NUTS, BOLTS AND NEUTRONS

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Fall 2022

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KANSAS STATE UNIVERSITY

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*Nuts, Bolts and Neutrons is published by the Kansas State University Carl R. Ice College of Engineering. It is available online at **mne.k-state.edu.***

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From the Department Head

Alumni, family and friends,

Greetings from the Alan Levin Department of Mechanical and Nuclear Engineering at Kansas State University. I welcome you to this issue of Nuts, Bolts and Neutrons. We ended the academic year last spring in strong fashion as classes and campus in general returned to normal. It was great to see students filling the halls, classrooms full and the buzz of activity on the third floors of Rathbone Hall and Ward Hall. We're proud of our students as they fought through adversity to complete their courses, to find interesting internships, to contribute to our student clubs and to attend campus activities. For those who graduated, they added job hunting and finding that first job to their activity list.

This past year also brought changes and exciting developments to the faculty and staff in the department. William Dunn, Donald Fenton, David Pacey and Ken Shultis all retired this past year. Many alumni had them in courses or as advisors during their time at K-State. You can read more about their careers inside this issue as we pay tribute to their many contributions. Faculty continue to provide national leadership, and you will also learn about Amir Bahador's American Nuclear Society Presidential Citation.

We also have many exciting student updates to share with you. You will see that our wind power team earned its first ever win at the national competition, and we are very proud of their work. Powercat Motorsports packed up the Formula car and headed to Michigan to compete this past spring. The K-State Robotics Competition Team, which includes many mechanical engineering students, swept the regional competition and headed to nationals. That's just a sample of some of the exciting things that have been happening here this past year.

I also hope you get a chance to come back to campus this coming year and that you'll stop by Ward Hall and the third floor of Rathbone Hall to see some of the changes. Our makerspace is actively used by students to do 3D-printed prototyping and build models as part of their coursework. We are currently remodeling our computer lab/team meeting space to drive innovative connections between students.

Thank you, I hope you enjoy this issue and we look forward to seeing you in the future.

Go 'Cats!

Steven Eckels
Department Head
Steven M. and Kay L. Theede Chair in Engineering

Bahadori receives American Nuclear Society Presidential Citation

Amir Bahadori, Steve Hsu Keystone research scholar and associate professor in the Alan Levin Department of Mechanical and Nuclear Engineering, was busy at this year's American Nuclear Society annual meeting, June 12-16, in Anaheim, California.

Bahadori was a panelist for the society president's special session and received a Presidential Citation for his work on radiation issues for the organization.

The panelist session, "Nuclear Grand Challenges: Moving the Needle," was organized by American Nuclear Society President Steven Nesbit, founder of LMNT Consulting, and was moderated by Catherine Prat, senior engineer from Westinghouse Electric Company.

In 2017, the American Nuclear Society announced its Nuclear Grand Challenges project. These nine challenges, put forth by the members and technical divisions of the society, identify cross-cutting technical issues to be resolved by 2030 to help address the economic, sociological and political concerns facing nuclear energy. The distinguished panel explored how students, as well as technical and industry leaders, impact progress on the grand challenges facing nuclear energy.

Bahadori was awarded his Presidential Citation from ANS based on his effective leadership addressing radiation issues for the organization, including the revision of one of the group's position statements on the health effects of low-level radiation.

Additionally, Bahadori recently served as an invited reviewer for the National Academies of Sciences, Engineering and Medicine report on a new low-dose radiation research program in the United States.

"These activities are all relevant to the Johnson Cancer Research Center because cancer is one of the major health effects of concern when it comes to low-dose radiation exposures," Bahadori said.

Teaming up to secure patent

Two faculty members in the Alan Levin Department of Mechanical and Nuclear Engineering have secured a patent for their work on nanopatterned surfaces and methods for accelerated freezing and liquid recovery.

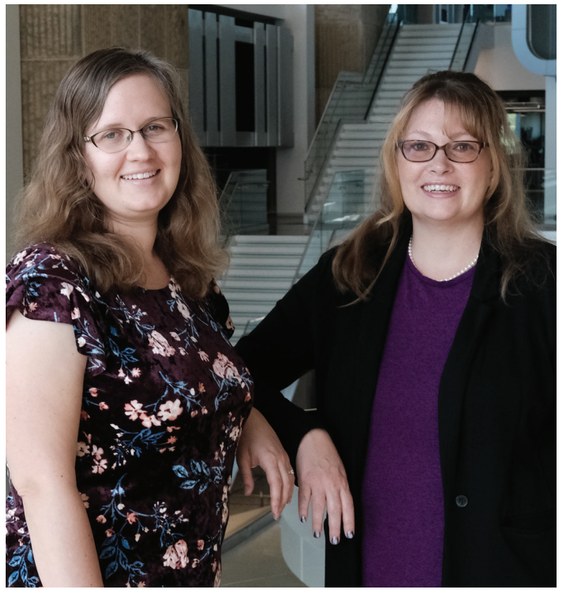
Amy Betz, assistant dean for retention, diversity and inclusion for the Carl R. Ice College of Engineering and associate professor, and **Melanie Derby**, recipient of the Hal and Mary Siegele Professorship in Engineering and associate professor, teamed up on the project with the overarching goal of investigating the effect surface structures and coatings have on freezing and frost formation. The project was funded by the National Science Foundation.

In 2015, Betz and Derby published a paper on mixed wettability surfaces that delayed freezing of condensed droplets and suppressed freezing down to a temperature of 21 degrees Fahrenheit as opposed to the regular freezing temperature of 32 degrees Fahrenheit. They hypothesized the physical mechanism delaying freezing was the movement of droplets due to coalescence. To further prove the influence of coalescence on freezing, they wanted to see if a surface that prevents coalescence will accelerate freezing. They used samples manufactured for the project by a collaborator, Edward Kinzel, with regularly arrayed nanopores and nanopillars that pinned droplets and suppressed coalescence. Some of the early data for the project was collected by Cara Snyder, a high school science teacher in Topeka. They found that surfaces that prevent coalescence did in fact accelerate freezing by orders of magnitude.

They also found other very interesting freezing behavior. For example, even though the initial freezing of droplets is accelerated, the subsequent 3D growth is significantly suppressed. They found that the droplets remained optically transparent as they froze and created cubic ice crystals.

Betz and Derby filed for a patent in 2016. While they were able to secure the patent for their nanopatterned surfaces, they never filed a patent for their mixed wettability surfaces that delayed freezing because they published their results before submitting an invention disclosure.

"We didn't even think about filing for patents until we started being contacted by companies after our 2015 paper," Betz said. "Our research is most applicable to cooling and refrigeration technologies, but it may also be used in water collection, cryogenics and optics."



> *"We are very excited about being an all-women invention team."*
>
> – Amy Betz

According to the 2020 report from the U.S. Patent and Trademark Office, women are only listed on 21.9% of patents and women are 12.8% of patent holders.

"We are very excited about being an all-women invention team," Betz said.

U.S. Patent No. 11,346,087 was issued May 31, 2022.

MNE Teams

Powercat Motorsports

Powercat Motorsports, K-State's Formula race team, competed at Formula SAE Michigan alongside 100 teams from universities all over the world, including Germany, Brazil and Canada, in a three-day event, May 18-21, in Brooklyn, Michigan.

The Formula SAE competition challenges teams of undergraduate and graduate students to conceive, design, fabricate, develop and compete with small, formula-style vehicles. It is an engineering education competition that requires performance demonstration of vehicles in a series of events, both off and on the track against the clock. Each segment of the competition gives teams the chance to demonstrate their creativity and engineering.

Powercat Motorsports is a student organization in the Alan Levin Department of Mechanical and Nuclear Engineering. Kevin Wanklyn, teaching associate professor and undergraduate program director in the department, is the faculty advisor.

Vance Weber, spring 2022 graduate in mechanical engineering and Powercat Motorsports past president and chassis lead, said the team solved several difficult design and mechanical issues in the month prior to the competition that caused the team to unite and work through adversity.

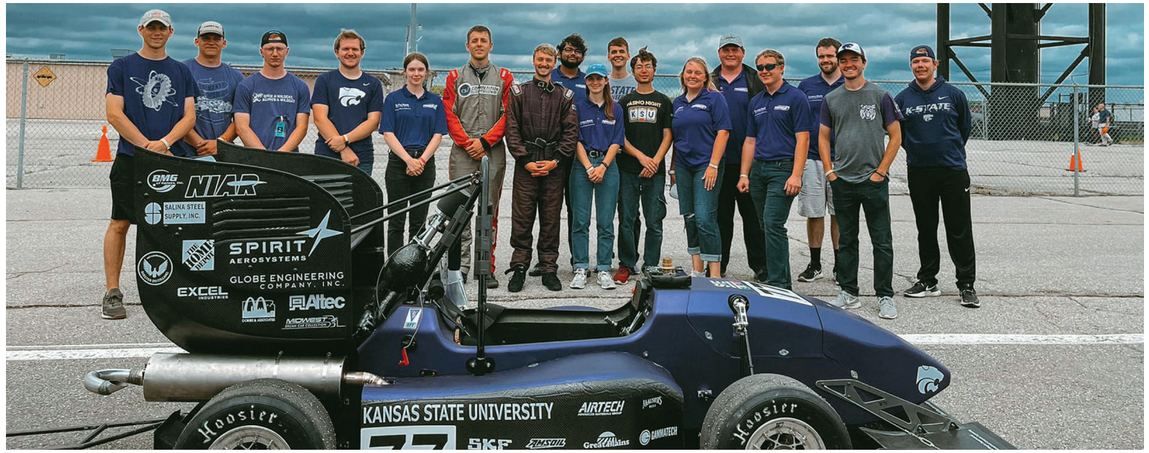
"Despite all of our issues, our team still performed at an extremely high level in Michigan against some of the best FSAE teams in the world," Weber said. "I'm proud that our team never gave up, and that no matter what, we found a way. I'm also especially proud of how beautifully our car turned out. In comparison to the other cars at FSAE Michigan, it was one of the best cars in terms of craftsmanship, fit/finish, manufacturing and sleekness."

The Powercat Motorsports team produced their fastest and most powerful car to date, where individual event highlights included fourth in acceleration, 14th in autocross and 23rd in skidpad.

"When we left the event, our team was confident we would return to the 2023 competition and finish inside the top 10," Weber said.

"The opportunity for extending classroom material into a real-life counterpart is unmatched," Weber said. "Additionally, the opportunity to meet automotive and aerospace professionals is one that continuously puts our team's graduates in those fields."

Powercat Motorsports thanks all of its supporters, including Kansas State University, the Carl R. Ice College of Engineering, the mechanical and nuclear engineering accounting staff, Powercat Motorsports alumni, family, advisor Kevin Wanklyn, department head Steven Eckels and donors. Important business sponsors include Spirit Aerosystems, Holley Performance, Globe Engineering, Park Aerospace, Dimensional Innovations, NIAR, Altec, Excel Industries, BMG of Kansas, Katalyst Wraps, Vortex and Lincoln Electric.



Wildcat Wind Power

Kansas State University's Wildcat Wind Power team won for the first time in club history at the 2022 Collegiate Wind Competition, a U.S. Department of Energy event, May 16-18, in San Antonio.

The K-State team battled 11 other schools to claim the top prize in the yearlong national competition. The team designed, built and tested its model wind turbines throughout the academic year before presenting and testing the models in a wind tunnel at the event, which was in conjunction with the American Clean Power Association's CLEANPOWER 2022 conference and exhibition.

Hongyu Wu, faculty advisor for Wildcat Wind Power, was pleased to see the team's hard work pay off.

"I am so proud of our team's effort in this competition," Wu said. "The chief judge was very complimentary of the team's performance, saying the turbine testing performance was the best he had seen since the inception of the DOE Collegiate Wind Competition."

The competition is divided into four contests that test the skills of the team on its ability to create a viable model, along with rating the team's design and presentation skills, its ability to design an offshore wind farm and its effectiveness in wind-related outreach.

K-State placed in the top half of each contest, winning in turbine testing, taking second in turbine prototype, fourth in connection creation and fifth in project development to finish with the highest overall score.

"We developed the turbine early in the fall semester and continued designing and testing right up until we left for San Antonio," said Hayden Dillavou, vice president of the club. "We have our own wind tunnel and workspace in the basement of the engineering building, where we do most of our testing and design work."

Dillavou said the club is made up primarily of mechanical and electrical engineering students but welcomes members from all majors and backgrounds, including those outside the Carl R. Ice College of Engineering.

MNE Teams

K-State Robotics Competition Team

Two teams from the Kansas State University Robotics Competition Team competed at the National Robotics League Championship and College Invitational, May 20-21, after sweeping first and second place at the regional competition in April.

Both squads qualified for the national competition at the Robert Morris University UPMC Events Center in Moon Township, Pennsylvania, after strong showings at the April 22-23 regional competition, called BOTSKC. The two teams ultimately faced off against each other for first place, with Team Takeoff claiming the top spot over Team Power Kitten MKII.

The regional event, sponsored by the National Robotics League, is a double-elimination, single-combat battle tournament bracket. For each battle, two teams put their robots into opposite corners and the first team to break, flip or otherwise incapacitate the other robot wins. If time runs out before there is a clear winner, a panel of judges declares a winner.

The squads from the Carl R. Ice College of Engineering competed in the 15-pound weight class and in addition to head-to-head battles, competed in video interviews and written documentation segments.

"Our professionalism and preparedness earned the respect of our competitors," said Ty Mathews, sophomore in mechanical engineering and captain of Team Takeoff. "However, it was our bots' robust design and nimble drivetrain that earned us first place in the college division of BOTSKC."

Team Power Kitten MKII had to rebound from a 0-1 start to end the day in the championship match.

"Power Kitten MKII was plagued by electrical and mechanical issues the whole event, but our amazing pit crew took us from a 0-1 record at the start of the competition to a 6-2 record, winning us second place in the college division," said Alex Howard, senior in electrical engineering and captain of Team Power Kitten MKII. "The largest issue we faced was screws loosening from large impacts."

Both teams had the opportunity to refine their bots between the two competitions.

"Our team is full of members that put 100% into their work, and we could not have done what we did without each of them," Howard said.

Department News

MNE faculty retirements

A quartet of professors in the Alan Levin Department of Mechanical and Nuclear Engineering retired during the 2021-2022 academic year.

Bill Dunn, **Donald Fenton**, **David Pacey** and **Ken Shultis** combined for more than 150 years of service to the Carl R. Ice College of Engineering at Kansas State University.

Dunn focused the majority of his teaching on nuclear engineering courses, introducing a pair of courses while also being a pioneer of early distance education at K-State. He was honored with the Radiation Science and Technology Award from the American Nuclear Society in 2015. Dunn also served as interim department head from 2013-2014 and department head from 2014-2019.

Fenton joined K-State in 1986 as an associate professor and was promoted to professor in 1992. He served as acting department head for the 1994-1995 academic year and the spring 1998 semester, and department head from fall 2009 to spring 2014. During his more than 35 years at Kansas State University, he personally developed four mechanical engineering courses, chaired the department's graduate committee during the 1990s and led numerous research projects related to refrigeration and energy conversion systems.

Pacey began his career at K-State with an eight-year stint as a power and machinery specialist within the extension agricultural engineering program. He began teaching in the engineering technology program before moving to the mechanical and nuclear engineering department, where he taught for 28 years. Pacey won a variety of awards throughout his career, both for his undergraduate teaching and his commitment to advising. Pacey also spent many years as the faculty advisor for the K-State chapter of the Society of Automotive Engineers.

Shultis came to K-State in 1969, joining the nuclear engineering department and embarking on a 53-year career the year after earning his doctorate from the University of Michigan. He has taught more than 30 different courses and conducted research on a variety of topics related to nuclear engineering. The author of seven books, Shultis' research brought in more than $19 million in research grants and contracts to the university. His span at K-State includes the tenures of five university presidents, four provosts, five engineering deans and eight department heads.

Bill Dunn

Donald Fenton

David Pacey

Ken Shultis

Faculty and staff updates

Amy Brox joined the MNE department as an academic advisor and graduate program coordinator. She holds a bachelor's degree in mechanical engineering from K-State. She returns to K-State after working for 27 years in public and private organizations, including as a process controls engineer for MAC Equipment, a natural gas safety engineer for the Missouri Public Service Commission and a strategic planning assistant for an entrepreneurial company in Manhattan, Kansas.

Alexander Gibson joined the MNE department as an instructor. He received his bachelor's from Northwestern University in 1983, his master's from the Massachusetts Institute of Technology in 1986 and his doctorate from the University of Michigan in 1999. Prior to coming to K-State, Gibson spent more than 20 years working in automotive research and development at Ford Motor Company, with a focus on vehicle suspension, steering and powertrain analysis, development, and control. Prior to joining Ford, Gibson worked in the aerospace industry on autopilot control and navigation system development as well as farm equipment development as an intern at International Harvester.

Scott Thompson, associate professor of mechanical engineering, earned tenure in the spring, joining 90 of his peers who also received a promotion or tenure.

"K-State has excellent faculty who are central to the academic success of this university," said Charles Taber, provost and executive vice president. "We are proud of the outstanding achievements of these newly tenured and promoted faculty in teaching, RSCAD and service. I am delighted to celebrate these professional milestones with them, and look forward to their continued success. Congratulations to all."

2022 Ice Scholars

The Carl R. Ice College of Engineering at Kansas State University recently announced its 2022 Ice Scholars, which recognize select outstanding students who plan to major in engineering at the university.

Of the six incoming freshmen honored as Ice Scholars, two are studying mechanical engineering. **Ryan Gitobu** and **Adam Riekeman**, along with the other Ice Scholars, will potentially receive a total of $30,000 over four years in addition to any other university scholarship awards. The renewable award is designated for high-achieving, highly involved student scholars and is the largest scholarship award made by the college.

Finalists were selected by a committee of college faculty and staff and participated in an on-campus interview as part of the application process.

"We are very excited to welcome this group of outstanding and diverse scholars into our fall 2022 freshman class," said Gary Clark, senior associate dean and professor in the College of Engineering.

2022 spring and summer graduates by the numbers

More than 140 students completed degree requirements from the Alan Levin Department of Mechanical and Nuclear Engineering in spring and summer of 2022. There were 120 bachelor's degrees, five master's degrees and 16 doctorates awarded.

Graduate students
Ph.D. in Mechanical Engineering: 10
Ph.D. in Nuclear Engineering: 6
M.S. in Mechanical Engineering: 2
M.S. in Nuclear Engineering: 3

Undergraduate students
B.S. in Mechanical Engineering: 107
B.S. in Mechanical Engineering with Nuclear Option: 13

Summa cum laude (3.95+ GPA): 12
Magna cum laude (3.85-3.949 GPA): 5
Cum laude (3.75-3.849): 16
Honors Program: 1
Secondary major: 1
Concurrent degrees: 3

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Revised August 14, 2020.