Design
that makes a difference.

2018 ANNUAL REPORT

Rensselaer Department of Mechanical,
Aerospace, and Nuclear Engineering

Rensselaer

2018

ANNUAL REPORT

INSIDE

Message From The Department Head

Dr. Suvranu De, Professor and Head

Dear Friends,

What an exciting year this has been! We hosted the first ***Engineering Innovations for Society*** (EIS – pronounced "ice") undergraduate student design competition in January. MIT, Yale, Columbia, and the US Military Academy were among the 13 schools represented in the three-day on-campus competition. Students received problems provided by the New York Center for Disability Services. We were blown away by the creativity of the solutions that the teams came up with, motivated by the higher mission of changing lives. The passion was palpable, the dedication undeniable. At Rensselaer, we have a rich tradition of design and innovation, supported by our alums. The latest of these is the ***Catherine and Stanley Weiss Colloquium on Design Development*** endowment established through the generosity of Dr. Stanley Weiss, an alum and member of our strategic advisory council.

This issue highlights the unique **innovation ecosystem** that we are cultivating in MANE that works beyond the basic innovation and design courses to move students through the entrepreneurial process, from design to prototyping to patenting to start-up. Our Inventor's Studios form the spine of courses that introduce our students to technological innovation, challenging them to come up with new ideas and new products that solve real-world problems that they identify. Putting students in charge is what we found makes the most difference. The Inventor's series builds on the legacy of the late Burt Swersey, a beloved professor who taught in MANE for more than 25 years. As the principal architect of the first Inventor's Studio in 2001, Swersey stood firm in his belief that Rensselaer students and faculty will continue to play leading roles in discovering solutions to grand, global challenges. In 2018 alone, eight provisional patents were submitted by ten students and three startups were launched by four students from the Inventor's Studios. We also launched the ***Lean Design for Six Sigma – Innovation & Product Design and Development*** certificate. Our students published the third edition of the ***MANE Student Research, Innovation and Design Journal***, a pdf copy of which can be downloaded from our department website.

It's also been an exciting year for our faculty colleagues. Tribology expert, Professor John Tichy received the prestigious ***Donald Wilcock Distinguished Service Award*** from the Tribology Division of the American Society of Mechanical Engineers (ASME). Professor Tichy is the seventh recipient of the award, which was established in 1989 to honor "distinguished service to the Tribology Division and the tribology community throughout the recipient's career." Nuclear engineering expert, Professor George Xu, the Edward E. Hood Jr. Endowed Chair of Engineering, has received the ***Distinguished Scientific Achievement Award*** of the Health Physics Society. The Distinguished Scientific Achievement Award is designed to acknowledge outstanding contributions to the science and technology of radiation safety. John Christian, assistant professor of Aerospace Engineering in MANE, has been elected to the ***Class of 2019 Associate Fellows*** of the American Institute of Aeronautics and Astronautics (AIAA). His formal induction will take place during the Associate Fellows Recognition Ceremony at the AIAA Science and Technology Forum and Exposition Jan. 7, 2019, in San Diego, California. Li (Emily)

Liu, associate professor of nuclear engineering in MANE, has been named a fellow of the ***Executive Leadership in Academic Technology and Engineering program***—ELATE at Drexel—a professional development program for women in science, technology, engineering, and mathematics (STEM) fields. Incidentally, Professor Liu has also been selected by the U.S. Department of Energy Solar Energy Technologies Office (SETO) to receive a $1.8 million award to study high-temperature molten-salt properties and corrosion mechanisms, targeting at advancing concentrating solar power research. Professor Wei Ji received the School of ***Engineering Education Innovation Award***, while Professor Sandipan Mishra received the ***Excellence in Teaching*** award from our strategic advisory council. Professor Mishra also joins the editorial board of the IEEE Transactions on Automation Science and Engineering as Associate Editor, while Professor Fotis Kopsaftopoulos joins the Journal of Structural Health Monitoring in the same role.

We are happy to report that a new research center —***The Center for Mobility with Vertical Lift (MOVE)*** — has been launched under the leadership of Farhan Gandhi, the Rosalind and John J. Redfern Jr. '33 Professor of Engineering. MOVE will pursue cutting-edge research in vertical takeoff and landing (VTOL) aircraft technologies. Joining Professor Gandhi in research activities at MOVE are nine additional Rensselaer faculty members and two affiliated faculty with a collective expertise in VTOL aeromechanics, multi-copters, advanced VTOL configurations, control and autonomy, flying qualities, diagnostics and structural health monitoring, computational fluid dynamics, experimental aerodynamics, nanomaterials, and design optimization. Professor Gandhi has also won the ***AIAA Faculty Advisor Award*** for Outstanding Education and Literary Excellence in Aerospace Engineering.

Every year, we acknowledge with gratitude the support we receive from our friends and well-wishers. This year, two of our colleagues stepped up to establish endowed awards in the department. The ***Dee Ann and John Tichy Junior Faculty Travel Award*** was enabled by the generous contributions by Professor Tichy and his family to support travel and other expenses of an untenured, tenure-track faculty member in the department each year. Professor Michael Podowski and his wife established the ***Michael and Irene Podowski Graduate Student Award*** for outstanding research accomplishments in Nuclear Engineering to be presented annually to an outstanding graduate student in Nuclear Engineering in the third year of their studies. A new endowed ***Eleanor Alexander Stribling Student Research Fund*** was established to support female undergraduate or graduate students in aeronautical or aerospace engineering and a ***Eleanor Alexander Stribling Lecture Series*** was set up to host an annual lecture by an accomplished female engineer or scientist. These two gifts are in the memory of Eleanor Alexander Stribling, great grandmother of one of our recent alums, who was active in the women's suffrage movement and was the first woman to serve as director of a national bank (San Antonio National Bank).

It is my privilege to present to you this 2018 MANE Annual Report and I hope you enjoy reading it as much as I do.

Suvranu De

J Erik Jonsson '22 Distinguished Professor of Engineering and Head

FACTS & FIGURES

DEPARTMENT OF MECHANICAL, AEROSPACE, AND NUCLEAR ENGINEERING

STUDENTS

1,411
UNDERGRADUATES

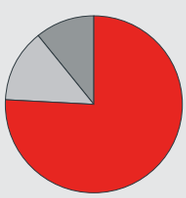
184
GRADUATES

95%
OF CURRENT FULL-TIME DOCTORAL STUDENTS RECEIVED FINANCIAL ASSISTANCE

DEGREES OFFERED

Aeronautical Engineering (B.S., M.Eng., M.S., Ph.D.)
Engineering Physics (M.S., Ph.D.)
Mechanical Engineering (B.S., M.Eng., M.S., Ph.D.)
Nuclear Engineering (B.S., M.Eng., MS)
Nuclear Engineering & Science (Ph.D.)

DEGREES AWARDED (AY) 2018



293 BACHELORS
51 MASTERS
41 PH.D.s

RESEARCH EXPENDITURES
(IN MILLIONS)

12.9
TOTAL DEPARTMENT EXPENDITURES

2.1
AERONAUTICAL/AEROSPACE ENGINEERING

6.5
MECHANICAL ENGINEERING

4.3
NUCLEAR ENGINEERING

RESEARCH

7
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
- Center for Engineering-based Patient Modeling
  cepm.rpi.edu
- Scientific Computation Research Center
  scorec.rpi.edu
- Gaerttner Linear Accelerator Center
  http://hahn.ne.rpi.edu
- Center for Mobility with Vertical Lift
  http://move.rpi.edu

RESEARCH AREAS

AEROSPACE SCIENCE AND ENGINEERING

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

NUCLEAR SCIENCE AND ENGINEERING

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

MECHANICAL SCIENCE AND ENGINEERING

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

CROSS-CUTTING RESEARCH AREAS

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

Seven Decades in Design

A pioneer in systems engineering discusses how design has evolved, where it could improve, and Rensselaer's role in it all

Stanley Weiss '46 discovered his fascination with design as a matter of necessity.

"An early task in my first job (with Goodyear Aircraft) was to analyze a new design for a tapered Fiberglas antenna," said Weiss. "The design team wanted me to come up with appropriate testing methods in a very short time, and I knew I couldn't do it. The easiest way to fulfill the task was to redesign the antenna so I could analyze it. That caused me to create an entirely new design—easily analyzed and with even greater weight savings. That really got me interested in design proper."

In the decades since, Weiss has built a distinguished career in industry, government, and academia, with a focus on systems engineering and design. He joined Lockheed in 1957, starting as manufacturing manager of the Discoverer satellite and eventually becoming corporate vice president of engineering and general manager of research and development. At one point he took a five-year hiatus from Lockheed to direct research programs for NASA and the U.S. Department of Energy. After retiring from Lockheed in 1990, he began an academic career at MIT, where he initiated the lean aerospace program and co-authored a book on the subject. Most recently he has taught at Stanford and worked with universities around the world. His input played a role in the creation of Rensselaer's Multidisciplinary Design Laboratory and the capstone course for which he established an award.

Catherine and Stanley Weiss

As you might expect, Weiss has a few ideas about the state of design today. We sat down with him recently to discuss them.

> "If you use overly structured methods, you may miss nuances that can help you arrive at better solutions."
>
> Stanley Weiss '46

Presentation from the Catherine and Stanley Weiss Colloquium, held annually at Rensselaer.

Q. What, for you, are the essential elements of design?

Weiss: Innovation and creativity are key. There is such a diversity of problems, arising from so many motivations—from national crises to basic necessities—that designers must exercise innovation to address them all. It's also essential to appreciate the relevance of design in most disciplines and specialties, no matter how technically specialized. An intimate knowledge of all stakeholders and their requirements is critical as well.

Q. Is there enough emphasis on innovation in design today?

Weiss: I think we may have become overly structured in the way we go about design. Some of that comes from all the tools we have today. In general some of those tools can be very beneficial: modeling, for instance, has made a huge difference in design—we can iterate much faster and identify problems much earlier than ever before. But sometimes, the ability to feed numbers into a computer can limit where you go.

About 20 years ago, we were developing a vehicle that needed stability in turbulent conditions. One of the designers came in with an unsuitable design because, he said, "the computer program didn't go any further." If you use overly structured methods, you may miss nuances that can help you arrive at better solutions. Sometimes logic will give you a better answer; logic is still fundamental in good design, including, particularly, in software design.

From what I see, MANE's innovation program has made a substantial contribution in re-emphasizing the importance of qualities like nuance and creativity.

Q. What other positive trends have you seen in the evolution of design?

Weiss: So much of design thinking today involves user input early in the process—actually at the very beginning. One of our colloquium speakers emphasized the need for extensive stakeholder interviews before design begins. That is a major step forward.

In my teaching I use a case study of a company that, after a major acquisition, thought they were positioned to improve the design of Greyhound-type buses. They set up a team to consider all the factors that might affect the bus design. The team identified 11 stakeholders to interview; before long, the list had expanded to over 30. What they heard, especially from regulatory stakeholders, convinced them that designing a better bus wasn't right for the company. This example illustrates the value of stakeholder engagement early on, informing seminal decisions that aren't limited solely to product improvements. I emphasized this point in my book Product and System Development – A Value Approach.

Q. You mentioned your colloquium (the Catherine and Stanley Weiss Colloquium, held annually at Rensselaer). What motivated you to found the colloquium?

Weiss: I wanted to emphasize to students that design is a really important consciousness to have no matter what their technical specialty. Graduate students can easily get focused on their specialty because it's so all-encompassing. We pick speakers whose relationship with design has caused them to go beyond simply translating specifications. These speakers often transcend disciplinary boundaries. They have unique experiences not only in innovative design, but in innovating the process they used to come up with the design.

Q. Rensselaer is becoming known for its emphasis on design education. How do you see its position in the marketplace of ideas?

Weiss: Rensselaer can be a beacon in the area of design. It has already made a great deal of progress toward that end. The whole program is excellent, especially its focus on innovation. Few schools are as well positioned to integrate the full breadth of engineering and design disciplines within their walls. In these areas, I believe Rensselaer is uniquely positioned to become dominant in the world of design-led engineering.

Several steps could draw Rensselaer closer to this position. I'd like to see the school sponsor international conferences on innovation in design. It has already formed partnerships with numerous companies; I believe many others would be interested in thinking about design with an educational institution that really emphasizes design. These collaborations have the potential to catalyze important breakthroughs in technical innovation.

Rensselaer has always excelled at producing leaders in fields of technology. I look forward to them producing many leaders in design and innovation as well.

$10k... and the Chance to Make a Difference

New design competition draws students from top Northeast schools to help people with disabilities

You arrive at a campus you've never seen before. You're assigned to a team of engineers you've never met. You're asked to research a problem that plagues people with disabilities. You have to design and prototype a solution, with all the steps and iterations that implies.

In three days.

"Initially, when we advertised the event, I thought the prize money would be the big draw. Instead, students participated because they wanted to apply their knowledge to solve problems that would impact real people."

Jason Hicken
MANE Associate Professor

That stiff challenge faced 31 students from some of the Northeast's top engineering schools as they convened at Rensselaer for the first Engineering Innovation for Society (EIS) student design competition.

"Students really threw themselves into the event," said Jason Hicken, MANE associate professor, who helped to facilitate the event in January. "Everyone worked so intensely for those three days. It was like a semester-long capstone project crammed into one weekend."

Rensselaer's reputation in design education made it a fitting host for the competition. MIT, Yale, Columbia, and the United States Military Academy were among the 13 schools represented.

At the outset, students received problem statements provided by the Center for Disability Services, a longtime Albany provider of programs and services for people who have disabilities. The teams quickly set to work.

"We really had to take the initiative to research the condition, clearly define the problem, and come up with some possible approaches," said Travis Jones, a York College of Pennsylvania student whose team was charged with deriving solutions to help people with hypertonia, an excess of muscle tone that makes hands and other extremities difficult to move.

There was a good deal at stake here. Prizes included $10,000 for the winning team, $4,000 for second place, and $2,000 for third. Many of the students, however, had a higher motivation.

"Initially, when we advertised the event, I thought the prize money would be the big draw," Hicken said. "Instead, students participated because they wanted to apply their knowledge to solve problems that would impact real people."

Jones's team did precisely that, arriving at a hypertonic grip expander that took home the top prize. In this solution, an inflatable sphere is inserted into the hand and then expanded with an air compressor, CO_2 canister, or hand pump attached to the arm for portability. Through a pressure sensor, constant force is applied to the hand, gradually stretching the patient's muscles—resulting in faster recovery with minimal discomfort.

Not that the path to this solution was easy. "As a team, we came up with three major design alternatives that we fleshed out and discussed extensively," he said. "Then, after using simplicity as a criterion for selecting a design, our main strategy with prototyping

PRIZES WERE AWARDED

- The Winning Team Received $10,000.
- Second Place Team Received $4,000.
- Third Place Team Received $2,000.

was to work on several design versions at the same time in parallel, so we could essentially increase our iterations and figure out what worked. There was a lot to research, brainstorm, analyze, specify, validate, and build in a short period of time, but working as a team we were able to divide and conquer."

Second place went to a chair for autistic students, and third to an independent lifting device for quadriplegic individuals. For Center staff, the participants' high caliber of thinking opened up a new range of possibilities for future innovations.

"So often, our caregivers simply accept the limitations of the equipment we use every day, and the extra physical burdens that those limitations place on themselves and the individuals they serve," said Marcia Pucci, PT, manager of clinical services at the Center's Langan School. "The students in this competition were able to think 'outside our box' with new, creative solutions—and support those solutions with the engineering needed to make them work."

> "So often, our caregivers simply accept the limitations of the equipment we use every day, and the extra physical burdens that those limitations place on themselves and the individuals they serve."
>
> Marcia Pucci, PT, Manager of Clinical Services at the Center's Langan School.

Innovation at Every Step

Inventor's Studio flourishes under Asish Ghosh and his innovation expertise

Burt Swersey began it. Asish Ghosh and Catalin Picu have made it flourish.

Inventor's Studio—the course, founded by the legendary Swersey, in which many Rensselaer students got their first taste of innovation and entrepreneurship—now consists of three courses, two undergraduate awards, a certificate program, and a student-run academic journal. All that growth started with a simple conversation just four years ago.

"We talked about refocusing Inventor's Studio to emphasize innovation at every phase of the invention process," said Ghosh, professor of practice at Rensselaer, who met with Swersey, Picu (MANE professor and associate head for undergraduate studies), Suvranu De (MANE professor and department head), and others in 2014 to discuss the program's future. "Innovation in ideation, in design, in prototyping, and in manufacturing."

Ghosh is more than qualified to talk innovation. During his 19 years at GE, he co-led an effort to adapt the company's Design for Six Sigma process to innovation. His travels as part of that effort led to a historic finding.

"In 1998 we went around the world talking with customers of several GE businesses to see what products the customers would be using in the future," Ghosh recalled. "The input told us that in 20 years the big thing would be organic white LEDs. They didn't even exist in 1998. There are other examples of innovative products that were predicted 20 years before they became mainstream using this process. In order to make such predictions a reality, a combination of research projects, acquisitions, and other strategies have to be launched."

Today, Inventor's Studio starts earlier in students' careers than it did in the past. The introductory course, on innovation and ideation, is designed for first-years and sophomores.

This early exposure to innovation has led to the rapid growth of the three-year-old awards program. Innovator Awards go to Inventor's Studio graduates who've applied for a provisional patent; Startup Founder Awards are bestowed on anyone who completes at least one Inventor's Studio course and founds a company.

"Before 2015, we would have maybe one student apply for a provisional patent every two years or so, and launch a startup every three years," said Ghosh. "This past year, we handed out 10 innovation awards for provisional patents. These students have been thinking and talking about innovation since they started at RPI; it's only natural that more of them would engage in their own innovations."

> "We are building an innovators' community, positioning our students to think independently, define their own problems, develop their own solutions, and assume leadership in whatever they do in engineering."
>
> Asish Ghosh
> Rensselaer Professor of Practice

Students working in the Inventor's Studio course.

All those innovations deserve a showcase of their own, which is why the MANE Student Advisory Council founded the MANE Student Research, Innovation, and Design Journal. Students run all aspects of the Journal, serving as editors, production managers, even peer reviewers.

"What happens to all the ideas that come out of Inventor's Studio but don't go to patent?" asked Ghosh, who serves as faculty co-advisor for the Journal.

"We wanted to provide a forum where students could document their ideas—putting a stake in the ground so they have the freedom to pursue the ideas later if they so choose."

They can pursue other opportunities as well. In 2017 the department launched a certificate program in lean design for Six Sigma, which produced its first graduate this past year. The MANE. Global Challenges Initiative enables undergraduates to work closely with a faculty mentor on a critical problem facing humanity today.

Ultimately, the goals of Inventor's Studio reach far beyond individual projects. "We are building an innovators' community," Ghosh said, "positioning our students to think independently, define their own problems, develop their own solutions, and assume leadership in whatever they do in engineering."

Designing with Biology

Eben Bayer '07 does it all the time—and the results may transform the world's waste stream

Childhood on a Vermont family farm may be why Eben Bayer doesn't see biology the way most people do.

"People think of biology as 'it just is,'" said the co-founder of Ecovative Design. "I see it as something begging to be worked with—to be designed with."

A bunker silo at the farm taught him a critical lesson in designing with biology. Some of the wood chips in the silo had become damp and covered with mushrooms. Bayer marveled at the formidable strength of the mycelium—the root structure of mushrooms—that snaked its way through the pile.

"It worked like glue, binding the wood chips together in one big mass," Bayer remembered. "No one was really thinking of mycelium as a technology at the time, but its value as an adhesive was right in front of me."

The world's waste stream is better for Bayer's discovery. Ecovative, the company he founded with fellow Rensselaer alum Gavin McIntyre '07, grows mycelium into a range of high-performance products: large flat panels for construction, textiles, foams, and packaging for just about anything that requires packaging materials. In most applications, the compostable mycelium replaces such landfill-busting materials as plastic, cardboard, and Styrofoam.

ABOVE: Gavin McIntire (left) and Eben Bayer (right) are 2007 graduates of Rensselaer's mechanical engineering program, and founders of Ecovative, a NY-based advanced materials company, designing the future of sustainable materials using their own mycelium biofabrication platform.

RIGHT: Eben Bayer '07 speaking at the United States Chamber of Commerce Circular Foundation Conference.

> "Design is all about intentionality for me. It's a discipline that allows you to think about the world and make choices that will improve it."
>
> Eben Bayer '07

Lest you think this sounds too good to be true, think again. In 2011 the World Economic Forum at Davos named Ecovative one of its Technology Pioneers, putting it in good company: other Pioneers include Airbnb, Google, and Rethink Robotics. Forbes named Bayer and McIntyre to its vaunted 30 Under 30 list for 2015. Ecovative has formed alliances with such innovators as Bolt Threads, which used Ecovative's Mylo leather-like material in the new Stella McCartney Falabella handbag.

For Bayer and McIntyre, the road to business success went through the Inventor's Studio capstone course at Rensselaer—and the ride wasn't entirely smooth.

"Burt [Swersey, teacher of Inventor's Studio for 15 years] saw promise in the mycelium project that I didn't see," Bayer said. "After I turned in the final project—four days early—I got a text from Burt: 'I'm not accepting this.' He actually passed me for the course, but he said, 'You have to take my class again, and you have to do it as a business.'

"That was typical Burt: great at being both supportive and annoying. But my experience with him, and with Rensselaer in general, got us to where we are today."

Not only does Ecovative grow products, but it also empowers individuals and organizations around the world with its technology. Through the Grow-It-Yourself program, anybody can buy mycelium materials from Ecovative and grow it to create products of their own choosing. An "open your own plant" initiative aims to help local entrepreneurs use the plants in their own region to produce sustainable products: operations are up and running in Israel, the Netherlands, and Italy.

Behind all this innovation is Bayer's vision of design. "Design is all about intentionality for me," Bayer said. "It's a discipline that allows you to think about the world and make choices that will improve it. For me, that meant choosing biology as a medium—which could go a long way toward making the world more sustainable."

Business Before Commencement

Undergraduate uses entrepreneurial spirit and a love of cars to launch a growing manufacturer

Kevin Lambert has the soul, and the CV, of an entrepreneur. He helped launch a company whose core technologies didn't make it to market. With several friends he converted his hobby into a business that ships parts all over the world. He has raised capital, leased a shop floor, and streamlined his core manufacturing process.

He's still earning his bachelor's degree.

"I was supposed to graduate in 2017," said Lambert, "but with starting the new business I had to take time off."

Lambert's newest business, The Factory Amsterdam, grew out of his passion for rebuilding classic American cars. Not many college students can claim a 1959 Plymouth Fury as their first ride.

Then again, not many students can claim Lambert's family heritage. "My grandpa used to drag-race moonshine cars in the fifties," he explained, "but no one in my family talked about it. Then I started tinkering with cars myself. My family said, 'Here we go again,' and told me the whole story."

Kevin Lambert shown above working on his 1984 Caprice Classic.

> "It's cool to realize that we put in a good solid week of work and these parts are getting shipped all over the world."
>
> Kevin Lambert

> "We used the lean design tools from Inventor's Studio to figure out the most efficient layout for our shop floor."
>
> Kevin Lambert

Kevin Lambert's first car was this 1959 Plymouth Fury.

It wasn't long before The Factory Amsterdam started to grow. Lambert and friends found the ideal shop floor on the top level of an old glove factory in Amsterdam. They raised funds for a Haas CNC mini-mill to expand their capabilities. Their dream was to design and make custom parts for automotive hobbyists and small repair shops.

Then came the competitive world of foam dart blasting.

"My roommate and business partner (Brad Matheus) became the number one go-to guy in the world for competition dart blasters," Lambert said. "This is a huge sport, especially in Australia, the Philippines, and Singapore. So we started making parts for competition foam guns. It's cool to realize that we put in a good solid week of work and these parts are getting shipped all over the world."

Lambert and Isaiah Stanley, another Factory Amsterdam partner, took Inventor's Studio 2 and 3 with Rensselaer Professor of Practice Asish Ghosh. Inventor's Studio made

Kevin Lambert and The Factory Amsterdam team.

a massive difference in streamlining the company's manufacturing process.

"We used the lean design tools from Inventor's Studio to figure out the most efficient layout for our shop floor," Lambert said. "Dr. Ghosh advised us to keep the machines in close proximity and make sure they were movable so we could reconfigure the layout as needed."

Before Factory Amsterdam, Lambert teamed with schoolmate Patrick Calhoun to found GridStarr, whose core technology involved a hydrogen regeneration cycle for turbines. Later the pair turned to deferred-action saltwater batteries for at-home power generation. While neither idea proved initially viable, Lambert hopes to return to the hydrogen regeneration cycle at some point.

In his own business, Lambert aims to rectify what he sees as room for improvement in the design field. "There's a big disconnect between design, manufacture, and maintenance," he said. "When I fixed cars at a Cadillac dealership, I often banged my head against the wall, looking at a part and saying, 'Who designed this thing?' Parts would be designed in such a way that you couldn't get a wrench in to work on them."

Lambert sees the cause of the problem in another disconnect. "It used to be that more engineering students worked with their hands, especially on cars, and I think that makes a big difference in bridging the gap between design, manufacturing, and maintenance planning," he said. "Today, we need people in all three fields to communicate with each other. That'll go a long way to bringing the fields together."

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