SETTING A NEW STANDARD

MICRON JOINS FORCES WITH THE ENGINEERING SCHOOL TO ADVANCE THE STATE OF THE ART IN AUTOMATA PROCESSING
The traditional view of engineering is that it is a numbers-driven discipline. Certainly there is much truth to that stereotype. Engineering is grounded in data, and engineers are by definition problem solvers.

But one thing I’ve learned during my tenure as dean is that there is so much more to engineering — especially engineering as practiced at U.Va. — that transcends the stereotype. In addition to analytical ability, successful engineering requires the creativity of the arts, the empathy and conceptual imagination of the social sciences, and the critical thinking and communication skills of the humanities. Engineers need these skills if they are to harness the full power of engineering for the benefit of society.

Our purpose in selecting subjects for this issue of UNBOUND was to highlight undergraduates, graduate students and faculty who embody, in their own ways, the breadth and depth that U.Va. engineering represents, who set new standards for excellence.

As a school, it is critical that we continue to attract people who share these qualities. We have been notably successful in persuading the most talented undergraduate students in the nation to join us. We have significantly improved the quality of our graduate program. And we have attracted outstanding scholars and teachers both to grow our faculty and to replace professors who are retiring.

The competition at all levels for these exceptional individuals is intense. Thanks to the support of the University and the Engineering School community, we will continue to succeed in bringing them to U.Va.
Trace the progress of a team of aerospace engineering students who, with the assistance of Lecturer David Sheffler, succeed in designing an unmanned flying wing that can be hand launched. The School’s Rapid Prototyping Lab makes it all possible.

www.youtube.com/watch?v=FwRD7UBGecg

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Trace the progress of a team of aerospace engineering students who, with the assistance of Lecturer David Sheffler, succeed in designing an unmanned flying wing that can be hand launched. The School’s Rapid Prototyping Lab makes it all possible.

www.youtube.com/watch?v=FwRD7UBGecg

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Every strategic plan undertaken by the University of Virginia during the past 15 years has recognized that the University’s place as a preeminent public institution rests in part on sustained excellence in science and engineering. As dean of the School of Engineering and Applied Science, James H. Aylor has been instrumental in ensuring that the University realizes this standard. During his decade as dean, Aylor has grown enrollment and added faculty, increased research revenue, built new facilities and fostered a series of innovative partnerships with industry and government. After a decade of accomplishment, he will step down when his second term ends in August 2015.

“Jim Aylor’s dedication to the Engineering School has been remarkable,” President Teresa A. Sullivan says. “He has been a powerful advocate for science and technology because he understands that excellence in these areas is critical to the University’s future.”

Aylor, the Louis T. Rader Professor of Electrical and Computer Engineering, has always been closely associated with the Engineering School. His father was a member of what was then the Applied Mathematics Department within the Engineering School — and Aylor holds bachelor’s (’68), master’s (’71) and doctoral (’77) degrees from the electrical and computer engineering department. In 1978, he joined
the School as an assistant professor of electrical engineering, conducted cutting-edge research in computer design and development, and founded the Center for Semicustom Integrated Systems. He chaired the department from 1996 to 2003. He was appointed interim dean in 2004 and assumed his present post a year later.

“Personal experience has convinced me that the key to the School’s future rests on people — students and faculty as well as alumni and industry partners,” Aylor says. He started with faculty. As dean, he has worked tirelessly to secure funding for additional faculty and to attract the best possible candidates for new and replacement positions. “We have taken the opportunity to rejuvenate the School and to build critical mass in a number of key fields,” Aylor says. “This has helped raise our profile and made us a more attractive collaborator.” Research funding has doubled during his tenure as dean, even as federal sources of research funding have declined.

To ensure that the Engineering School made focused hiring decisions, Aylor and a team conducted a strategic planning initiative, which was concluded in 2011. The plan calls for the School to focus its research on societal challenges in sustainability, health, cyber and physical infrastructure, and personal and society-wide security.

Faculty growth also provided the cornerstone of Aylor’s efforts to meet increasing demand for the undergraduate program and enhance the graduate program. “It was important to maintain the close faculty-student relationships that have always characterized the School,” he says. Undergraduate enrollment rose by one-third between 2005 and 2014, even as the number of applicants more than doubled. Thanks to more-competitive admissions, the median combined SAT scores of Engineering School entering classes are now the highest of any school at the University.

Research funding secured by the faculty has also energized the graduate program. The School now has more graduate students than at any time in its history.

“Our responsibility — and it’s one I feel deeply — is to provide an education that’s equal to the talents of our students,” Aylor says. Under his leadership, the School has expanded the engineering business minor, introduced an entrepreneurship minor and offered a teaching mentorship program for graduate students. In addition, it has greatly expanded its experiential learning program.

As an alumnus himself, Aylor has been notably successful in engaging the School’s graduates in advancing these initiatives. With their support, he opened the Rice Hall Information Technology Engineering Building, as well as Lacy Hall and the Ann Warrick Lacy Experiential Learning Center.

Aylor has also been a pioneer in forging innovative alliances with government agencies and corporations, which taken together have generated significant research support for the School, funded several professorships and provided exceptional learning and career opportunities for students. Aylor played a pivotal role in founding U.Va.’s Applied Research Institute, which provides a conduit for government and businesses seeking to access University expertise and resources. He was also a driving force behind the formation of the Commonwealth Center for Advanced Manufacturing, a partnership that includes five university members, 21 industry members and NASA.

“Jim’s leadership has been transformative for the School,” says David Gee, president of the Engineering School Trustees. “His vision and energy have led to improvements and growth in the School and have set the stage for future success.”

RENnovated Thornton Stacks Dedicated to Dean James Aylor

Having made a lead gift to renovate the Thornton Stacks, the Raber family — Bradley (Darden ’15), Katherine (SIE ’12), Steven and Karen Raber — dedicated the facility to Dean James Aylor (at right).

With its 16-foot ceilings and row of Palladian windows facing Darden Court, Thornton Stacks retains hints of its original function as the Engineering Library. Stripped of its books, it has gone through a number of transformations, ultimately serving as a large study hall.

With funding from parents Steven and Karen Raber, as well as the U.Va. Alumni Association’s Jefferson Trust and the Engineering Student Council, this elegant room has been converted to a collaborative learning space. At its unveiling, the Rabers surprised Dean James Aylor by naming the newly renovated facility the James H. Aylor Student Collaboration Center. “Without overstatement, we can honestly say that Jim has made a significant difference in our children’s and, consequently, our family’s lives,” says Steven Raber. “Honoring him in this small way is our way of saying thanks.”
SETTING A NEW STANDARD

Ultimately, it’s the creativity and drive of our faculty members, undergraduates and graduate students that determine the quality of our programs. They are setting a new standard of excellence, whether it’s partnering with industry, conducting original research or mentoring students.

Professors Mircea Stan, Kevin Skadron and Stuart Wolf are heading the Center for Automata Processing, the only center of its kind in the world.
Micron Technology finds itself in an unusual position for a company known for innovations in computer memory and storage. It has entered new territory by developing a processing chip capable of opening the door to advances in fields like bioinformatics, video/image analytics and network security. It turned last year to computer scientists at the University of Virginia with expertise in novel processor architectures and relevant applications to build a worldwide community devoted to realizing the Automata Processor’s potential. The Center for Automata Processing, cofounded by Micron and the University, is a virtual collaboration of universities, companies and government agencies.

“Our goal is to foster collaborations among industry and academic researchers to advance the field of automata computing,” says Professor Kevin Skadron, chair of the Department of Computer Science and the center’s director. “We hope to facilitate teaming on proposals and provide industry with a source of academic expertise in solving big-data problems.” He points out that the center will also generate research opportunities for University graduate and undergraduate students and could enrich existing courses in areas such as processor design and data mining.

The Automata Processor addresses a critical drawback of conventional processors, one that impedes the progress of research in scores of fields. Computers are very good at producing exact matches, combing through millions of records in milliseconds, for example, to find the precise match to DNA lifted from a crime scene. But when it comes to imprecise matches — identifying commonalities in strings of genetic code from two different persons — they slow to a crawl, undone by the limited bandwidth between processor and memory.

Micron used insights gleaned from its many years as one of the world’s leading providers of computer memory to overcome this problem. Conventional processor designs require that instructions and data be fetched from and stored in memory, while the Automata Processor does not, thus avoiding memory-access bottlenecks.

“The Automata Processor preconfigures each of its 1.5 million pattern-matching elements in advance, so that a huge number of parallel matching operations can occur simultaneously and instantaneously for each input item,” Skadron says. “This sets the stage for high-speed, comprehensive search and analysis of complex, unstructured data streams.” Thanks to this architecture, the Automata Processor can not only help researchers find matches among seemingly dissimilar items, but it could also help them deduce the factors that produce those patterns.

Skadron credits Electrical and Computer Engineering Professor Mircea Stan and Materials Science and Engineering Professor Stuart Wolf — who are associate directors — for being instrumental in securing the center for the University. Thanks to their expertise in memory technologies, both faculty members have longstanding research collaborations with Micron. This positioned them to introduce Micron to Engineering School expertise in processors and in applications, such as image analytics, where the Automata Processor would be highly effective.

“This is an extraordinary opportunity,” says Terry Leslie, Micron’s director of business development for Automata processing. “The University of Virginia’s partnership is a critically important part of building an ecosystem for this exciting new architecture.”

The center has already attracted interest across the University. In addition to faculty from computer science as well as electrical and computer engineering, there are a number of interdisciplinary collaborations underway with faculty from the departments of biomedical engineering, biochemistry and molecular genetics, systems and information engineering, and public health sciences. “The University’s Institute for Advanced Technology in the Humanities is also participating in the center,” Skadron says. “These diverse collaborations are an indication of just how powerful and broadly applicable the Automata Processor is.”

For more information on the center, visit www.cap.virginia.edu.
SETTING A NEW STANDARD

YIQI CAO
DISCOVERING HER OWN PATH
Yiqi Cao admits that when she applied to the Engineering School she didn’t have a firm idea of what engineering was all about. But her four years at U.Va. have taught her that engineering is a creative discipline — a body of knowledge and a way of thinking — that can guide her as she explores and interacts with the world. “The technical skills and the problem-solving mindset you learn as an engineer give you a springboard to make changes in society,” she says. “And at U.Va., you also learn to apply this knowledge ethically and responsibly.”

A Jefferson Scholar, Cao has taken full advantage of opportunities — both at the School and the University — to develop these skills. Her interest in health and biology led her to major in biomedical engineering, where she benefited from the department’s focus on medical device design. “We get hands-on experience shadowing physicians in the clinic, observing problems and creating solutions that fix them,” she says. Based on these experiences, Cao and her classmates developed a wireless system that would remind health care professionals to use hand sanitizer before interacting with patients. They took this idea to the University’s Entrepreneurship Cup competition, earning a second-place award of $10,000 for their concept.

This emphasis on understanding technology in its context — a key element in the process of engineering design — has proved invaluable in Cao’s work with the U.Va. chapter of Engineering Students Without Borders. “We collaborate with local partners in communities in Virginia and abroad to jointly develop projects and implement them,” she says. “In the process, we’re learning what it takes as engineers to help people address problems that are important to them, and to do so in ways they can sustain.”

Cao’s interest in context has also led her to explore her own background. Her family emigrated from China when she was 11 years old, and she was curious about the intersection of culture, cuisine and history there. She applied for and received a University Award for Projects in the Arts, which enabled her to travel through China, learn more about how climate and history shaped cuisine and spend time with her grandparents, both excellent cooks. “One of the great things about U.Va. is that I feel encouraged to explore things that matter to me personally,” Cao says. “It is important to me as I get ready for graduate school and a career to have a better understanding of my own family’s legacy.”
For graduate student Philip Asare (ECE ’15), the fascination of engineering lies less with discovery than with the process of discovery. He views engineering not so much as an end but as an activity. “When most people think about engineering, they think about the product,” he says. “I think about how it gets made and how it affects people.”

Asare has selected a research topic that melds this philosophical approach with a practical goal. He is working with Professors John Lach and Jack Stankovic, co-directors of the Center for Wireless Health, which develops wearable monitors that enable medical professionals to assess health more accurately. For these devices to be approved by the U.S. Food and Drug Administration, they must be safe, but as of yet there is no commonly accepted way to translate the medical injunction “do no harm” into specific design parameters. Asare is devising design tools — mathematical models — that can be used with these devices to do exactly that.

In essence, Asare is trying to insert a precise, understandable concept of safety into the engineering process. “A lot of my time has been spent coming up with an adequate definition of safety so that the FDA, which regulates these devices, and the manufacturers who want to produce them, have a common understanding,” he says. Lach feels that Asare’s work has the potential to create uniform standards for these emerging products. “Having a shared concept of safety — and a design tool that embodies the way this vision of safety would work in a complex, dynamic system — is critical to advancing the field,” he says.

Asare’s penchant for understanding engineering processes in their larger context led him last summer to secure funding from the Engineering School to attend Science Outside the Lab, a 10-day policy workshop organized by Arizona State University’s Consortium of Science,
Policy and Outcomes, in Washington, D.C. The program is aimed at doctoral students interested in how decisions about public science funding, regulation and policy are made at the federal level. “Understanding this particular process is important to me because as a graduate student working on a faculty grant and as a potential faculty member, I’m part of the system,” he says. “I’m also interested because it is my ultimate intention to return to Ghana and help develop a sustainable education and science policy so we can tackle our own social problems.”

In the final analysis, Asare sees engineering as a humanist enterprise, a perspective that inspires his dedication to teaching and outreach. To hone his skills as a teacher, he took part in the Engineering School’s Graduate Teaching Internship Program, which gives students considering an academic career the opportunity to develop and co-teach a course with experienced faculty mentors. Here again, he emphasized process. “I tried to encourage students to think through engineering problems before they begin implementation,” he says.

Asare also participates in summer programs for high school students organized by the School’s Center for Diversity and has even visited a second-grade classroom to explain engineering. “I enjoyed the challenge of trying to think about engineering on their terms,” he says. “And they sent me a wonderful thank-you card.”
What’s it like being a student in the Engineering School today? It’s a question that alumni and donors often ask, but it’s one that faculty members and administrators can answer only indirectly. Fortunately, the School’s 14 Dean’s Ambassadors are available to provide a full response. “Our purpose is to draw on our own experiences to describe student life and answer questions,” says Michael Schad (MAE ’15), the group’s co-chair. “We’re a diverse group, so each student has a unique perspective to offer.”

Among their responsibilities, Dean’s Ambassadors host visitors, attend School outreach and fundraising events, and represent the School to the public. Accordingly, the School is quite selective, choosing ambassadors for their poise and maturity as well as for their achievements. “They are outstanding people,” says Dean James Aylor, who started the program.

Given these qualities, it is no wonder that the Eastman Chemical Co. hosts an annual Corporate Leadership Development Conference at its headquarters in Kingsport, Tenn., for Dean’s Ambassadors at its strategic partner universities. This gathering, designed to hone student leadership skills, is also an opportunity for Eastman Chemical recruiters to get a close look at some of the most accomplished young students in the country. This year, for
Apoorva Lonkar (SIE ’15) appreciates her good fortune. A graduate of Thomas Jefferson High School for Science and Technology, in Northern Virginia, she has always been encouraged to pursue her interests in mathematics and science. As a result, Lonkar, as president of the U.Va. chapter of the Society of Women Engineers (SWE), has dedicated herself to making the opportunities she has enjoyed available to other young women.

“One reason I became involved in SWE is that it’s both fun and satisfying for me to introduce younger girls to engineering,” Lonkar says. “You feel like you’re making a difference and having an impact on their future.”

Each year, SWE organizes fall and spring weekend events for female high school juniors and seniors that attract up to 200 students each. The high schoolers attend panel discussions with U.Va. students and faculty members, visit labs and take on a series of design challenges. The goal is to introduce these young women to engineering at U.Va. In addition, SWE organizes a one-day event for middle school girls and a Girl Scout Day to help Scouts earn their science and technology badges.

But Lonkar herself has also benefited from her participation in SWE. She joined the group during her first year and found that her older colleagues were a source of excellent advice and guidance as she made critical academic and career decisions. “SWE gave me a support system and a sense of community that I might not have had otherwise,” Lonkar says. “Going to SWE regional and national conferences also opened my eyes to new career possibilities.”

Lonkar has accepted a position at Microsoft and intends to remain active as a professional member of SWE. “Ideally, I would be a resource to a collegiate section,” she says. “It would be another way I could strengthen the presence of women in engineering.”
The Tower of London. Canterbury Cathedral. Highclere Castle (the real-life location of TV’s Downton Abbey). One reason why people visit the United Kingdom is to tour its historical buildings. Sarah Hill (SIE ’15) went to England to help save them.

As a summer intern at the Prince’s Regeneration Trust, Hill was part of an organization dedicated to working with communities to rescue and reuse buildings that otherwise may be lost to demolition or decay. “I’ve always been interested in architecture,” she says, “so the internship was perfect for me.”

The summer’s highlight — the reopening of Middleport Pottery after a £9 million restoration — is typical of the challenges the trust takes on. Built in 1888 for the Burgess & Leigh ceramics company, this complex of brick buildings in Stoke-on-Trent, southeast of Liverpool, seemed destined for demolition, forcing the pottery company to move and diminishing the historic fabric of the area. The trust bought the site, leased half back to the pottery and half to other businesses, and created a heritage center for tourists. The result has been a remarkable revival in the fortunes of the community. “Attending the opening was a great way to get a sense of what the trust can accomplish and how it works,” Hill says. “And it was exciting to see Prince Charles arrive in his royal barge.”

Community education is an important part of the trust’s mission, and Hill was asked to help set up an evaluation process for its education program and to compile a lessons-learned document. Her background in systems engineering helped her think through these projects. She is currently working with Associate Professor Michael Smith to develop a case study for Systems 2001 classes based on her experiences.

Not surprisingly, Hill enjoyed living in London, and she also found being part of the interdisciplinary team at the trust a memorable and instructive part of her summer. “Working with people from different backgrounds made me more conscious about communicating technical information in terms that make sense to others,” she says. “I’m still exploring the direction I’d like to take with my career, but working with people from other fields is pretty commonplace, so this was certainly a valuable experience.”
When Justin Gage DeZoort (’18) was in high school, he had the opportunity to pursue any extracurricular activity that piqued his interest. That was one of the advantages of being part of a class of just 26 students at Tuscaloosa Academy. But DeZoort didn’t just pursue these activities; he excelled. He was editor-in-chief of the school newspaper, *The Knight Writer*. He was on the five-person math team that twice won first place at the Alabama Independent School Association’s State Math Tournament. He took one of the lead roles — the Mad Hatter — in the school production of *Alice in Wonderland*. And he was selected a member of the Tuscaloosa Mayor’s Youth Council.

When asked what he liked about these experiences, DeZoort’s response is straightforward: “They were so much fun.” He loved attacking the hard problems that his calculus teacher posed. He enjoyed the challenge of learning to relax onstage. And he found it absorbing to get to know the workings of his hometown government. DeZoort even had a good time as a member of the Tuscaloosa Academy Knights cross-country team, although, he admits, he wasn’t such a great runner.

And in his free moments, DeZoort was a member of a band that has just produced its first album. Here again, DeZoort doesn’t go halfway. His guitar heroes include Mikael Åkerfeldt of the progressive death metal band Opeth and the extreme metal musician Devin Townsend.

Given the diversity of his interests and the quality of his work, it is not surprising that he was awarded both Rodman and Jefferson Scholars Foundation scholarships. “Although the scholarships enabled me to attend UVa, I’d had my heart set on coming here from the moment I visited Grounds,” he says. “It was pretty inspiring to walk the Lawn and think that I could be part of the university that Thomas Jefferson created.”

Now that he’s a first-year student, DeZoort is confronting a vastly different challenge from the ones he faced in high school: As a University student, there are many more activities available than he could ever hope to sample. He is weighing his options carefully before diving in, meanwhile playing his guitar whenever he can find the time.

DeZoort is also considering his options for a major. He is thinking about pursuing a joint degree in either computer science and physics or biomedical engineering and physics, two dramatically different paths, but both founded on interests cultivated in high school. “I feel that being able to explore so many different experiences in high school helped me learn a lot about myself,” he says. “I’m looking forward to continuing that process at the University.”
There are many good reasons for an electrical and computer engineering department to offer a course in embedded computing. As Associate Professor Harry Powell points out, “It is hard to conceive of an electrical design today that doesn’t include an embedded computer in some key functional subsystem.” Furthermore, the widespread use of embedded computers means that their prices have fallen so dramatically that faculty members can now easily purchase them for classroom use.

But Powell and Professor Joanne Bechta Dugan, co-leaders of Introduction to Embedded Computer Systems, realized that the ubiquity of embedded computers made them the ideal platform with which to achieve more-ambitious goals. They observed that their undergraduate students tend to compartmentalize the information learned in courses like Digital Logic Design, Linear Circuits, and Signals and Systems. They saw their course in embedded systems as an opportunity to help students integrate that knowledge.

Dugan and Powell conceived of the course as a series of weekly assignments, each of which is designed to teach students an embedded computing concept while requiring them to draw on knowledge from elsewhere in the curriculum. For instance, assigned the task of reducing the effects of interference on their systems, students must review sampling concepts from Signals and Systems and arithmetic manipulations from Digital Logic Design. “The problems that engineers must solve in the field don’t respect subject boundaries,” Dugan says. “As an engineer, it’s critical that you draw on all the relevant knowledge needed to arrive at a solution.”

The combination of affordable microcontroller development kits and locally manufactured header boards that Powell designed for them serves another important educational purpose for Dugan and Powell. It takes these assignments out of the realm of theory and places them solidly in the real world. “Students programming these controllers have to develop an algorithm that will enable them to achieve their goals while accommodating the physical and computational limitations of the devices they are using,” Powell says.

When students succeed in thinking the problem through and producing a device that does their bidding, there is a sense of immense satisfaction. “In this course,” Powell says, “students end up with something tangible in their hands that says, ‘I learned those concepts because I made this thing work.’”
News reports make it abundantly clear that one skill leaders in the 21st century need is the ability to bridge the cultural gap between the developed and developing worlds. This gap makes it difficult to forge long-term solutions to virtually every global challenge, from peace and security to climate change and health care. Thanks to their participation in Professor James Smith’s PureMadi and MadiDrop projects, Engineering School students are adding cross-cultural communication and design to their technical expertise as they introduce inexpensive ceramic water treatment technologies to rural communities in South Africa.

Smith, the Henry L. Kinnier Professor of Civil and Environmental Engineering, has worked for more than a decade to refine and develop water purification technologies that are appropriate for developing countries. His PureMadi filter looks like a clay pot and can easily be produced by local potters with local materials. The MadiDrop, a ceramic tablet about twice the thickness of a hockey puck, is infused with a disinfecting silver solution and will be mass produced and distributed.

Scores of undergraduate students from the Engineering School and the rest of the University have worked with him to develop and test these technologies. Chloe Rento (ChE ’16), Veronica Son (CEE ’16) and graduate student Beeta Ehdai spent a year in the lab adjusting, among other things, the MadiDrop’s composition and shape, to optimize the release of water-purifying silver. U.Va. students have also been involved in field-testing both projects. With financing from the University’s Jefferson Public Citizens program, Rento, Son and Sydney Turner (CEE ’15) spent two months this past summer evaluating the performance of the filters and MadiDrops in South African households. They analyzed the quality of water before and after it was treated, and such factors as the amount of disinfecting silver that was released.

Among other issues, they had to consider ways to involve local participants in the project, a process they might have taken for granted in the United States. “I knew when the participants started asking me about the results of our water testing, and when their neighbors started asking to use their water, that we had come a long way in engaging them in the technology,” Turner says.

This year, undergraduates will work with Smith to optimize production processes for the MadiDrop. Smith has set up a prototype-manufacturing facility at the Engineering School Research Facility on Observatory Hill. “There are so many opportunities for students to learn valuable lessons from a project like this,” Smith says. “Whether it’s how to detect waterborne pathogens or build relationships with people from other cultures, it’s all relevant to engineering.”
There is a reason that form follows function. Animals move through a series of gaits to maximize energy efficiency at different speeds. By comparison, human-made vehicles are inflexible, confined to a single method of propulsion regardless of speed. A car moves the same way at 6 miles an hour as it does at 60.

That's why Associate Professor Hilary Bart-Smith, a mechanical engineer, is using nature as her inspiration for developing new, high-performance methods to propel underwater vehicles. This year, Bart-Smith secured her second highly competitive Multidisciplinary University Research Initiative (MURI) grant from the Department of Defense to expand on her pioneering investigation of aquatic propulsion. The award totals $7.4 million over five years.

During her first MURI, Bart-Smith and her colleagues studied batoid rays, which include manta rays and cownose rays. Their work produced a better understanding of issues that affect the rays’ movements through water, including wake structure, structural dynamics and kinematics.

For the second MURI, Bart-Smith and her colleagues, who include faculty members from Princeton, West Chester, Harvard and Lehigh universities, as well as from the University of Virginia, have chosen to study trout, tuna and dolphins. These fast, efficient swimmers display similarities and differences in their fin structure, mechanical properties and swimming mechanisms that make them ideal for further investigation. “We want to be able to make a connection between performance and structure,” Bart-Smith says.

Bart-Smith now knows much more about aquatic animals than she ever thought possible. “When I was growing up, I watched David Attenborough’s nature programs on the BBC,” she says. “At the time I was much more interested in chemistry and physics than biology. Thanks to my work on the MURI grants, I have a whole new appreciation for marine biology.”
There is no bigger technological challenge facing the 21st century than mastering big data. Given the stakes, it is not surprising that the U.Va. Board of Visitors made the Data Science Institute the first of four pan-University centers it plans to create as part of its new strategic plan. President Teresa Sullivan tapped Donald Brown, the William Stansfield Calcott Professor of Engineering and Applied Science, to serve as its founding director.

Brown has embraced the challenge with characteristic thoroughness and energy. “This is extraordinarily exciting for me,” he says. “There has been support for this initiative at every level and in every corner of the University. The enthusiasm this initiative has inspired will enable us to accomplish something substantial.”

During the past year, institute funding has played a role in the University’s hiring of a dozen new faculty members, including three systems engineers and three computer scientists. The institute also helped mobilize the funding to install Rivanna, the University’s new Cray CS$300, a 4,800-core, high-speed interconnect cluster with 1.4 petabytes of storage.

To help faculty members make the most of Rivanna and the University’s other high-performance computing clusters, institute staff members are offering training and support. Brown has other infrastructure projects on tap. “We are currently working on creating a private cloud that would meet standards for handling private and sensitive information,” Brown says. “In areas like cancer research, this would help us assemble the critical mass of data needed to conduct research that could lead to personalized, more effective treatments.”

Although U.Va. is not the first university to create an institute focused on big data, Brown believes the institute’s interdisciplinary approach will allow it to make unique contributions to the field. “Most other programs are in a single discipline, like business, statistics or computer science,” he says. “The University is small enough and collegial enough that we believe we can establish an institute that transcends stovepipes, that leverages the knowledge already on Grounds and that brings researchers together from different fields to attack common data challenges.”
Steven Easter (MAE ’13, ’17) was 26 years old, a self-employed computer repair and networking specialist with a wife and growing family, when he decided to combine an associate of science in engineering degree from his local community college and then transfer to U.Va. to complete the coursework for a bachelor of science in engineering. “It was a risk,” Easter says, “but I knew that to get a stable, full-time job, I needed a university diploma.”

Easter’s willingness to take a risk — combined with the support of his wife, Tina — has allowed him to redirect his family’s future. After he completed his associate’s degree at John Tyler Community College in Richmond, the Easters moved to Charlottesville for his last two years at U.Va., where he and his brother, Jonathan Turman, secured a summer internship with the MITRE Corp. Their task: designing and printing an unmanned aerial vehicle at the Engineering School’s Rapid Prototyping Laboratory.

With guidance from their adviser, David Sheffler, a mechanical and aerospace engineering lecturer, and putting in 80-hour workweeks, they produced a plane with a 6.5-foot wingspan assembled from printed parts. It achieved a cruising speed of 45 mph in tests at the U.S. Air Force Academy in Colorado Springs.

“I had a blast,” Easter says. Professor George Cahen, now associate dean for undergraduate programs and a consultant on the project, urged him to apply to graduate school. Easter’s academic record — he had the highest GPA in his class — made him an excellent candidate.

Today, Easter has joined Professor Pamela Norris’ Nanoscale Heat Transfer Laboratory, where he is pursuing his doctorate so he can teach college engineering. If Easter’s track record is any indication, he’ll reach his goal. “It’s another risk,” he says, “but as a family, we’re making it work.”
As Ensign Jennifer Jones (MSE ’15) describes it, service is a family tradition. The ideal of service determined her decision to attend the U.S. Naval Academy, her father’s alma mater. It sustained her through the academy’s demanding program. And it shaped her approach to her responsibilities during her last semester, when she was selected brigade commander, the highest-ranking midshipman at the academy. “The selflessness of service is very important to me,” she says.

Jones’ desire to serve also helped determine her choice when, as one of her class’ top 20 students, she was permitted to pursue a master’s degree at a civilian institution immediately following graduation. At U.Va., Jones chose corrosion research, in part because corrosion represents the most critical and long-standing materials challenge the Navy faces. “I think there is a gap between scientists and engineers who understand corrosion on an atomic level and those at sea who confront corrosion and have to devise solutions,” she says. “I want to bridge that gap by being able to share my technical insights with my fellow officers on board ship.”

The practical application of her research is not the only reason Jones was drawn to researching corrosion. She also has a deep interest in materials science. During her junior year at the academy, Jones was appointed a Bowman Scholar, which included a summer internship at the Naval Research Laboratory in Washington, D.C., and one semester of research in corrosion science. During her last year, she was selected as one of 13 Trident Scholars, allowing her to conduct a yearlong, graduate-level research project on the long-term performance of surface-hardened stainless steel. One of her advisers, Professor Michelle Koul (MSE ’93, ’97) encouraged Jones to apply to U.Va. for a master’s degree.

At U.Va., Jones is working with James Burns (MSE ’06, ’10), an assistant professor and U.S. Air Force Academy graduate, to measure the rates at which aluminum aerospace alloys experience fatigue cracking at high altitudes. She is also throwing light on the mechanisms that cause these cracks to grow. She has found that the alloys display a higher resistance to fatigue-crack growth when exposed to high-altitude conditions than they do at sea level, and that protocols based on sea-level observations may be unnecessarily conservative.

While Jones appreciates the rigor of the Naval Academy schedule, she welcomes the opportunity, as a graduate student, to have more control over her own time. This break from naval discipline, however, won’t last much longer. After graduation in May, Jones is slated for a two-year tour of duty as a nuclear surface warfare officer on a destroyer.

Research that Ensign Jennifer Jones (MSE ’15) is conducting suggests that protocols for monitoring fatigue cracking in aluminum aerospace alloys may be too stringent.
Although David Miller (EE '81) jokes about having a six-year undergraduate degree, he clearly didn't waste any time earning it. Miller was a chemistry major before shifting to electrical engineering, and that combination turned out to be the perfect platform for his career at DuPont. Today, Miller is president of DuPont Electronics and Communications, which produces the materials for such applications as photovoltaic cells, rigid and flexible circuit boards, and advanced displays. “The Engineering School gives you a way of thinking about solving problems and understanding systems that serves you well in a business career,” he says.

A fifth-generation DuPont employee, Miller held several positions in engineering and manufacturing at the Savannah River Site, a nuclear facility in Aiken, S.C., before moving to the DuPont Electronic Materials business. He held several posts, including managing director of the Asia Pacific region, before stepping up in 2009 to lead the business, one of nine in the company.

Miller reconnected with the School after his son, Brian, enrolled as an undergraduate. Now as president-elect of the School of Engineering Trustees, he hopes to bring to the School some of the concepts he has learned over the course of his career. “I want students to leave the School with a global perspective and an appreciation that the world is interconnected in ways that were unimaginable when I was a student,” he says.

As he looks ahead, he sees an even bigger role for the trustees. “Next year, we are going to have a new dean,” he notes. “As a group, we will be focused on doing whatever we can to make sure that whoever fills the job will be successful.” Miller also sees opportunities for the trustees to help the Engineering School deepen its corporate relationships. In his view, the nation’s foremost corporations are looking to establish mutually beneficial partnerships with a select group of engineering schools — and he wants U.Va. to be among them.

“I’m very proud of the School and gratified to be working with such an experienced group of trustees,” Miller says. “We are all working very hard because we believe in this School’s mission.”
Dudley White (EE ’76, ’77) and his wife, Barbara (AE ’81), have long been supporters of the Engineering School. But when Lockheed Martin purchased Zeta Associates, the company for which he works, they were in a position to make a bigger difference — and they did. This fall, the Whites made a substantial gift that expanded their support for the Science and Technology Policy Internship Program in Washington, D.C. They also established the Dudley and Barbara White Fund for Enhanced Student Experiences to fund experiential learning in the Department of Electrical and Computer Engineering.

Founded in 1984, Zeta Associates focuses on leading-edge software, communications and ground systems innovations that helped solve mission-critical challenges for the U.S. defense and intelligence communities. White joined in 1987. Throughout his career, he has been deeply involved in solving the complex digital signal processing problems that the company’s clients faced. “I’ve always enjoyed solving difficult problems,” White says, “and Zeta has given me ample opportunity to do so.”

White’s long experience working in Washington brought him face to face with another problem: the lack of scientific and engineering expertise among the nation’s policymakers. “Virtually all the global challenges we face have a technical component,” he points out. In the Whites’ view, supporting the 10-week policy internship program — which connects students with meaningful projects at government agencies, think tanks and nonprofits — would be a way they could help bridge this gap. The Whites have created an endowment for the internship program and are underwriting its cost for the current academic year.

The Whites’ support for experiential learning in electrical and computer engineering addresses another problem Dudley White encountered on the job: the difficulty of recruiting qualified engineers with practical experience. It also reflects his own approach to learning. As an undergraduate, White would collect electronic parts that local manufacturers discarded and use them to make circuits or components of various kinds. “I’ve always been drawn to real hands-on engineering,” he says. “The department’s effort to revise its curriculum to emphasize experiential learning was appealing to me.”

In addition to the endowment for experiential learning courses, the Whites are also supporting the creation of an undergraduate student lab and a student lounge. “I think this facility and the new curriculum will boost enrollment in the major,” White says. “It will also contribute to producing engineers who can balance their theoretical knowledge with practical experience.”
This is a pivotal moment in the evolution of the Engineering School. As a result of the generational turnover, more than a third of our faculty in 2020 will have joined the School in the previous 10 years. These new faculty members will shape the course of the School for decades to come.

It is essential that we manage the generational turnover successfully. Your support will help us recruit faculty members and graduate students that best embody the School’s ideals. Give now at www.giving.virginia.edu/engineering.

To find out more about our new faculty members, visit www.seas.virginia.edu/newfaculty.