nuclear Engineering (MANE) community as its new department head. Joining me in this effort are Professors Yoav Peles, Catalin Picu and Thierry Blanchet as associate heads for graduate, undergraduate and faculty affairs, respectively. Professors Miki Amitay and George Xu have graciously agreed to champion our Aerospace and Nuclear Engineering programs, respectively. I am confident by working together, we will continue to elevate our reputation as home to three elite engineering programs in the country—a place our alums are proud to call their alma mater. I would also like to take this opportunity to thank our outgoing acting department head, Thierry Blanchet for his leadership, dedication and selfless service to the department.

MANE has been and will remain synonymous with dynamism and change. Going forward, some of the most important issues that I wish to make progress on include:

- enhancing and restructuring our graduate and undergraduate programs to meet the needs of academia and industry,
- consolidating our research efforts into cross-cutting strategic thrusts centered around energy, materials, manufacturing and human health,
- stimulating programs for advancement, and nurturing large-scale research programs and centers.

Above all, our goal is to give voice to and actively engage all constituent communities—faculty, students, staff and alums in a meaningful way, while at the same time respecting their individuality. These efforts enjoy strong support of Dean Rosowsky and are guided by his leadership and vision, as well as the core principles of the Rensselaer Plan.



The outlook for the future is more positive than ever before. Let us look at some of the facts:



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NEW FACULTY: DYNAMIC NEW RESEARCH

< Farhan Gandhi

actively and passively changing the shape of helicopter blades

Zahra Sotoudeh ^

computational structural and fluid dynamics applied to the stability of flexible aircraft and helicopter structures

Jason Hicken >

design optimization for environmentally responsible aviation



Rotorcraft expert Farhan Gandhi has joined the department as the Rosalind and John J. Redfern Jr. '33 Professor of Engineering. Farhan is a world-leader in morphing helicopters and adaptive cellular structures. His rotorcraft research program explores new methods for actively and passively changing the shape of helicopter blades, towards the goal of increasing the capabilities and adaptability of the aircraft, and making them more fuel efficient.

We have also welcomed Jason Hicken and Zahra Sotoudeh as assistant professors in the department from Stanford and Virginia Tech, respectively. Jason's research is in the area of simulation-based design optimization with application to environmentally responsible aviation. Zahra's research centers around computational structural and fluid dynamics applied to the stability of highly flexible aircraft and helicopter structures.

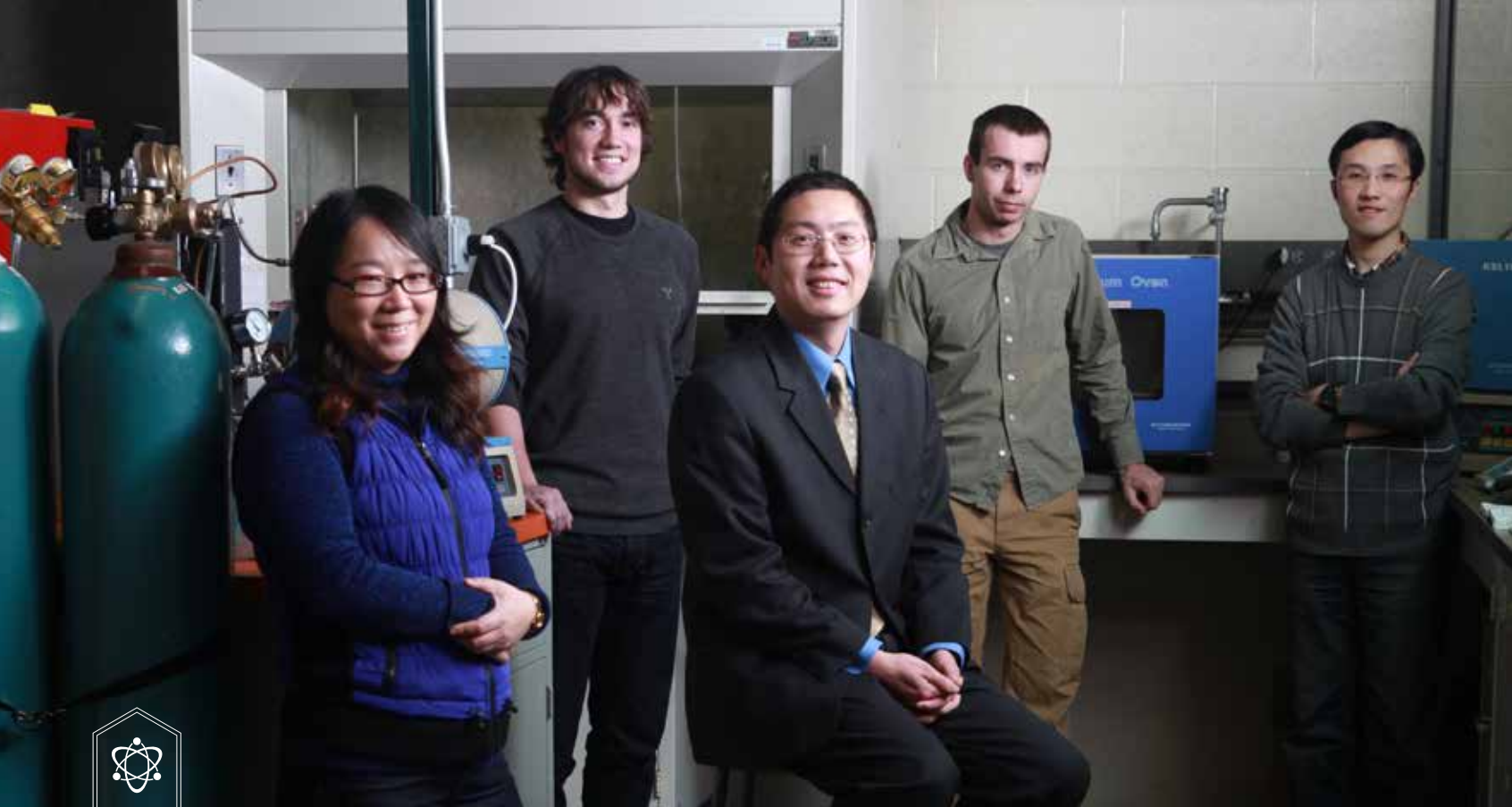
Professors Miki Amitay and Nikhil Koratkar have been named John A. Clark and Edward T. Crossan, and James L. Decker '45 Endowed Chair Professors in Aerospace Engineering. Miki is an internationally recognized expert in the fields of fluid dynamics and flow control and serves as director of the Rensselaer Center for Flow Physics and Control. His ground breaking research is based on using flow control techniques to boost the performance of aerial and underwater vehicles, as well as increase the efficiency and lifespan of wind turbines and buildings. Nikhil's work, on the other hand, has centered at the intersection of nanotechnology, energy, and sustainability. In particular, his focus is on the synthesis, characterization, and application of nanoscale material systems, including graphene, graphene oxide, carbon nanotubes, and fullerenes, as well as metal and silicon nanostructures.

Professors Jie Lian and Riccardo Bevilaqua have received the prestigious NSF CAREER and AFOSR Young Investigator awards.

Professor Miki Amitay has been awarded the Boeing Supplier of the Year (Technology Category) and Performance Excellence (Silver Level) awards.

Professor George Xu has been named Fellow of the American Nuclear Society (ANS) and received the ANS Radiation Protection and Shielding Division Professional Excellence Award. George has also been invited to be a member of EPA's Science Advisory Board (SAB) Radiation Advisory Committee.

Professor John Tichy has received a honorary doctorate from INSA de Lyon in France.

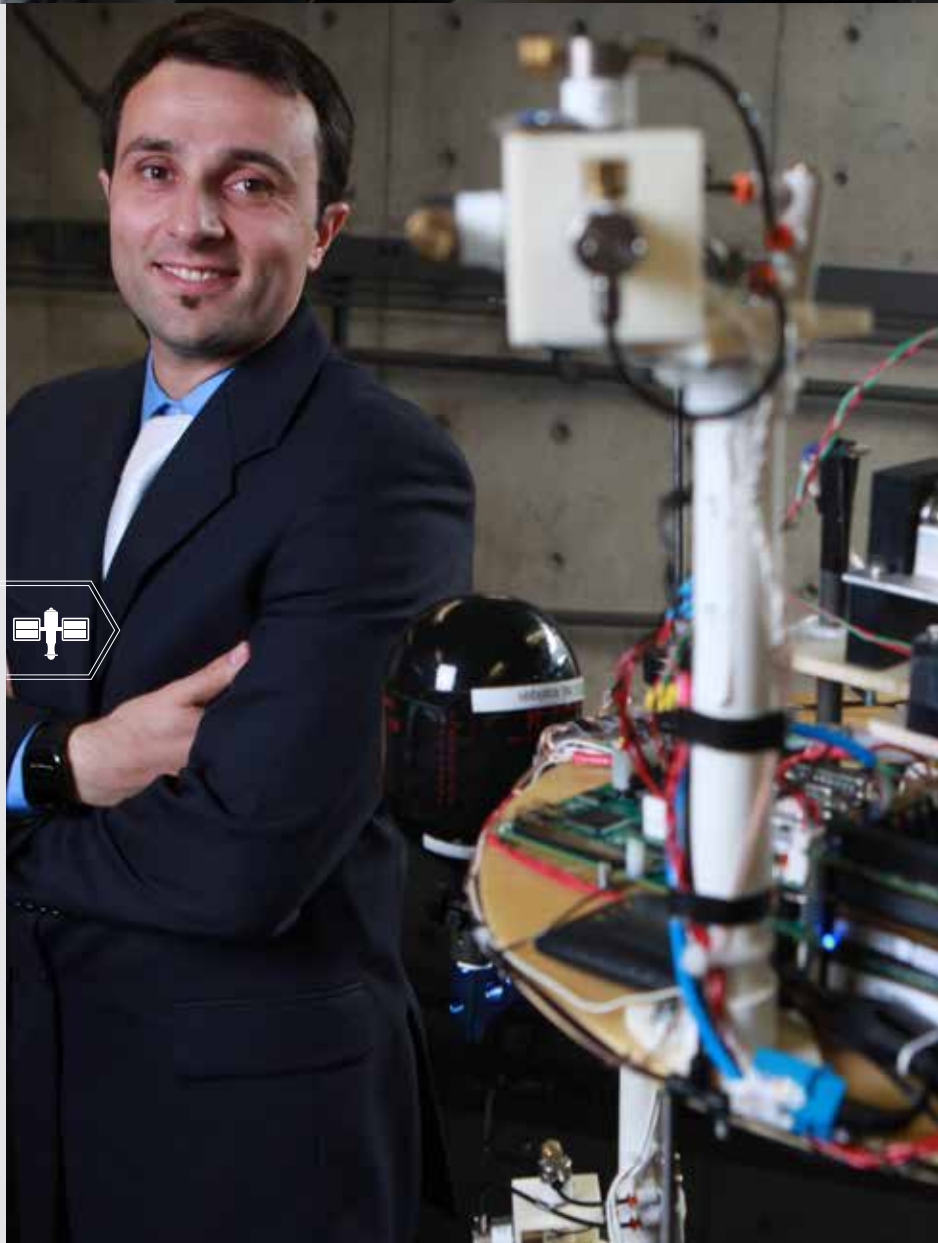


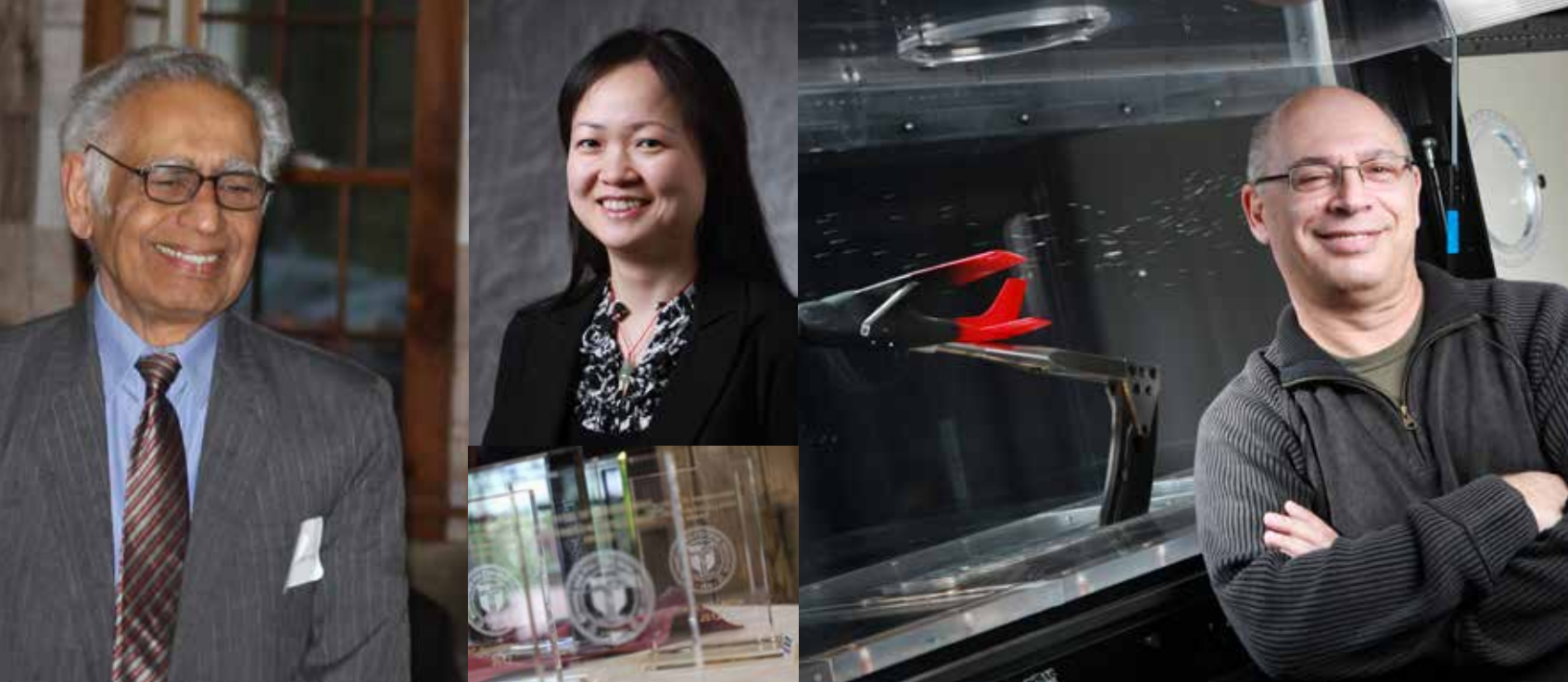
Dr. Jie Lian, with his research team, (l to r) Dr. Jinling Xu, Mr. Theodore E. Frater, Jie Lian, Mr. Brent Ragsdale and Dr. Fengyuan Lu. Lian won the prestigious Faculty Early Career Development Award (CAREER) from the National Science Foundation (NSF). Lian will use the five-year, \$500,000 award to further his research into the design of nanomaterials for use in nuclear energy systems. His research program is focused on better understanding advanced materials and nanomaterials to help further nuclear energy production.



Riccardo Bevilacqua and his research team are working to define the next-generation of low-orbit satellites that are more maneuverable, cheaper to launch, easier to hide, and longer lived. They are developing new theories for exploiting the forces of atmospheric drag to maneuver satellites in low-Earth orbits.

This project, titled "Propellant-free Spacecraft Relative Maneuvering via Atmospheric Differential Drag," is funded by the Air Force Office of Scientific Research (AFOSR) Young Investigator Research Program with an expected three-year, \$334,000 grant.





(l to r) Professor Bimal Malaviya was awarded the School of Engineering Teaching Award for classroom excellence, while Professors Emily Liu and Miki Amitay received the School of Engineering Research Excellence Awards in the senior and junior categories.

Our faculty have also been very successful in winning Rensselaer awards. Professor Bimal Malaviya has been awarded the School of Engineering Teaching Award for classroom excellence, while Professors Miki Amitay and Emily Liu have received Research Excellence Awards in the senior and junior categories, respectively. A team led by Professor George Xu has received the Outstanding Research Team Award for their work on virtual humans. Professor John Tichy has received the Institute's Jerome Fishbach '38 Faculty Travel Award while Mr. Burt Swersy has received the David M. Darrin '40 Counseling Award.

This has also been a great year for our students. Graduate student Fazel Yavari has been awarded the \$30,000 Lemelson-MIT Rensselaer Student Prize for his graphene-based nanosensors to detect trace amounts of hazardous gases and explosives. Lauren Bolden and Cory Crean have each won NSF Graduate Research Fellowships, while Lauren has also won the Department of Energy Graduate Research Fellowship. Aerospace Engineering undergraduate student Jeff Mockelman has won

the prestigious Barry M. Goldwater Fellowship. Five of our students - Meghan Olson, Rosalie Shaw, Rebecca Zell, Alexandra Allen, and Nicole Mowder - have received the Society for Women Engineers (SWE) fellowships.

Also during the year, we had several excellent special lectures, three from members of the National Academy of Engineering. Most notably, we initiated the Leaders in Engineering Lecture series and invited Professors Alexander Smits (Princeton University), Karen Thole (Pennsylvania State University), Balakumar Blachandran (University of Maryland, College Park), Sutanu Sarkar (University of California, San Diego) and Mark Campbell (Cornell University). The Newkirk Lecture was delivered by Professor Andrew Jackson (University of Pennsylvania), the Hemke Lecture by Professor Robert Moser (University of Texas at Austin) and the Gurley Lecture by Professor Achille Messac (Syracuse University).

However, the year was not without poignant moments. We bid farewell with a heavy heart to our long time

colleague - Professor Debbie Kaminski. A proud Rensselaer alum herself, Debbie joined the Rensselaer faculty in 1985, establishing herself as a renowned researcher in the field of thermal radiation and heat transfer. She has been a source of inspiration to our women faculty and has led major initiatives including the RAMP-UP and NSF GK-12 graduate STEM fellowship programs. Another significant loss was that of our long term staff member Darwisah Burgess.

Finally, I would like to take this opportunity to thank our vibrant MANE community and all the many friends and well-wishers. I am highly optimistic that our best days are ahead. Working together, we can reach great heights. I look forward to serving and working with each and every one of you.

Suvranu De
Professor and Head

Our classrooms emphasize hands-on learning, faculty interaction, and exposure to real world problems.

That means our undergraduates have opportunities to work in laboratories conducting some of the most exciting research of our era, but also to interact closely with our faculty in the classroom.

Engineers for a Sustainable World (ESW) members Jenny Li, Andrew W. Chung, Sam Brown, and Terrance McGovern showing off the makings of the ESW Biodigester. A few years ago, ESW members investigated anaerobic digestion to pasteurize milk for farmers in rural Peru. Now they are building a prototype and testing its performance by converting food waste from the Terra Cafe (a student-led cafe serving local and organic foods) to biogas and fertilizer.

This past year, ESW students converted a shipping container into a sustainable Haitian orphanage, installed solar-panels at a locale middle school, and continued work on a sustainable development in the Mayan village Ek'Balam, Yucatan.

An outgrowth of the popular Formula SAE program at Rensselaer is the Formula Hybrid program. Their goal is to maximize power from our drive train while minimizing fuel usage, in a high-performance application. Inset, image from the RPI 2012 Formula Hybrid Endurance Front Facing Cam.



**2013 RECIPEINTS
DEAN'S GRANTS
FOR SCHOOL OF ENGINEERING
FACULTY & STUDENTS**





LEMELSON-RENSSELAER

BE REWARDED FOR YOUR INNOVATION

In partnership with the Lemelson-MIT Collegiate Student Prize Program

Above, 2012 Lemelson-Rensselaer Student Prize winner, Fazel Yavari developed a new sensor to detect extremely small quantities of hazardous gases. The doctoral student harnessed the power of the world's thinnest material, graphene, to create a device that is durable, inexpensive to make, and incredibly sensitive.

Yavari is the sixth recipient of the \$30,000 Student Prize, which is awarded annually to a Rensselaer senior or graduate student who has created or improved a product or process, applied a technology in a new way, redesigned a system, or demonstrated remarkable inventiveness in other ways.

Rensselaer Hosts 2012 Manufacturing Day.

More than 100 local high-school students came to campus to get a first-hand look at how high-tech products are made—working directly with Rensselaer students currently in the Manufacturing Innovation Learning Laboratory (MILL).

Looking forward, MILL will be an important foundation for infusing micromanufacturing, nanomanufacturing, and other advanced manufacturing technologies into the Rensselaer undergraduate engineering curriculum and graduate student experience.





Design. Build. Fly. (DBF) When it comes to designing, building, and flying a remote-controlled airplane, Rensselaer aeronautical engineering students are among the best in the country. Now in it's seventh year, the DBF club prepares for another national competition. Shown here (l to r) Peter Finigin, Kevin Housley, Mike Tuccio.

Members of this year's Solar Car Team: Top (l to r): Amelia Peterson, Varun Behl, Nicholas Tantisujjatham, Sarah Williams, Kurt Hadaway, Kristin Sechrest, Paul Blejwas, Benjamin Lam, Nora Rogers. Bottom (l to r): Daniel Sparer, Yujun Li, John Yannou, Matt Dawson, Philip Yeh. The team is working hard to compete in the seventh annual Shell Eco-marathon Americas competition in April, 2013 in their 36V solar electric car "Testa" shown below.



Some people look at the world and ask "why?" Rensselaer students look at the world and ask "why not?" Rensselaer has a tradition of graduating people with not only great technical skill, but with the ability to apply that technology in ways that will change the world.



**2013 RECIPEINT
DEAN'S GRANTS**
FOR SCHOOL OF ENGINEERING
FACULTY & STUDENTS

BALANCE
IN ACTION

THIERRY BLANCHET, PH.D.



*“Life is like riding a bicycle.
To keep your balance you must keep moving.”*
~Albert Einstein

Dr. Thierry Blanchet might agree with Einstein. He rides as a nationally-ranked mountain biker for the amateur North American Velo (NAV) team in competitions around the Northeast U.S.A. as well as serving as acting department head for the Department of MANE from June 2011 to May 2012. While his specialty in the field of engineering is tribology, reducing the friction and resistance between surfaces, he confesses that his own trusty old Cannondale bike is usually the noisiest of the bunch when out for a group training ride.

Biking is a Passion

For 2013, Blanchet will focus on competitive endurance rides of about 100 miles to start next year, the National Ultra Endurance series; 100 mile single-loop trail rides. “I just love riding my bike.” he replied during a recent interview. Biking inspires Dr. Blanchet to clear his mind and allows him to problem-solve a research concern or academic challenge while out covering miles on local training rides.

He has participated in many cycling events including the Adirondack Black Fly Challenge, a 40 mile race over the Moose River Plains between Inlet and Indian Lake. He wrote about the race in *Adirondack Sports & Fitness* (June 2010): “Watch the speed on the downhill turns, especially those to the right, as you don’t want to risk poor traction leaving you drifting into oncoming traffic which though infrequent can still be present...” Expert advice offered from hard won experience and taken by many in the cycling community.

Commitment to Rensselaer/MANE

Blanchet’s commitment to biking is as passionate as his commitment to engineering and the the Department of MANE at Rensselaer. He favored the technical even in high school; first, studying technical drawing and then focusing on engineering as an academic path and then career. He began as an undergraduate mechanical engineering major at the University of Vermont developing interest in polymers

and material science through co-op internships, then undertook graduate work at Dartmouth College focusing on polyethylene being developed for hip replacement joints which eventually led him into tribology.

A series of coincidences and happy occurrences led Thierry to Rensselaer as well as his chosen field of tribology. He describes the process as “one fortuitous step after another.” Initially coming to the department under Professor James Lauer as his post-doc, Blanchet joined the Rensselaer faculty in 1993 as an assistant professor. Promoted to associate professor in 1999, he became full professor in 2006. From 2007 to 2009, he served as associate department head for undergraduate studies. He served as the associate department head for graduate studies, from July 2009 to June 2011 when he became acting department head of MANE.



photo: Robert D. Povich
http://www.robertdovich.com

Awards and Academics

While at Rensselaer, Blanchet has received ASME's Burt L. Newkirk Award (2002), as well as the Al Sonntag Award (1993 and 1998) and the Walter D. Hodson Award (1997) from the Society of Tribologists and Lubrication Engineers, and the Ralph R. Teetor Award (1998) from the Society of Automotive Engineers. He is most proud of being named a Fellow of the STLE in 2005 and a Fellow of ASME in 2008.

He was a recipient of the Young Investigator Award from the National Science Foundation in 1994, and RPI's Early Career Award in 1999. Dr. Blanchet was Associate Editor of the *ASME Journal of Tribology*; his six-year term ended in 2011. Since 1996, he has held the position of Associate Editor of STLE's Tribology Transactions and also served on the editorial board of *Tribology & Lubrication Technology* from 2005-2007.

He recently completed a 6-year term on STLE's Fellows Committee, serving as chair during 2011-2012. His 5-year term

on ASME Tribology Division's Committee on Honors & Awards ended in 2010-2011, serving as chair as well. Additional previous service includes chairmanship of STLE's Awards Committee and Solid Lubricants Technical Committee, as well as ASME/STLE's International Joint Tribology Conference in 2004.

MANE Acting Department Head

From June 2011 to May 2012, Thierry served as acting department head for the Department of MANE. While he never aspired to positions of administrative leadership, his ability to attend to complex tasks and incrementally move issues ahead, in his own words "exhaustive attention to the details of the most immediate matters at hand" singled him out as a potential acting department head. He also had another qualification: he had already served as associate department head of both graduate and undergraduate programs.

Though reluctant at first, Dr. Blanchet enthusiastically took on the position. He had already been serving as an at-large

member of the School of Engineering's Promotions and Tenure Committee and much of his work in the department remained focused in this area of faculty development. During his year as acting department head, Blanchet worked closely with faculty and staff to finalize the awarding of two chairs to colleagues: Miki Amitay as the James L. Decker '45 Chair and Nikhil Koratkar as the John A. Clark and Edward T. Crossan Chair.

The filling of such Chairs is officially an activity carried out by the Dean, but the consideration of these two colleagues for the above chairs began under Blanchet's department head predecessor, and was completed with Blanchet's assistance during his year as acting head.

Under Blanchet's leadership during 2011-12, the Department of MANE hired three new faculty members, all in Aeronautical Engineering: Zahra Sotoudeh (Ph.D., Georgia Tech/post-doc Virginia Tech) and Jason Hicken (Ph.D., U. Toronto/post-doc Stanford) both as assistant professors, and Farhan Gandhi (Ph.D., U. Maryland



Blanchet in summer 2011, competing at the Wilderness 101: a 101 mile mountain bike race in Rothrock State Forest, PA.

Blanchet working in the tribology lab with graduate student, Tony Peto.



and a well-established Professor of many years at Penn State) as Rosalind and John J. Redfern '33 Chaired Professor.

Blanchet is very grateful to students, staff and faculty for all their support during the year he was acting department head. He expressed it simply, "I could not have done the job without them."

A Researcher, Teacher, Advisor

A prolific researcher, he has published seven book chapters and more than 60 peer-reviewed journal articles related to his tribology research. Blanchet's research is funded by several agencies and organizations, including the National Science Foundation, Air Force Office of Scientific Research, Office of Naval Research, and others.

Blanchet has advised 20 graduated master's students, and 10 completed doctoral students and is a respected teacher and advisor in the mechanical engineering department. Andrew Ennaco, graduating Spring 2013, with a Bachelors in Mechanical Engineering and a Master's of Engineering also in Mechanical spoke of his experience working with Thierry:

"Dr. Blanchet is one of the only professors I've had who makes a point of putting in as much effort outside the classroom as his students. He never gives anyone the impression that he believes his time is more valuable than ours and that's a big part of what motivates me to be diligent inside and outside of lecture. His enthusiasm for the subject is quite contagious."

A Return to the Lab

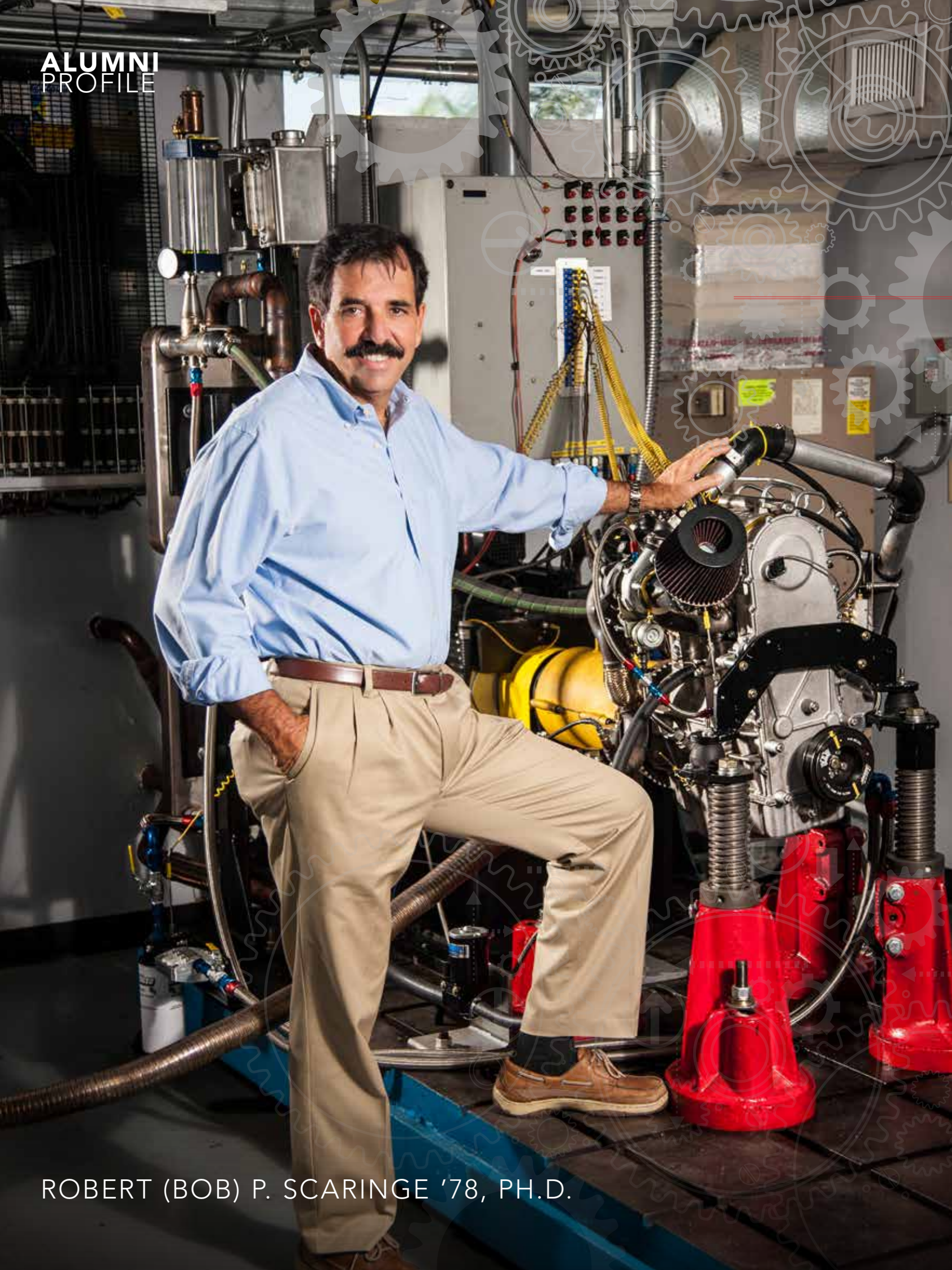
Blanchet now plans a return to teaching and research in the coming year. He looks forward to returning to the collaborative environment of his tribology lab. Currently, he is teaching a course in Tribology and working closely with students interested in the field. In the Spring 2013 semester, he will be teaching Analysis of Manufacturing Processes.

Blanchet's research interests concern the wear of sliding surfaces of mechanical components. Specific projects include wear-resistant nanoparticle-filled polymer composites, control of melt wear under extreme sliding conditions, and the wear of radiation-sterilized polymeric hip replacement bearing surfaces.

He concluded, "My time as acting department head was busy and demanding. I was happy to serve. I am the kind of detail-oriented person suited for this kind of short-term interim position since I was very able to deal with the "now," the immediate concerns of the Department of MANE. I am happy the new department head, our longtime faculty colleague, Suvranu De is a person who looks ahead into the long term developing visionary strategies that will bring the department into the 21st Century with vigor and verve."

Combining research and teaching, excellence in administrative service to the Department of MANE in his many roles and most recently as acting department head, along with his commitment to his cycling pastime, Dr. Thierry Blanchet is an example of balance in action.

ALUMNI
PROFILE



ROBERT (BOB) P. SCARINGE '78, PH.D.

The background of the entire page is a light gray pattern of interlocking gears of various sizes. Some gears have arrows pointing in different directions (up, down, left, right) either inside them or next to them. The gears are arranged in a complex, overlapping manner, creating a sense of mechanical movement and interconnectedness.

Innovation, Success and Giving Back: Meet Bob Scaringe '78

... [Scaringe's] company Mainstream Engineering has never laid off an employee during its entire 26-year history...

RPI alumnus, Robert (Bob) P. Scaringe, Ph.D. (1978) is an entrepreneur and engineer who believes in possibility and works to bring innovation to the marketplace. His company Mainstream Engineering has never laid off an employee during its entire 26-year history. Today, Mainstream has 57 active R&D contracts, 100+ employees, millions in government production contracts, as well as a successful line of refrigeration and air conditioning products called QwikProducts. "I am very grateful for the success of Mainstream Engineering," said Scaringe, "but when I think about it, it has not felt like work to me!"



An engineer at heart:

when Scaringe was just a boy, he purchased a set of plans for the Wright Brothers' plane from the Smithsonian, to try and assemble their flying machine.



In addition to his professional success with Mainstream, Scaringe served as an Executive Board Member of the Kennedy Space Center Support Committee.

Becoming an Engineer at Rensselaer

Bob Scaringe always knew early on he wanted to be an engineer. As a boy growing up on Long Island, he tinkered a lot, taking apart about everything under the sun, building go-karts and mini-bikes. He even purchased a set of plans for the Wright Brothers' plane from the Smithsonian and unsuccessfully attempted to assemble their flying machine.

Although confident he would pursue an engineering degree, he imagined attending a public university in New York State since his family did not have the means for private school tuition. Instead, the avenue to Rensselaer opened when he was awarded a Grumman Aerospace scholarship in 1970 (he was one of the awardees who was not the child of a Grumman employee). When he received that scholarship, he was able to consider any of the top schools and chose Rensselaer. Bob earned his first of three degrees from Rensselaer in 1974. Advanced degrees followed in 1975 (M.S.) and 1978 (Ph.D.).

Building a Company: Mainstream Engineering

In 1986, Scaringe founded Mainstream Engineering as a solution-oriented, research, development and manufacturing small business located in Rockledge,

Florida. The company began with two R&D contracts from the U.S. Air Force, and the organization now produces equipment and performs R&D research for most agencies of the U.S. government and many government prime contractors.

Mainstream's products are sold worldwide, and the company holds a Department of Defense Commercialization Index of 100%. Dr. Scaringe has seen significant company growth, having secured more than \$100 million in long-term production contracts, ranging from 5 to 7 years, from the Department of Defense.

Mainstream Engineering's mission statement embodies a strong commitment to research: To research and develop emerging technologies, to engineer these technologies into superior-quality, military- and private-sector products that provide a technological advantage. According to Scaringe, "Mainstream is determined to continue its tradition of manufacturing all its products in the USA and displaying the "Proudly Made in the USA" label on every product."

Located on the East Central coast of Florida, minutes from Orlando and Kennedy Space Center, Mainstream has a 10 acre campus with five buildings devoted to research, development and manufacturing. Mainstream is a leader

in the development and manufacture of a wide assortment of advanced thermal control and energy conversion products.

A look at the company website (mainstream.com) details projects ranging from the development of methods to convert organic farm residue and trash into bio-fuels, to projects including advanced batteries, advanced fuel cells, advanced thermionics, high-energy-density laser cooling systems, advanced materials, avionics cooling, advanced turbine developments and innovative new diesel engine configurations. Scaringe is quick to point out that all Mainstream's products focus on technologies and systems that make economic as well as environmental sense.

Awards and Achievements

Mainstream has received numerous honors for outstanding products, performance and innovation, including the State of Florida Governor's New Product Award, Regional Winner of the SBA Small Business Prime Contractor of the Year Award, two Blue Chip Enterprise Initiative Awards, and the U.S. SBA's Award for Excellence, NASA's Technical Commercialization Award, and the SBA's Tibbetts Award for commercialization. Mainstream has also received awards for job creation and economic development including awards from the area's Business Incubation Center and from the local Economic Development Council.



Scaringe's company Mainstream is determined to continue its tradition of manufacturing all its products in the USA.



A successful and demanding business would keep almost anyone fully occupied, but Bob Scaringe is also an active seaman who enjoys sailing off the coast of Florida near his home in Cocoa Beach.

In addition to his professional success with Mainstream, Scaringe served as an Executive Board Member of the Kennedy Space Center Support Committee. He has been both a DuPont and Ford Foundation Research Fellow and is currently an ASME Fellow. He is also an active member of various technical societies and is a Registered Professional Engineer. In addition, he has more than 84 publications and 64 patents related to thermal control systems, power conversion and thermal management.

Best "Hands-on" Engineering Education in the Country

During his years at Rensselaer, Scaringe received what he calls the best "hands-on" engineering education in the country. He hopes Rensselaer always remains true to what it started out being: a polytechnic institute, an engineering school providing the majority of the course work in the applied and technical disciplines, placing a premium on applied technical learning.

Bob Scaringe tells everyone and anyone he can that Rensselaer has the best undergraduate engineering education in the world. He proved this conviction by sending his oldest son to Rensselaer.

R.J. Scaringe graduated in '05 with a degree in Mechanical Engineering and then pursued his Ph.D. at MIT. He is the founder of a new automotive company, Rivian Automotive, in Rockledge, Florida. And following in a family tradition, his youngest son Ryan '15 also chose Rensselaer and is currently working toward a dual major in EMAC (Electronic Media, Arts and Communication) and Business.

Mainstream Hires on Campus Each Year

Dr. Bob Scaringe's confirms that Rensselaer excels at developing the skills he seeks in employees at Mainstream: superior hands-on skills combined with expertise in the lab and an ability to generate innovative ideas that work.

He stated, "There is tremendous value in developing a complete person. That is what I was able to do with my education at Rensselaer and what I look for in my employees."

At Mainstream, Dr. Scaringe currently has more than 20 openings for innovative, bright, entrepreneurial, hands-on engineers in all disciplines (except civil engineering), and he actively recruits at Rensselaer during both the fall and spring Career Fairs. Rensselaer graduates do well at Mainstream, and he believes, "Rensselaer turns out many of the best engineers in the world."



A family affair: above, oldest son R.J. Scaringe who graduated in '05 with a degree in mechanical engineering, featured here on the cover of "Florida Trend" for his new car company, Rivian Automotive, below, youngest son Ryan '15 currently working on a dual-degree in (EMAC) Electronic Media, Arts and Communication and Business.



MECHANICAL ENGINEERING

The strength of the Mechanical Engineering Program (the most highly subscribed program on campus) is the synergistic combination of great people: faculty, staff and students.



“Students in the Mechanical Engineering Program receive the rigorous education Rensselaer has always been known for. In addition, they gain valuable experience in creative problem solving. Mechanical Engineering faculty and staff play a leading role in developing and teaching the innovative design programs at Rensselaer.”

— Dr. Antoinette Maniatty, ME program representative

Addressing the world’s most pressing technological problems, the Mechanical Engineering faculty are doing research and training students to address emerging global challenges in:

- energy
- advanced manufacturing
- sustainability
- advanced materials
- human health and safety



A majority of students enrolled in Product Design and Innovation (PDI) are ME students, such as Eben Bayer '07 and Gavin McIntyre '07, founders of Ecovative, an award-winning company (including World Economic Forum's Technology Pioneer award, 2011) which develops and manufactures biodegradable materials to replace plastic packaging. Pictured, Professor Daniel Walczyk works with student Jaron Koppers to refine the design and properties of biocomposites made from natural fibers as part of a collaborative project with Ecovative.

In the O. T. Swanson Multidisciplinary Design Laboratory, students work in teams solving real-world engineering problems posed by sponsors.



“It is an incredibly exciting time to work in our field,” notes Dr. Antoinette Maniatty, “we can bring expertise to problems not even imagined twenty years ago. Using the tried and true tools of mechanical engineering, we can solve technological challenges with outstanding, innovative results.”



MECHANICAL ENGINEERING
Degrees Offered: B.S., M.Eng., M.S., Ph.D.

Research/ Concentration Areas

- Advanced composites manufacturing
- Fuel cell design and manufacturing
- Human Health
- Microscale and nanoscale manufacturing
- Microscale and nanoscale heat transfer
- Multi-scale modeling of materials
- Nano-Mechanics

Recent Undergraduate Research

- Improved human joint replacement materials
- Nanoscale/microscale heat transfer and thermal phenomena
- Society of Automotive Engineers Formula Car and Hybrid Car

Co-op Experiences

- Boeing
- Borg Warner Automotive
- Kimberly-Clark
- Pitney Bowes
- Vicor Corporation



THE **DESIGN LAB**
at Rensselaer

The program is in a period of unprecedented growth with many new faculty positions anticipated in the next five years. The Mechanical Engineering Program has recently hired three assistant professors: Sandipan Mishra (right), Johnson Samuel (far right), and Onkar Sahni (below).

Dr. Mishra brings experience in smart building systems and modeling and control of micro/nano scale manufacturing processes. He develops control strategies improving additive manufacturing, an emerging field radically changing the way products are manufactured and allowing designers to produce things that were previously considered far too complex to make economically.

Dr. Samuel's expertise is in manufacturing of advanced materials to address societal needs in sustainability and health care. Together with Mishra, he builds Rensselaer's strength in manufacturing research and education, an essential component to reinvigorating American ingenuity and competitiveness in the marketplace.



Together Dr. Mishra (left) and Dr. Samuel (right) are working on novel methods in micro/nano scale manufacturing—producing products that were previously considered far too complex to manufacture economically.



A \$2.7 million NIH grant was awarded to Professor Suvranu De and CeMSIM to create, test, and validate a virtual electrosurgery simulator.



Led by Professor Mark Shephard, researchers at SCOREC harness the computing power of 16 IBM Blue Gene/L Racks at the Computational Center for Nanotechnology Innovations (CCNI)—a world-class supercomputer facility.



Dr. Sahni adds to the department's renowned program in Computational and Simulation-based Engineering, which involves developing new methods to model complex processes utilizing high performance computing, such as the facilities in Rensselaer's

Computational Center for Nanotechnology Innovations (CCNI). This powerful approach allows new designs and processes to be explored in simulation, leading to superior products brought to market faster than ever before.

Mechanical Engineering faculty lead two major centers. The first is the Center for Modeling, Simulation and Imaging in Medicine (CeMSIM), launched in 2010, led by Suvranu De. CeMSIM is a School of Engineering center, where a large number of ME undergraduates work side by side with researchers, pursuing the mission of: "actively developing advanced modeling, simulation and imaging (MSI) technology for healthcare through interdisciplinary collaborations with the aim of transitioning the technology to clinical practice - from the laboratory bench to the hospital bedside."

The second is the Scientific Computation Research Center (SCOREC), directed by Professor Mark Shephard. SCOREC is an institute-wide center focusing on computational research and aimed at the development of reliable simulation technologies for engineers, scientists, medical professionals, and other practitioners.

AEROSPACE ENGINEERING

Aerospace engineering faculty are conducting ground-breaking research into the performance of fixed wing aircraft, rotorcraft, and space vehicles, as well as micro-vehicles. This research is supported by fundamental studies in aerodynamics, advanced propulsion concepts, vehicle dynamics, design optimization and advanced structures.



“The Aerospace Engineering Program is prepared to advance adaptive strategies pioneering new territory in the coming years leveraging research funding from private industries such as Boeing, Grumman and others with available state and federal funding.”

— Dr. Michael Amitay, James L. Decker '45 Chair in Aerospace Engineering and new Director of the Aerospace Engineering Program

State of the art facilities include the:

- fluid dynamics laboratory and
- structures and controls laboratory.

Research is complimented by a breadth of educational offerings offered by committed faculty including coursework in:

- Flow control
- Aerodynamics
- Smart structures/materials
- Mini- and micro-aerial vehicles
- Air vehicles performance enhancement
- Wind energy
- Smart wind turbines



Rensselaer made a large investment in aerospace engineering and the program is now bringing the newest developments in flow control, smart materials, and adaptive systems into the labs and the marketplace.



AERONAUTICAL ENGINEERING

Degrees Offered: B.S., M.Eng., M.S., Ph.D.

Research/ Concentration Areas

- Active flow control
- Theoretical and computational aerodynamics
- Advanced structures
- Cooperating spacecraft

Recent Undergraduate Research

- Design of micro-vehicle systems
- AIAA Student Design, Build, Fly Competition
- Wind tunnel testing of space lightcraft

Co-op Experiences

- Boeing
- GE Aircraft Engines
- GE Power Systems
- Jet Propulsion Laboratory
- NASA Langley Research Center
- Pratt & Whitney



A bright future

The Aerospace engineering faculty have turned their focus to a specific vision: **Adaptive Systems for Aerospace Applications.**

Adaptive configuration can:

- Allow the aircraft to perform more optimally in diverse conditions.
- Allow expansion of the flight envelope.
- Improve performance throughout the flight envelope.
- Configuration change can be structural (e.g., smart materials) or virtual (e.g., flow control).

Exciting developments abound in this field, bringing collaboration into the lab by innovation in industry. The Aerospace Engineering Program plans to open its own research center devoted to these new developments in adaptive systems.



Rotorcraft expert Professor Farhan Gandhi (far left) is a world-leader in morphing helicopters and adaptive cellular structures. Here, he works with Silvestro Barbarino (Research Associate), Michael Pontecorvo (Graduate Student - Ph.D.) and Mihir Mistry (Visiting Researcher) in a rotorcraft research program exploring new methods for actively and passively changing the shape of helicopter blades, towards the goal of increasing the capabilities and adaptability of the aircraft, and making them more fuel efficient.

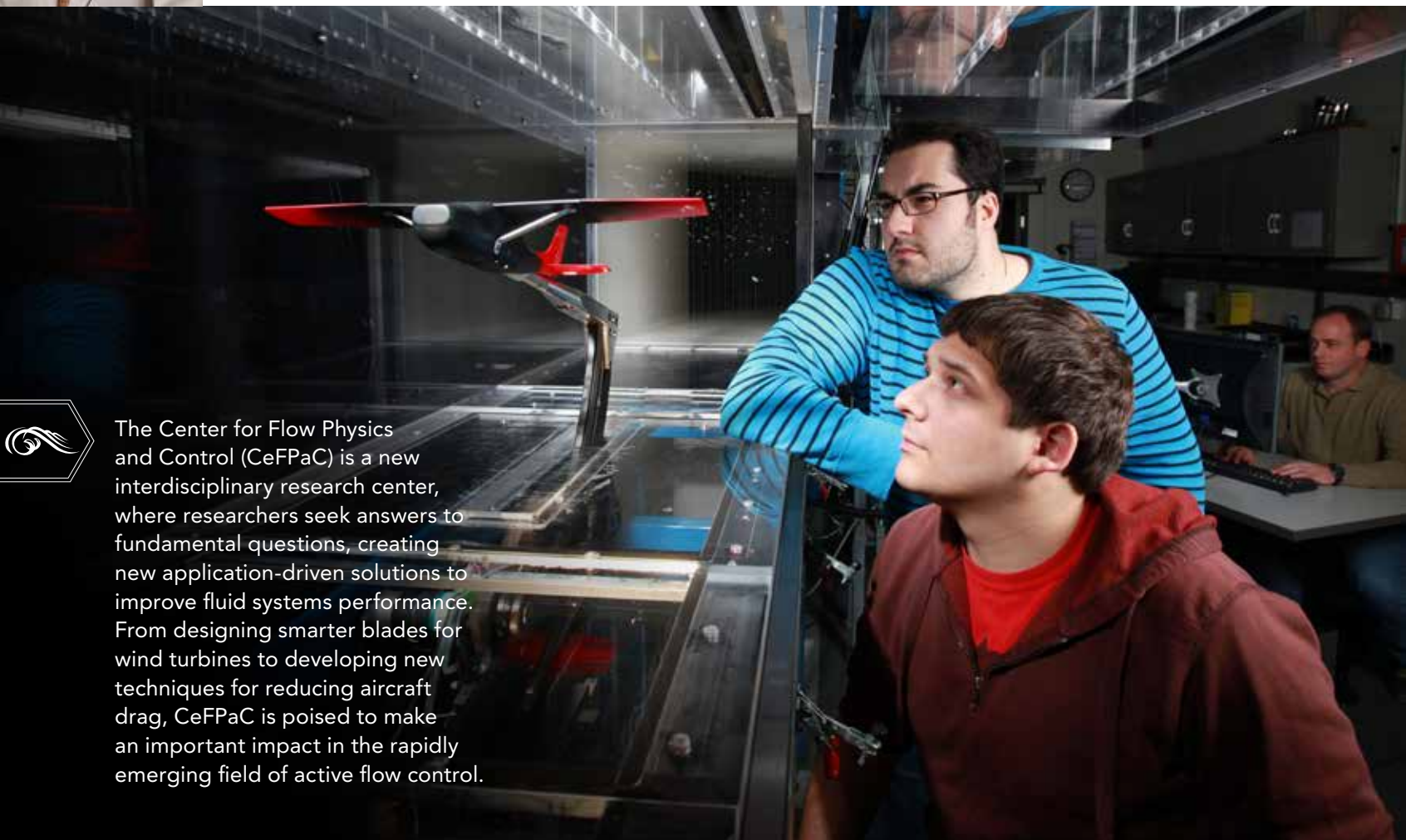


Three new faculty chairs have been established in the department including Michael Amitay, James L. Decker '45 Chair in Aerospace Engineering (pictured on previous page), Farhan Gandhi, the Rosalind and John J. Redfern Jr. '33 Chair in Aerospace Engineering (pictured above), and Nikhil Koratkar, the John A. Clark and Edward T. Crossan Chair

Professor (pictured on left). Thirteen faculty members offer coursework and collaborative research opportunities in the state of the art research facilities. These faculty bring years of experience to the classroom and more than 10 new graduate-level courses are offered in the curriculum as a result of this expansion.

2X

Aerospace engineering faculty have nearly doubled in the past two years



The Center for Flow Physics and Control (CeFPaC) is a new interdisciplinary research center, where researchers seek answers to fundamental questions, creating new application-driven solutions to improve fluid systems performance. From designing smarter blades for wind turbines to developing new techniques for reducing aircraft drag, CeFPaC is poised to make an important impact in the rapidly emerging field of active flow control.

NUCLEAR ENGINEERING

The Nuclear Engineering Program at Rensselaer ranks among the finest in the country. The over fifty-year history of the Program has at its foundation outstanding faculty and world-class research facilities.



In our undergraduate education program, we emphasize hands-on nuclear system design capabilities as well as communication skills and teamwork.

Currently, we are implementing several new initiatives to boost our visibility at the national level. Our outstanding faculty, students and facilities will keep our program at Rensselaer in the forefront of education and research.

— Dr. George Xu, newly-appointed head of the Nuclear Engineering Program



With the modern need for dependable, inexpensive sources of energy, Rensselaer Nuclear Engineering graduates are in constant demand for positions in industry or graduate study. The current marketplace holds exciting career opportunities in space power propulsion, fusion reactor engineering, medicine, and homeland security.



NUCLEAR ENGINEERING

Degrees Offered: B.S., M.Eng., M.S., Ph.D. (Nuclear Engineering and Science)

Research/ Concentration Areas

- Reactor physics
- Nuclear materials
- Nuclear detectors
- X-ray and neutron physics

Co-op Experiences

- Dominion Energy
- Jet Propulsion Laboratory
- Knolls Atomic Power Laboratory

Recent Undergraduate Research

- Alpha particle detection
- Medical isotope production
- Radiation analysis



40
METERS

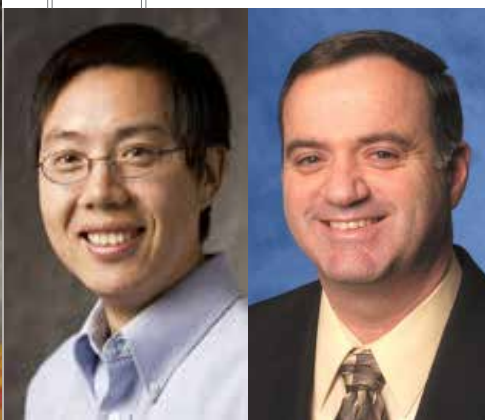
Nuclear engineering students at the newly renovated 40 meter station of the electron accelerator. LINAC is the only facility in the US that covers all types of neutron measurements which plays an important role for developing the next generation of nuclear power.



Three assistant professors joined the program in recent years. One of those, Dr. Jie Lian has won a prestigious Faculty Early Career Development Award (CAREER) from the National Science Foundation (NSF). He plans to use the \$500,000 award to advance his research into the design of nanomaterials for use in nuclear energy systems. This award is one of NSF's most competitive, recognizing high-quality research and novel education initiatives.



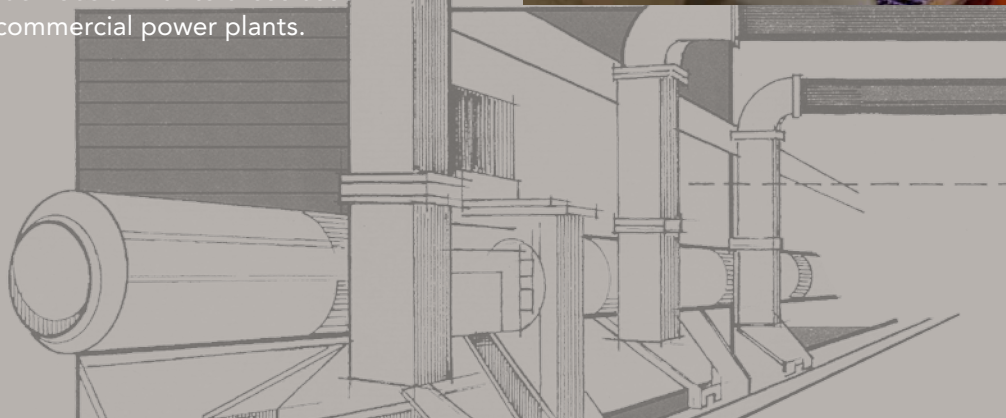
A new \$2.6 million NIH grant was awarded to researchers in the program. Funding was also received from the Department of Energy (DOE), and the Nuclear Regulatory Commission (NRC), in order to work with students and upgrade reactors. Due to this rapidly expanding research portfolio by program faculty, a total of 15 graduate assistantship positions are anticipated for fall 2013.



Dr. Yaron Danon was recently named director of the new Gaertner Linear Accelerator (LINAC) Center. The high-accuracy nuclear interaction data measured at the LINAC Center is used by researchers and engineers world-wide and under his aegis, these applications will continue in innovative directions.



An undergraduate student works at the Walthausen Reactor Critical Facility, one of only 25 research reactors at U.S. universities, and the only low-power test reactor that uses fuel rods similar to those used in commercial power plants.



The Gaertner Linear Accelerator (LINAC), a high-power electron linear accelerator, is among the most powerful and versatile accelerators in its class. LINAC enables advanced nuclear engineering research at Rensselaer.



Rensselaer

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