Michigan Tech

2018 • VOLUME 55 NUMBER 1

MAGAZINE

Welcome

RICHARD J. KOUBEK

OUR TENTH PRESIDENT

DRIVING INNOVATION

Named for the Greek deities of knowledge, learning, and the north wind, Michigan Tech's Prometheus Borealis team placed second in concept design and eighth overall in the inaugural competition of the AutoDrive Challenge, held April and May 2018 in Yuma, Arizona. The AutoDrive Challenge is a three-year collegiate autonomous vehicle design competition sponsored by SAE International and GM.


snowbird
AutoDrive Challenge

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REGULAR FEATURES

Michigan Tech Magazine
Published by University Marketing and Communications

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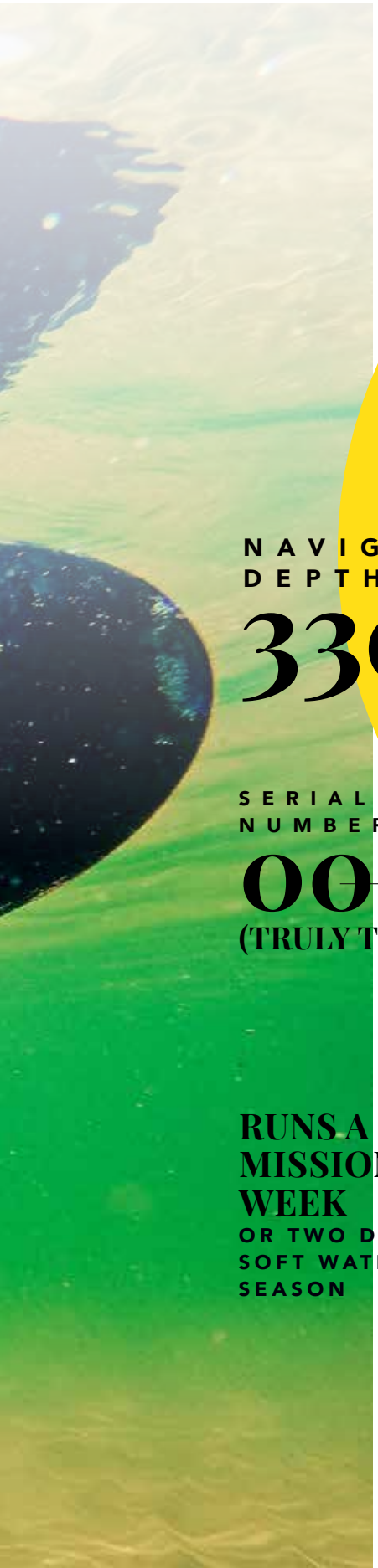
THE ANATOMY OF . . .
AN UNDERWATER ROBOT

GREAT LAKES RESEARCH CENTER'S autonomous underwater vehicle (AUV)—the IVER-3—is the first of the third generation sold to anyone outside the military. The torpedo-shaped robot imaged two previously unknown shipwrecks last year. The Michigan State Police Underwater Recovery Unit has an identical robot, purchased after spending a week on campus training with our experts. Learn more about the crazy smart IVER-3:

Michigan Tech's custom fleet of research tools and vessels launch right from campus on the Keweenaw Waterway—explore more: **mtu.edu/greatlakes**



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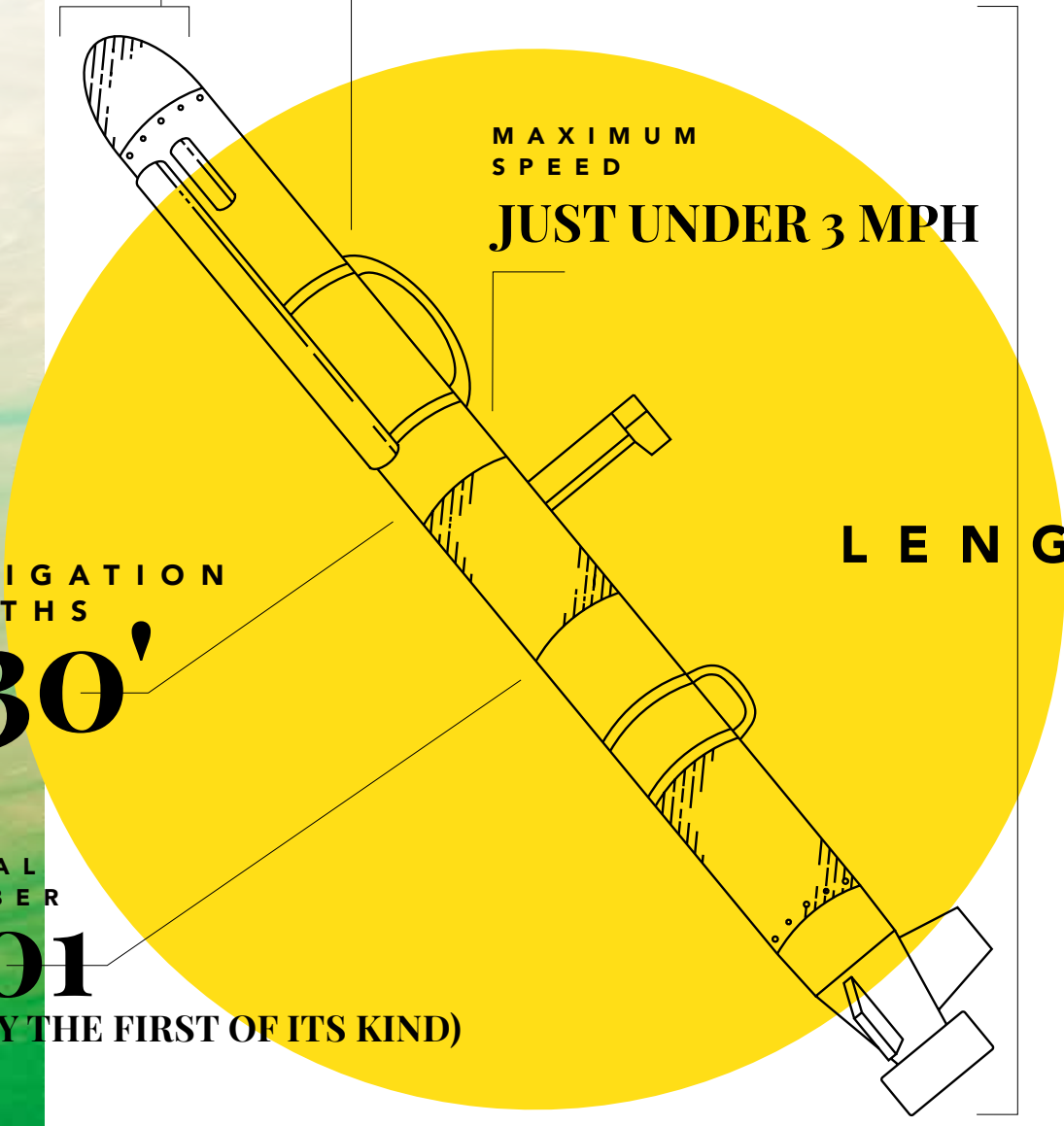


MAXIMUM SPEED
JUST UNDER 3 MPH

LENGTH
6' 1"

NAVIGATION DEPTHS
330'

SERIAL NUMBER
001
(TRULY THE FIRST OF ITS KIND)

RUNS A MISSION EVERY WEEK
OR TWO DURING SOFT WATER SEASON

MAXIMUM AUTONOMOUS OPERATING TIME:
UP TO EIGHT HOURS (COMPLETES MISSION AND RETURNS TO A PREDETERMINED PARKING POINT ON THE SURFACE)

ARRIVED ON CAMPUS SEPTEMBER 6, 2013
GLRC STAFF TRAVELED TO MASSACHUSETTS FOR PICKUP AND OPERATION TRAINING

IMAGES OBJECTS USING SOUND WAVES
AT TWO DIFFERENT FREQUENCIES TO CREATE SONOGRAMS

MICHIGAN TECH NAMED SAFEST CAMPUS IN THE COUNTRY

This past winter, *College Magazine* ranked our campus the safest in the nation. While we're proud of the distinction—the magazine noted our crime rate is 53 percent lower than the national average—we know it's attributed to the values Huskies share: community, scholarship, possibilities, accountability, and tenacity.

Read and share, Huskies!
mtu.news/2v2eNzr

This gnarly art? Credit goes to **Katie Jo Wright**. Shredding Huskies might know her from Tech's very own ski hill, Mont Ripley.

1,500 Huskies.
More than 2,036 snowmen.
One hour.

Snow? Check. People? Check, check. Good packing snow? Meh. But Huskies love a good challenge. As part of this year's Winter Carnival events, campus and community converged on a snow-covered Sherman Field to attempt to break our fourth-ever Guinness World Record. The frigid temp and dry snow didn't make things easy. Huskies pulled out engineering tricks of the trade to get the job done. (No official word as of press time—head to *mtu.edu/news* for the latest.)

A HUSKY HIGH-FIVE TO UNDERGRADUATE STUDENT GOVERNMENT FOR PLANNING THE EVENT.

ALUMNUS BOB EVANS
BREAKS GUINNESS RECORD

There are running records to be broken. There are juggling feats to tackle. One crazy smart alumnus combined running and juggling by performing them simultaneously and backwards. And broke a Guinness record for fastest mile joggling backwards with three objects.

Time: 6 minutes 45.85 seconds

"I've broken a few existing records, but never went through the process of getting them verified," says Bob Evans '07.

Bob's inspiration came from a close friend, Bill Bails. Bill works as a race director and hosts an annual 5K with prizes for the fastest juggling runners. He has been a source of support for Bob and wife Trish '08 over the years. "Bill's a great man who has been battling a terrible form of cancer for the past couple years. I wanted to do something to honor him," says Bob.

Bob broke the record in Bill's hometown of Stanwood, Iowa, as part of a community track meet and a ceremony officially naming the stadium Bill Bails Track.

"It was a surreal night. Six-months-pregnant Trish rode a bike with a GoPro attached alongside me the whole mile. My niece was there. Just about the entire town came out to cheer. It was really a special night . . . intense yet peaceful."

Bob is currently training for the fastest mile while dribble-juggling three basketballs (mind = blown). "I like the idea of breaking a world record every year around my birthday, July 24."

Follow the adventures of Bob and Trish and meet baby Jasper Grit (future Husky?!) on Facebook:
@BobandTrishJuggling

Innovation Shore—that's here. Michigan Tech and the surrounding communities. Discoveries in science, technology, engineering, and math fuel our town, region, and world.

What's happening along the Shore:
mtu.edu/innovation

Team effort! Alumni Bob Evans '07, joggling, and Trish Evans '08, pacing on bike, during last summer's successful Guinness World Record feat.

WHAT IS STEM EDUCATION?

Especially at a technological university, the term "STEM" is used a lot. In a pre-college setting, STEM education focuses on how to implement the best practices for teaching science, technology, engineering, and math. Assistant Professor of STEM Education in Cognitive and Learning Sciences Emily Dare and her team found there is less consistency in these practices than the K–12 educational community may assume. In fact, K–12 teachers use a variety of models to teach STEM—a more complex system than initially apparent. Read on: mtu.news/2vYrISy

Get a look at what's happening inside our Ion Space Propulsion Laboratory:
mtu.news/2u1HNZX

MENDING BROKEN HEARTS WITH CARDIOMYOCYTE MOLDS

Whether caused by an undetected birth defect or a heart attack, when a heart sustains damage, it can be difficult to repair. Fixing broken hearts with new heart muscle cells requires growing cells in an environment like that found in the heart. Assistant Professor Parisa Pour Shahid Saeed Abadi designs three-dimensional substrates that promote better maturation and functionality of heart muscle cells created from induced pluripotent stem cells.

Read on:
mtu.news/2p4ID4z

ZEN MASTER

BIG OPPORTUNITIES IN [BIG] DATA SCIENCE

In 2000, the amount of data stored globally hovered around 800,000 petabytes. These days, Twitter and Facebook both generate more than seven terabytes of data each day—and projections for 2020 place the data lode at approximately 35 zettabytes. The US Bureau of Labor Statistics forecasts a 19 percent growth in employment for computer and information research scientists by 2020. With its MS in data science, Michigan Tech answers the call.

"The data sciences program at Michigan Tech truly reflects the multidisciplinary aspects of the field. Students are not only educated in the curriculum—data mining, statistics, coding, and business—but they also extend their focus to domain areas including machine learning, health sciences, mathematics, management systems, and more," says Tim Havens '99 '00, William and Gloria Jackson Associate Professor of Computer Systems and graduate program director.

It's free to apply. Interested? Know someone who is? Visit:
mtu.edu/data-science

The Mi-STAR vision: Engineering and science are taught and learned as an integrated body of knowledge to address societal challenges.

Mi-STAR: MICHIGAN SCIENCE TEACHING AND ASSESSMENT REFORM

Led by Michigan Tech and made possible by a donation from the Herbert H. and Grace A. Dow Foundation, Mi-STAR is a partnership of universities, school districts, and professional societies working together to develop curriculum, assessments, and professional learning programs supporting teachers.

"The Dow Foundation is committed to improving STEM education—and their commitment is paying off across the state, particularly in their home area of Midland. Midland teachers participate in every aspect of Mi-STAR, and there is strong support for Mi-STAR from the district's administration," says Jacqueline Huntoon, Michigan Tech provost and vice president for academic affairs and Mi-STAR project lead and principal investigator.

Midland leveraged its Mi-STAR work by securing funds from the state to run Mi-STAR curriculum development centers throughout Midland and Saginaw. The funds helped Midland build the capacity needed for STEM education reform in the Bay Region, and at the same time, increase the size of the Mi-STAR network.

National Science Foundation (NSF) is sponsoring a Michigan Tech program—$2.8 million in overall funding—to further grow Mi-STAR; Kalamazoo Public Schools and the Saginaw Intermediate School District are key partners on the NSF project.

"Michigan Tech's collaborations with Michigan school districts advances the success of K–12 projects like Mi-STAR," Huntoon adds.

Read on:
mi-star.mtu.edu

2015
6 SCHOOLS/DISTRICTS
16 Mi-STAR TEACHERS
1,700 STUDENTS

2018
105 SCHOOLS/DISTRICTS
450 Mi-STAR TEACHERS
45,000 STUDENTS

HUSKY TALES MAHSA ASGARISABET

I received my second master's degree in mechanical engineering with a focus in acoustics from Michigan Tech and will soon graduate with my PhD. I was always interested in coming to the US for school. It was a hard decision to leave my family and friends back home. I did have a few friends at Michigan Tech before coming here, which helped a lot. Being in such a small town was new to me. I was born in Tabriz, Iran, and have always lived in big cities, but I have enjoyed my time here—everyone is so friendly.

Being a Husky means being hard-working—classes demand a lot. I also think it means being happy and helpful. I didn't expect everyone to be so happy in this weather. They love and embrace it.

Michigan Tech has a strong engineering program, the professors are great, and it's well-known in industry. I learned a lot and developed many contacts from industry during my time here. I've become independent despite being so far away from my family and loved ones. It has given me confidence in my research and myself.

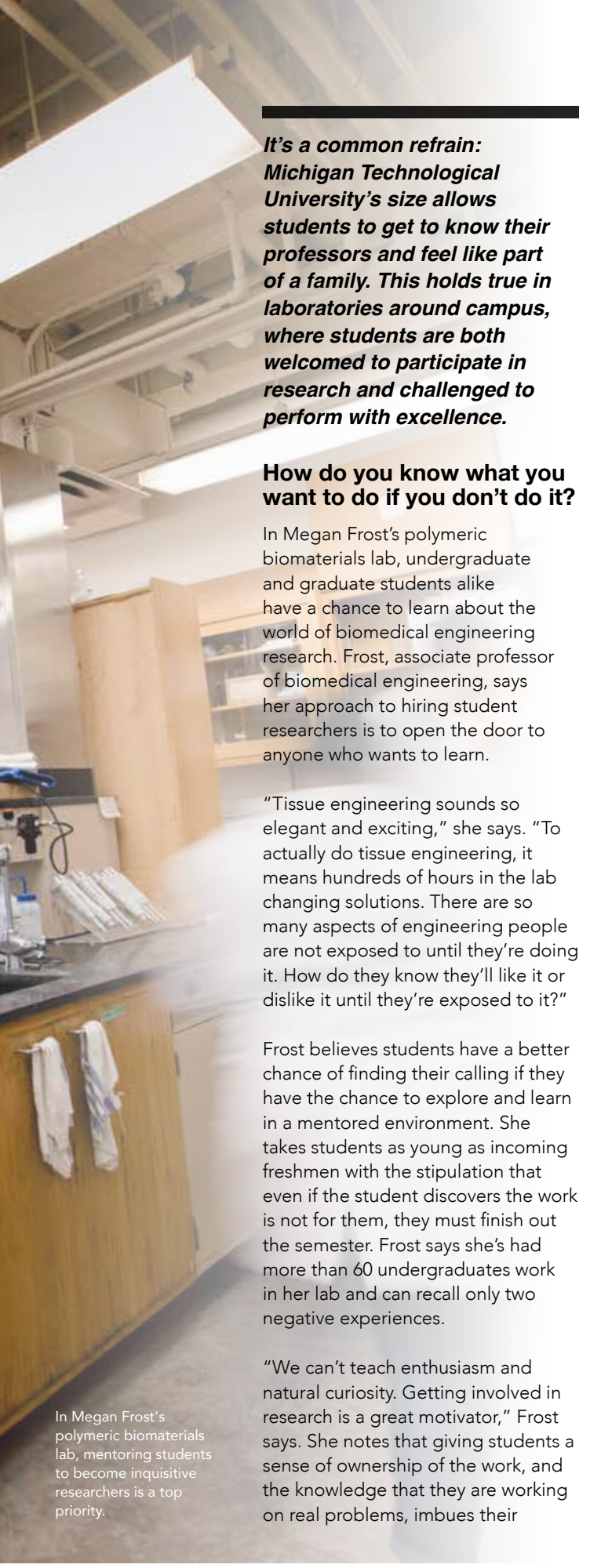
I recently received an offer to intern with Apple. I got a message through LinkedIn from Apple's recruiters. From there, they interviewed me twice and offered me an internship within a day. They were very fast! This will be my third internship and I am excited to use the knowledge I gained here and apply it practically. My background in acoustics helped me secure this position, along with the courses I took and help I've received from Career Services along the way.

Believe in your dreams. And girls: don't be afraid to go into engineering. Don't be disappointed if you fail—I was turned down by many companies. Update your online profiles regularly and use all resources at Michigan Tech.

Husky Tales | Follow along:

LAB CULTURE

AT MICHIGAN TECH, THERE ARE LABS THAT DEMAND MORE THAN JUST EXCELLENCE— THEY PROVIDE THE OPPORTUNITIES TO CREATE IT.



In Megan Frost's polymeric biomaterials lab, mentoring students to become inquisitive researchers is a top priority.

It's a common refrain: Michigan Technological University's size allows students to get to know their professors and feel like part of a family. This holds true in laboratories around campus, where students are both welcomed to participate in research and challenged to perform with excellence.

How do you know what you want to do if you don't do it?

In Megan Frost's polymeric biomaterials lab, undergraduate and graduate students alike have a chance to learn about the world of biomedical engineering research. Frost, associate professor of biomedical engineering, says her approach to hiring student researchers is to open the door to anyone who wants to learn.

"Tissue engineering sounds so elegant and exciting," she says. "To actually do tissue engineering, it means hundreds of hours in the lab changing solutions. There are so many aspects of engineering people are not exposed to until they're doing it. How do they know they'll like it or dislike it until they're exposed to it?"

Frost believes students have a better chance of finding their calling if they have the chance to explore and learn in a mentored environment. She takes students as young as incoming freshmen with the stipulation that even if the student discovers the work is not for them, they must finish out the semester. Frost says she's had more than 60 undergraduates work in her lab and can recall only two negative experiences.

"We can't teach enthusiasm and natural curiosity. Getting involved in research is a great motivator," Frost says. She notes that giving students a sense of ownership of the work, and the knowledge that they are working on real problems, imbues their educational experience with greater meaning.

"Research can be a black box that seems out of reach for undergraduates and it shouldn't be," she says.

Genevieve Romanowicz, who graduated from Michigan Tech in 2012 with a bachelor of science in biomedical engineering, is now pursuing her doctorate of dental surgery (DDS) and a PhD at the University of Michigan. She is one of two students accepted annually into the DDS/PhD program. She began working in Frost's lab the summer after graduating from high school.

"The laboratory experiences really developed my inquisitive thinking," she says. "I believe it helped me to perform well in my courses as well as our Senior Design projects. It gave me an early mindset of how best to think about problem solving and to explore solutions."

Romanowicz also learned how to be a mentor herself.

"Dr. Frost emanates a joy and passion for research. She would be whistling and singing as she was showing me how to synthesize some chemicals," Romanowicz recounts. "Now I have to be the one whistling at the bench. I also try to mimic Dr. Frost in much of her mentoring style when I work with undergraduate students because I know she really helped to shape my view of research and my success so far."

The next Einstein may be knocking at your door

For Tarun Dam, associate professor of chemistry, balancing the requirements of teaching and research can be a gamble. Dam says training students can be frustrating at times but is ultimately incredibly rewarding. Rather than a research pedigree, Dam says what he looks for in a student is a passion for the work.

"Research is tough. It's heartbreaking," he says. "I want students to discover early if they want or don't want to pursue research."

Dam adds that he doesn't weed out applicants to his lab based on their academic background.

"If we do not open the door, we do not know who is knocking at the door. It could be Einstein," Dam says. "But students, no matter how bright they are, need supervision. We need to give students fundamental knowledge and train them properly."

A culture of excellence and self-management

Thomas Werner's drosophilid lab is a breeding ground. Literally. Undergraduate and graduate students work side-by-side with 6,000 fruit fly pupae annually to better understand developmental genetics.

But the assistant professor of biological sciences also says his lab is a place where commitment to excellence is required, encouraged, and rewarded.

"I'm pretty strict. Get your job done," he says. "I'm all about quality. Research has to tell an elaborate story in biology. There have to be multiple proofs. You have to prove everything you do."

Werner requires students in his lab to work their way up through the ranks, beginning with lab maintenance and making food for the flies. Once they do those duties reliably, they are given the privilege of helping with research experiments. It's a strict environment, but it gives students a window into the workings of an industrial lab. And based on the number of students in his lab who have gone on to pursue graduate or medical studies, or who have landed jobs in hospitals or industry, it's a model for success.

MICHIGAN TECH'S TENTH PRESIDENT

Welcome RICHARD J. KOUBEK

Koubek brings an impressive record of leadership to the University, with 30 years of experience in academia as a faculty member and administrator.

"This is an opportunity for those who recognize it. The window is open, but it will close if we don't take advantage of it."

Richard Koubek sits at an oversized conference table in an undersized conference room. Laptops and cellphones clutter the surface; lighting equipment and video cameras clog the aisles. From the hallway, phones ring and voices emanate.

If Koubek finds it all distracting, he doesn't let it show. He's focused on the people in the room, the question at hand.

What excites you about Michigan Tech?

"This is a unique moment in time," he says. "We are truly in the fourth industrial revolution. In the Renaissance, we celebrated the individual. But when we moved into the Industrial Revolution, we lost that sense of individuality a little bit. We focused on automation. And with the emergence of information technology, humans were encouraged to interact with and think like computers.

"But that's all in the past now. The value of the individual is no longer eclipsed by technology. Today, the Renaissance meets the Industrial Revolution. Technology is sophisticated, but it's here to help us."

And a school like Michigan Tech is primed to lead, Koubek says, on a global scale, because we understand not only the technology, but it's implications for society and our environment.

In other words, Richard J. Koubek—the tenth president of Michigan Technological University—is ready to seize the opportunity.

Atypical engineer

Born outside Chicago in Berwyn, Illinois, Koubek spent time growing up in California's San Fernando Valley and Farmington Hills, Michigan, before returning to the Chicago area during his high school years.

"I couldn't afford to go to a four-year institution right out of high school," Koubek says, "so I went to a community college and worked at a local hardware store."

After two years, Koubek transferred to Oral Roberts University. He started out as a chemistry major, but soon realized he wanted to work with people. He switched to a biblical literature major with a minor in chemistry, and after graduating with his first bachelor's degree, Koubek headed to Trinity Divinity School in northern Illinois.

It was there that he had a surprising realization about his true passion.

"I woke up one morning and said to myself, 'It's the math!'" Koubek laughs at the memory. "I wanted to work with people, but I also really enjoyed math. I wanted a career that included both."

The realization led Koubek to Northeastern Illinois University, where he completed a second bachelor's in psychology, with a focus in engineering psychology. Following the eight months it took to complete his degree, Koubek worked as a research assistant in human-computer interaction.

"I have an unusual educational background. One you wouldn't expect for an engineer. My first degree in is liberal arts, and my second is in social sciences."

From there, he moved on to Purdue University, where he received his Master of Science and PhD in Industrial Engineering. His research focused on expertise and human factors in advanced manufacturing—"designing systems to fit the person, not persons to fit the system."

Engineering expertise

In 1988, Koubek joined Wright State University in Dayton, Ohio, where he taught and conducted research in usability engineering, human factors engineering, and human-computer interaction as an assistant professor. He was the College of Engineering's Teacher of the Year in 1991. "Wright State is located near Wright-Patterson Air Force Base," Koubek says. "It

"I cannot imagine a person better prepared to lead Michigan Tech into the future than Rick Koubek. Rick is a true servant leader who will be a wonderful role model for students and a fantastic ambassador for the university. He understands the power of technology and how technology can be applied to solve complex problems. His intellectual curiosity drives him to seek always a new and better way, and his humility gives him the confidence to thoughtfully consider diverse opinions when reaching a conclusion. Rick will set a powerful vision for the university and inspire the entire Michigan Tech community to reach its full potential."

– Luther C. Kissam IV, CEO, Albemarle Corporation

Richard and Valerie Koubek. Valerie's career as a registered nurse spanned 25 years and focused mainly on pediatrics and women's health. The couple have three grown children—a teacher, a physician, and an engineer—and two German Shepherds.

was a hotbed of human factors engineering. In fact, at the time, it was the only bachelor's program in human factors engineering."

After three years with Wright State, Koubek joined the faculty at his alma mater Purdue, where he was an assistant and then associate professor in the School of Industrial Engineering. He won the Pritsker Outstanding Teaching Award in 1995.

In 1997, Koubek headed back to Wright State to serve as professor and chair for the Department of Biomedical, Industrial, and Human Factors Engineering. Over the course of four years, he established the university's industrial engineering program, earned the "Click-It" Award for Innovative Use of Instructional Technology, and was named Department Chair of the Year in 2001. He was also associate dean for research and graduate studies in the College of Engineering and Computer Science from 1999 to 2001.

"Then I went from the newest industrial engineering program in the nation to the oldest," Koubek says. In July 2001, he was named head of Pennsylvania State University's Harold and Inge Marcus Department of Industrial and Manufacturing Engineering. Penn State's industrial engineering program ranked as one of the best in the nation during his tenure.

> "Super experts are the ones that, when you ask them the big questions, they say, 'It depends.' They have deep knowledge, and they know all the implications. They understand every piece of the puzzle and how those pieces fit together. I developed a passion for understanding expertise and how to develop it for educational purposes. It's the reason why I believe experiential learning is so important for students."

Professional Highlights

- As dean of Louisiana State University's College of Engineering, expanded undergraduate enrollment by 53 percent and secured more that $90 million in philanthropic funding.
- Recipient of the NASA Group Achievement Award for managing the National Center for Advanced Manufacturing.
- Established the industrial engineering program at Wright State University.
- Renowned expert in human factors engineering, usability engineering, and human-computer interaction.
- 2016 Outstanding Industrial Engineer of the Year, School of Industrial Engineering, Purdue University
- 2014 BASF Professor of Excellence Award, Louisiana State University
- 2013 Governor's Technology Award for Outstanding Leadership in Technology, State of Louisiana
- Member, Tsinghua University's Department of Industrial Engineering's International Advisory Board, 2011-12
- Board member, Our Lady of the Lake Hospital in Baton Rouge, 2015-18

"It is an honor and privilege to be chosen as the University's tenth president," Koubek said at the time of his election, "and I'm excited to start working with the Michigan Tech community."

"Rick is a true visionary who knows intuitively how to move an institution forward. Not only is he a strategic thinker and planner, but he is also excellent at engaging with people on so many levels. Rick's boundless energy and thoughtful approach, combined with his vast experience, will allow him to make an immediate impact. I know he and Valerie will be a real asset to the MTU community."

– Stuart R. Bell, President, The University of Alabama

Callin' Baton Rouge

After seven years at Penn State, Koubek was appointed dean of the College of Engineering and Bert S. Turner Chair at Louisiana State University (LSU). During his six years in this position, Koubek expanded the college's undergraduate enrollment by 53 percent, elevating it to the 17th largest college of engineering in the United States. The number of doctoral degrees awarded nearly doubled.

Koubek also pioneered an innovative public-private partnership with Louisiana Economic Development and IBM to contemporize the curriculum in the Department of Computer Science. The effort helped earn him the 2013 Governor's Technology Award for Outstanding Leadership in Technology.

In 2015, Koubek was named LSU's executive vice president and provost. During his three-year tenure, he guided the university through an extensive strategic planning process and launched the LSU Strategic Plan 2025.

"LSU wanted to realign its course structure to better prepare students to be problem solvers and leaders, and of equal importance, to be global citizens and think of themselves as such."

It was this global perspective that brought Koubek to Michigan Tech.

"Everybody has the same goal—to advance the institution. There may be different opinions about how to go about it, but a good leader will respect those different opinions and figure out how to knit them together. That moves the institution forward at a rapid pace without compromising integrity."

On a mission with a vision

Koubek points out that Michigan Tech's vision statement demands that the University be a global leader, not just in technology, but in understanding the impact technology has on society, individuals, and the environment. "Michigan Tech wants to lead," he says, "not to benefit itself alone, but to benefit the state, the nation, and the global community. Our goal is to improve quality of life for everyone, and to promote mutual respect and justice."

"We have to understand not just what the technology is, but what it means. If you throw a rock in the pond, you see a big splash, but it's the ripples that rock the boat."

For Koubek, the first step toward realizing that vision is to keep his focus on the people around him, and listen.

"It's going to take our collective wisdom to determine the best path forward, to take advantage of this unique moment in time," Koubek says. "We're in uncharted territory. And that's why I'm excited to be at Michigan Tech. These are the people I want to be on this adventure with—the students, the faculty, the staff, the Board. I'm ready to roll up my sleeves and work with every member of the community. We have what it takes to be a leader in the fourth industrial revolution."

The Fourth Industrial Revolution

In his introduction to *The Fourth Industrial Revolution*, Klaus Schwab, founder of the World Economic Forum, describes the pace of profound shifts in the ways humans live. Around 10,000 years ago, he notes, the first shift occurred when people transitioned from foraging to farming. In this agrarian revolution, food production slowly improved, leading to larger human settlements, urbanization, and cities.

But thousands of years passed before the next major shift. It was not until the second half of the 18th century that mechanical inventions gave birth to a series of industrial revolutions brought about by innovations such as railroads and the steam engine; electricity and the assembly line; computers, personal computers, and the internet. Each innovation demanded higher-skilled workers.

"Still valid today is the lesson from the first industrial revolution—that the extent to which society embraces technological innovation is a major determinant of progress."

– Klaus Schwab

Schwab argues that we are now at the dawn of a fourth industrial revolution, characterized not only by smart, connected machines and systems, but also by a wide-ranging scope of breakthroughs. "It is the fusion of these technologies," he argues, "and their interaction across the physical, digital, and biological domains that make the fourth industrial revolution fundamentally different from previous revolutions."

The transformation, he says, will fundamentally alter "the way we live, work, and relate to one another." While it is not clear how this transformation will unfold, Schwab says the response must be "integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society."

THERE ARE MANY REAL-WORLD SCENARIOS WHERE MOBILITY IS NEEDED. INTERDISCIPLINARY TEAMS AT MICHIGAN TECH TACKLE RESEARCH CHALLENGES IN THE AIR, ON LAND, AND EVEN UNDERWATER.

A PROTOTYPE DRONE CATCHER SHOOTS A NET TO SAFELY CAPTURE AND PHYSICALLY REMOVE A ROGUE DRONE. THE PATENT-PENDING TECHNOLOGY OFFERS A VIABLE SOLUTION FOR INTERCEPTING ROGUE DRONES WHEN FORCE-LANDING OR SHOOTING THE DRONE WOULD JEOPARDIZE SAFETY.

THE MOVEMENT OF PEOPLE, GOODS, AND INFORMATION.

MOBILIT

AIR

Everyone's heard of drones. Some of the press has been sinister. But these unmanned flying machines, operating autonomously and by remote control, can go where people can't or prefer not to venture—under bridges, inside culverts, down deep and narrow shafts—carrying sensors that transmit information about the conditions and critical needs of those systems.

Colin Brooks, a senior research scientist at the Michigan Tech Research Institute (MTRI), leads the University's work using drones or unmanned aerial vehicles (UAVs) to help federal and state agencies develop safer, more effective, lower-cost ways to monitor transportation infrastructure.

Using high-resolution aerial imagery to understand conditions on the ground is nothing new, Brooks points out. "The oldest surviving aerial photo is of Boston from 1860, taken from a tethered balloon," he explains. "We're just making data-gathering quicker, easier, safer, and more detailed for rapidly understanding our transportation infrastructure."

COLIN BROOKS

Brooks, who specializes in remote sensing technology and geographic information systems (GIS), heads Tech's UAV transportation research team, which includes Rick Dobson, Thomas Oommen, Tim Havens, Tess Ahlborn, Kuilin Zhang, and Amlan Mukherjee.

MTRI deploys five main UAVs: Bergen hexacopters, a heavier-lift Bergen quad-8 system, a DJI Mavic Pro, a DJI Phantom 3 Advanced, and a Mariner 2 Splash waterproof system. The hexacopter platform is used primarily to collect high-resolution 3-D optical and thermal data of bridge decks, construction sites, and road corridors. The larger Bergen quad-8 system, with four pairs of rotors, is used to carry larger sensors and sensors in combination. The Mariner 2 Splash can land and take off from the water, helping inspect the underside of bridges over water. The Mavic Pro and Phantom 3A are smaller quadcopter systems. Both are useful for obtaining traffic operations data, imaging hard-to-reach locations, and providing site documentation photos.

Recently, the Michigan Tech team incorporated UAV technologies into the Michigan Department of Transportation's (MDOT) day-to-day operations. Five bridges, three road corridors, and one construction site were analyzed, producing seven well-documented standardized geospatial outputs based on UAV imagery. The team showed MDOT how to use optical, thermal, and LiDAR sensors for corridor evaluations, bridge condition assessment, and traffic operations data analysis. A detailed cost-benefit analysis demonstrated that UAVs can provide better estimates of distress, leading to lower maintenance costs.

MO RASTGAAR

Up to now, agencies responsible for roads have been reactive, checking out problems after someone calls to complain, Brooks explains. "This technology turns reactive responses to proactive responses."

Brooks also led the Michigan Tech components of two new UAV transportation research efforts. Working with the University of Texas at Arlington on a Texas Department of Transportation project, Brooks' team analyzed rail crossing roughness, identified erosion areas along railways, and documented bridge fascia conditions using UAV-collected imagery. Working with the City University of New York under the Federal Highway Administration (FHWA), the team completed 3-D modeling of two bridges in eastern Maryland, demonstrating how UAV-enabled sensing combined with sonar sensing can help evaluate post-hazard scenarios where bridge components may have been affected by bridge scour or other issues.

While Michigan Tech works to develop good uses for drones, University researchers also designed a way to get rid of bad ones: Mo Rastgaar's drone catcher, which captured the imagination of the media and the public.

It's a simple system: a launcher that shoots a big net attached to a large drone by a string. The system can be autonomous, controlled by a ground-based human pilot, or a combination of the two.

After an intruding drone is spotted, the drone catcher gives chase, firing the net from a distance of up to 40 feet. Because the net is so big and can be deployed so quickly, it can capture even the fastest, most maneuverable small drone.

"If the threat is a drone, you really don't want to shoot it down—it might contain explosives and blow up," Rastgaar, associate professor of mechanical engineering, explains. "What you want to do is catch it and get it out of there."

Rastgaar and his colleagues are working to get their drone catcher patented and commercialized.

Michigan Tech's Great Lakes Research Center is the University's water mobility flagship.

WATER

While at times the isolation, snow, and resulting travel can be frustrating for Michigan Tech researchers, the campus location and its arctic-like environment offer many benefits. This is particularly true for mobility research in and on the water.

The Great Lakes Research Center (GLRC) is water mobility's flagship. The GLRC does, literally, have ships—a fleet that includes several research and survey vessels, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), and, hopefully a new addition coming soon, an autonomous surface vehicle (ASV).

"Michigan Tech is ideally situated to help develop the State's vision for mobility in all sectors, notably in the marine sector," says Guy Meadows, the director the GLRC and Robbins Professor of Sustainable Marine Engineering. "Not only is Tech's depth and breadth substantial on the technology side, but we are also ideally located as a testbed for year-round autonomous marine systems. Marine traffic, both commercial and recreational, is far less here in central Lake Superior than most places in the world."

Travis White '11 is the backup captain for the GLRC's R/V *Agassiz* and also the latest research engineer hired at the GLRC; he focuses on the technology and operational environment behind the center's autonomy research and is actively working on the proposal to acquire an autonomous boat.

The sensors and control systems scale up, and boats can be classified at different levels of autonomy; the highest levels are able to analyze real-world scenarios and make decisions with minimal human input. An ASV can gather data on water quality, algae blooms, fish populations, and thermodynamics—zigzagging in research surveys for up to five days and 840 nautical miles, pushing into the shoulder seasons and difficult-to-reach areas. One challenge with ASVs, however, is unpredictable—rough water.

"The Keweenaw Waterway has the only US Coast Guard station for all of the Great Lakes that has these 47-foot surf boats designed to go out in over 15-foot seas," White says. "Anything we learn here about rough water in central Lake Superior can be applied to the Atlantic or Pacific or other oceans."

Below the waves is another challenge. For underwater mobility, the major obstacles are communication, positioning, and limited energy. That's why a marine robotics engineer and an underwater acoustics electrical engineer teamed up using reinforcement learning.

"Water is less forgivable," says Nina Mahmoudian, the Lou and Herbert Wacker Associate Professor in Autonomous Mobile Systems. "We want robots to learn from their mistakes."

To do so, Mahmoudian is partnering with Zhaohui Wang, assistant professor of electrical and computer engineering and a member of the GLRC. Together, they are working on a low-cost and high-modularity mobile network infrastructure including low-cost AUV and ASV systems connected underwater by soundwave-based communications. The goal is to study fundamental challenges to achieve seamless integration of acoustic communication modules within a fleet of operational vehicles.

Coordination, of course, is all about collaboration. On a policy scale, the GLRC is leading the charge on

R/V *Agassiz*

the economics and governance through the Smart Ships Coalition, a Michigan initiative to inform the development for rules of the road for autonomous vessels in the Great Lakes. Ultimately, the US Coast Guard will be responsible for implementing and enforcing future regulations on autonomous vessels for commercial and recreational use.

"We have to solve a lot of challenges in order to set baseline rules of conduct for autonomous boats," White says, adding a recent parallel can be found in adoption and commercial use of drones, which now requires a drone pilot license. "That's where I see the GLRC making a difference, to establish a framework and facilitate those conversations."

TRAVIS WHITE

NINA MAHMOUDIAN

ZHAOHUI WANG

MORE THAN CARS

Mobility on the ground applies to more than cars. Tanks on a battlefield. Trains and shipping. Landing a plane. The many forms of concrete.

The Michigan Tech Transportation Institute brings together research expertise in infrastructure, materials, modeling, remote sensing, and engineering design. Autonomy does not mean going on autopilot. The underlying systems engineered to support the movement of goods, people, and information need innovation as much as the mobile vehicles that transport them. *mtti.mtu.edu*

GROUND

Rush-hour traffic. Semi-trucks change lanes. Off-ramp construction reroutes travel. Cars line the streets, buses pull away from stops. Pedestrians are everywhere. Rain starts to fall, the jolt of crossing a railroad—a sudden stop as a car runs a red light.

In the organized chaos of modern ground transportation, what mobility technology will pass the test of real-life scenarios?

Let's start with a single car—and let's go all out to see what the not-so-distant future holds. The blue 2017 Chevrolet Volt looks familiar, but it's different inside and out.

"The Volt has one of the most complex drive systems of any vehicle today—with an internal combustion engine and two electrical motors," says Jeff Naber, director of the Advanced Power Systems Labs (APS LABS), adding that his team will equip the car with sensors, software, and a few other improvements. "These seamless technologies will operate without the driver being aware of what's happening under the hood."

The car is one of eight in the fleet at APS LABS and is part of a project funded by the US Department of Energy's ARPA-E NEXTCAR program that seeks to reduce fuel consumption and increase electrical range through connected and automated technologies. The APS LABS team has worked with other university engineers and scientists, demonstrating that optimized vehicle powertrain control, enabled with vehicle connectivity, can reduce fuel energy by more than 20 percent and increase the electric vehicle range by more than 6 percent.

Fuel itself—and injecting it into an engine—is another aspect of mobility research. Xiucheng (Sheldon) Zhu '16, a mechanical engineering graduate student, works in the Alternative Energy Research Building, a nondescript brick facility in Hancock. Inside, the equipment is anything but nondescript. Under his advisor, Seong-Young Lee, Zhu takes simulations and watches them come to life in a 1.1 liter optically accessible, constant-volume combustion chamber. This rare device is used to study ignition, fuel injection, along with spray and emissions. Researchers can see the entire combustion process through a four-inch sapphire window.

"Few people have a chance to work with this type of equipment," Zhu says. "There are only two of these combustion vessels in the US, one here and one at Sandia National Laboratory."

Once fired up and moving, researchers need to understand how a car navigates traffic. Intervehicle communication software is the key (see Mobility: Sensors on page 25). This can be vehicle-to-vehicle communication ("Hey! I'm driving here"), vehicle-to-infrastructure communication ("Roadwork on the bridge"), and vehicle-to-anything communication ("Accident ahead" or "I'm a bicycle" or "Cellphone alert: detour"). The three are respectively called V2V, V2I and V2X technology; they all rely on cloud computing to work.

But could a car designed to navigate Detroit during rush hour handle a Keweenaw blizzard? The Keweenaw Research Center is ready to find out. They have more than 100 lane miles in four snow-packed handling loops, circle tracks, vehicle dynamics surfaces (locally known as "ice"), slopes ranging from 15 percent to 40 percent, and a big cold room that dips down to 40 below.

This kind of engineering is what Jeremy Bos, assistant professor of electrical and computer engineering, calls "autonomy at the ends of the Earth." Rather than bemoaning Keweenaw winters, Bos wants Michigan Tech to embrace them—and push mobility research outside the yellow lines in a full blizzard of off-road and real-world possibilities.

"I see a renaissance in the state driven by new mobility technologies, which leverages the considerable engineering talent that already exists here," says Dan Fuhrmann, chair of the Department of Electrical and Computer Engineering. "Engineers who can cross disciplinary boundaries among mechanical engineering, electrical engineering, and computer science are needed to keep this movement vital."

AURENICE OLIVEIRA

SENSORS

Spanning air, water, and land—sensors make the mobility world go around. They are the eyes, ears, nerves, and guts of mobility technology, but they're only as effective as the communication between systems.

Several researchers from the Department of Electrical and Computer Engineering are working on the science, technology, engineering, and math behind sensors.

CONNECTED CONTROLS

Sensors within a vehicle can be enhanced. A member of the NEXTCAR research team, Bo Chen focuses on developing a model predictive control system to optimize a hybrid vehicle's powertrain. The goal is to maximize energy and fuel when switching between the car's electric motors and internal combustion engine. Based on input from vehicle velocity, power trajectory, traffic simulation, road grade, and many other factors, the most efficient powertrain control can be maintained.

COMM NETWORKS

Sensors feed systems that require connection to function. That communication has to happen inside and outside a vehicle. Aurenice Oliveira works at the interface of the two domains and she says the emerging technology has the power to reduce vehicle crashes by 80 percent. To improve safety, traffic efficiency, and fuel consumption all around, Oliveira works within the Vehicular Ad Hoc Network (VANET) to meet the biggest communication challenges—poor connectivity and the fact that cars are moving targets.

PLATFORM FUSION

The sum is more than its parts. Tim Havens wants to help produce a total combined measurement that is more than adding up data from individual sensors. A fusion platform that integrates multiple different types of sensors, which all complement and round out how they sense the world together, will make real-time analysis more feasible. That's crucial for detecting explosive devices on battlefields, unexpected road obstacles, and weaknesses in bridges.

WHY DO PEOPLE MATTER?

Knowing the user—and the greatest source of error—is important to advancing mobility technology and systems.

"Whether in a car, on a phone, or playing with a robot, people will find technology more fulfilling if they're engaged. That's why in the Mind, Music, Machine Lab we look at the intersection with human creativity to create more empathetic tools."

Myounghoon (Philart) Jeon studies the interface of sound, machines, and psychology. See what he says about driving while sad: *mtu.news/2gmZ0E4*

"Why do we pay attention to the things that we do? Why do we sometimes fail to notice important content or have difficulty finding information that we need? And, ultimately, how can we design better interfaces to help people perform their work more safely and efficiently?"

Kelly Steelman focuses on understanding human attention in information-rich environments, ranging from airplane cockpits to radar displays to websites. The work is highly interdisciplinary: *mtu.news/2phMrgA*

"Social implications and human implications are the starting point of every technology. Context matters."

Roman Sidortsov works on energy policy issues, notably in the Arctic. He helped guide the undergraduate students studying the social and ethical aspects of the AutoDrive Challenge and autonomous electric vehicles. Read about their results: *mtu.edu/unscripted/aev*

Taking strike and dip measurements of rock outcroppings along the Keweenaw Fault helps Michigan Tech researchers understand how the fault is oriented.

FORGED IN STONE AND FIRE

Mapping the Keweenaw Fault reveals the peninsula's unique geologic history.

The Keweenaw Fault runs like the spine of an ancient creature of rock and fire through the center of the rugged Keweenaw Peninsula. On the northwestern side of the fault are the Portage Lake Volcanics—stone forged in a primordial environment of heat and pressure below Earth's surface—while Jacobsville Sandstone predominates on the southeastern side, its characteristic red and white streaks derived from iron-rich sediments deposited nearly a billion years ago.

A fault is a break in the Earth's crust, and on either side, the rocks have moved past each other. The Keweenaw thrust fault was active more than 900 million years ago and last slipped after the Jacobsville Sandstone had been deposited. Despite the presence of the fault, the Keweenaw does not experience earthquakes. The fault's pulverizing movement is but a memory, forged into the contact of volcanic rock and sandstone. Without the fault, viridescent forests, plunging waterfalls, and placid inland lakes of the Keweenaw wouldn't exist.

Arguably, neither would Michigan Tech.

The fault is partly responsible for bringing to the surface the rich copper deposits that fueled the economic engine of the region for decades. Michigan Technological University was founded in 1885 as the Michigan Mining School to train mining engineers.

Several years before the University's founding, the Keweenaw Fault was mapped on horseback and by canoe, to aid the mining industry in locating profitable deposits. The fault was mapped again in the 1920s, and by the US Geological Survey (USGS) in the 1950s. It is being mapped again, this time by using modern GPS technology and venturing offshore to map underwater.

But the mining boom that began in the 1840s and interest in the fault are but newer manifestations of longtime interest in the area's natural resources; Native Americans used copper in many ways: crafting tools, projectiles,

(Top, from left) Colin Tyrrell and Daniel Lizzadro-McPherson discuss how a Trimble aids their work mapping the fault.

(Bottom) Jim DeGraff explains how the Keweenaw Fault goes underwater off the coast of Bete Grise.

MAPPING THE KEWEENAW FAULT

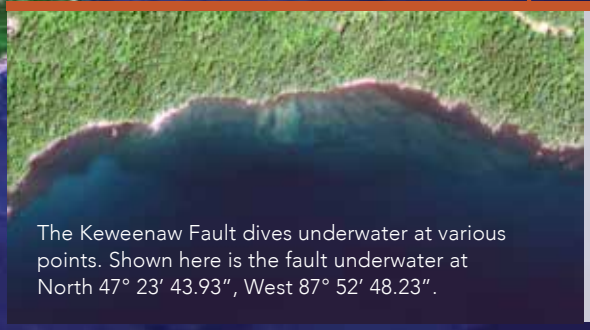
The **Cliff Mine,** near Phoenix, Michigan, was the first copper mine in the Keweenaw to turn a profit, paying dividends to shareholders in 1849. Oddly enough, no mines have been productive near the Keweenaw Fault, but exploratory diggings have been made right up to and sometimes crossing the fault line.

The Ontonagon Boulder: A boulder of native copper weighing 3,708 pounds is in the National Museum of Natural History, Smithsonian Institution. It was deposited on the west branch of the Ontonagon River by glaciers, first discovered by Ojibwe, later by Voyageurs, and moved in 1843 by hardware store merchant Julius Eldred, who relocated the boulder to Detroit.

Landsat satellite image of Keweenaw Peninsula provided by DigitalGlobe, a Maxar company.

Douglass Houghton, Michigan's first state geologist and two-term mayor of Detroit, surveyed large, productive veins of copper in the Keweenaw Peninsula with federal funding beginning in 1840. While surveying off the coast near Eagle River in 1845, Houghton and two colleagues drowned during a sudden storm.

Bare Bluff, a well-loved hiking and Lake Superior viewing destination, is an intrusive rhyolite plug that rises from the forest at Bete Grise. Nearby is 98-foot high **Montreal Falls.**



The Keweenaw Fault dives underwater at various points. Shown here is the fault underwater at North 47° 23' 43.93", West 87° 52' 48.23".

The orange line is the current interpretation of the Keweenaw Fault location. Based on DeGraff and Tyrrell's observations and analysis, the fault appears to be a system of splay faults (shown here by dotted lines) rather than a single thrust fault. This may indicate the termination of the fault at the eastern end of the Peninsula.

Current interpretation of the Keweenaw Fault location.

DeGraff and Tyrrell's observations and analysis.

Mishibijiw (pronounced "mishipeshu")—The Ojibwe tell of the "Great Lynx" that guards the copper deposits in Lake Superior; also said to be the source of rip currents.

Manitou Island, three miles off the eastern tip of the Keweenaw Peninsula is uninhabited by humans or browsing moose and deer, but home to boreal forest, spruce bogs, and rare plants. The Manitou Island light station construction was authorized by Abraham Lincoln in 1861. The modern lamp in the tower is maintained by the US Coast Guard.

beads, and fishhooks, and trading the copper itself, which has been found thousands of miles away.

The Geometry of Stone

Jim DeGraff '75 '76, research geologist, and Colin Tyrrell, a master's student in geology, are in the process of mapping a portion of the approximately 200-mile-long fault. The two geologists, often accompanied by undergraduate Graham Hubbell and incoming graduate student Daniel Lizzadro-McPherson, have trekked across heavily wooded terrain in addition to mapping the fault where it plunges into the cold waters of Lake Superior.

"We've identified five areas of high priority where we can observe contacts between Jacobsville Sandstone and the Portage Lake volcanic deposits," DeGraff says.

On land, mapping involves walking the fault line, taking strike and dip measurements, and standing very still, so a backpack-sized device called a Trimble can communicate with satellites to put a point into a database with a description of the rock at a specific point. Using handheld magnifying lenses, DeGraff and Tyrrell make careful notes in water-resistant notebooks—for example, "light reddish-orange, poorly sorted sandstone, containing large basalt clasts"—while noting the tilt (dip) and direction (strike) of the rock layers.

"Rock layers, when deposited, are nearly horizontal," DeGraff explained one day in October last year, under the swaying boughs of pine trees clinging to the Bete Grise shoreline. Rock outcroppings the size of automobiles punctuated the autumn landscape. DeGraff's group planned to map offshore, but large white-capped waves prevented the activity. The sound of crashing waves couldn't smother the tap-tap-tapping sound of rock hammers and jokes about DeGraff's propensity to lose his.

"Tectonic forces twist and distort the geometry of the rocks. There's close to a 90-degree rotation in the younger rocks along the lake, which get older as one moves toward the Keweenaw fault. The collision of tectonic plates was the force that pushed the rocks to tilt," DeGraff says.

Here Be Dragons: Mapping the Unknown

Tyrrell, a diving enthusiast and US Navy veteran, puts his expertise to use to chart underwater portions of the fault—which previous charting attempts guessed at—on the map.

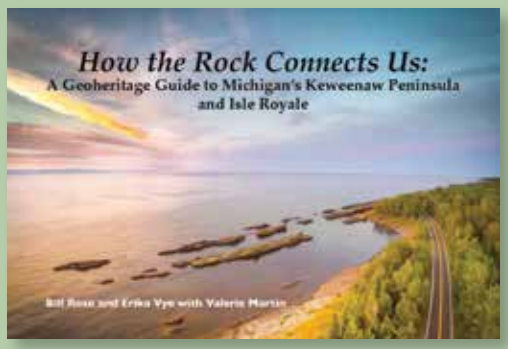
"We're going offshore because, as you can see from this map, previous geologists made a dashed line—there's some unknowns as far as the fault's actual location," Tyrrell says. "This will increase the confidence of the map. We're swimming down, identifying both types of rock on either side."

The team utilizes a differential GPS unit that uses satellite signals and a reference signal from the US Coast Guard to map points with a final accuracy of one meter horizontally and vertically. This year, the team plans to use the Great Lakes Research Center's autonomous underwater vehicle to trace the fault farther underwater.

Mapping the fault line again, which is partly funded by the USGS Educational Mapping Program, is about more than creating the map itself.

"It may have impact on movement of groundwater, where mineralization occurs. It could impact mining exploration in the future," DeGraff says. "It's interesting how the current landscape is tied to significant tectonic events from the past."

Rock Tour: New Guide Digs into Keweenaw Landscape



It's pretty enough to display on your coffee table. But it isn't meant to stay there. *How the Rock Connects Us*, by Bill Rose and Erika Vye with Valerie Martin, takes users deep into a landscape formed by an ancient magma ocean and massive glaciers, and found only on Michigan's Keweenaw Peninsula and Isle Royale.

Rose, a Michigan Tech professor emeritus and volcanologist, and Vye, who earned her PhD in geology at the University in 2016, share a passion for geoheritage and Earth science communication. They collaborated with long-time National Park Service interpreter Valerie Martin, who's been telling Isle Royale's story for 18 years. If you can take a guided tour with any of these educators, you should. In the meantime, self-guidance is made easy thanks to QR codes and a comprehensive web-link list directing DIY geoexplorers to maps, and other trip-planning resources for day trips or longer explorations of the geosites associated with five major geo-element categories: Lavas and the Rift; Red Sediments; The Keweenaw Fault; Glaciers; and The Big Lake.

Questions, geological to philosophical, add another layer of interactivity to the guidebook. Why does US-41 run at an angle through Calumet? What do Keweenaw's Brockway Mountain and California's Death Valley have in common? How does the Keweenaw inspire you?

Lavish with color photos and graphic explainers, the 60-page, 6-by-9-inch coil-bound guide published by Isle Royale & Keweenaw Parks Association (IRKPA) is available through the association for $9.95.

For more information on upcoming guided geoheritage tours by land and water email keweenawgeology@gmail.com.

LASTING FRIENDSHIPS

50 YEARS OF CARNIVAL

In 1969, Jim Accetta '73, Carl Benz '73, Dan Bonner '73, and Ed Anderson '72 met in Douglass Houghton Hall (DHH). The men developed an instant bond participating in campus activities, Winter Carnival in particular. In fact, the friends have come back for the event every year.

When Carnival next comes around, it will be Jim and Sally Accetta's 45th consecutive. "Actually, if you count the Carnivals we attended as students, it will be our 50th," Jim Accetta said.

It wasn't statues or parties that brought the friends back initially. At first, the group returned to campus to watch their friend George Lyle play hockey. Accetta says at some point the motivation for their trips changed. "Our friendship was always there, but I don't think we realized what was bringing us back. It isn't about Winter Carnival, but our friendship."


CALEB LAMZ

A TEAM ABOVE ALL

Initially it was basketball that brought Emily (McClone) Brown '03, Annie (Madden) Pudelko '03, Andrea (Novak) Bonk '03, and Jennifer (Swanson) Essex '04 to Michigan Tech. All varsity basketball players, the women have not only remained friends, but Brown, Pudelko, and Essex actually live in the same neighborhood in Wauwatosa, Wisconsin, while Bonk lives in nearby Milwaukee.

"Michigan Tech forged an amazing bond between us. We didn't really make a conscious decision to live within houses of each other, but we're glad it worked out that way," Brown says.

Brown acknowledges the group will sometimes go a month or so without seeing each other (each has three young children), so time spent together is special. "We get together for holidays, and our kids love each other," Brown says.

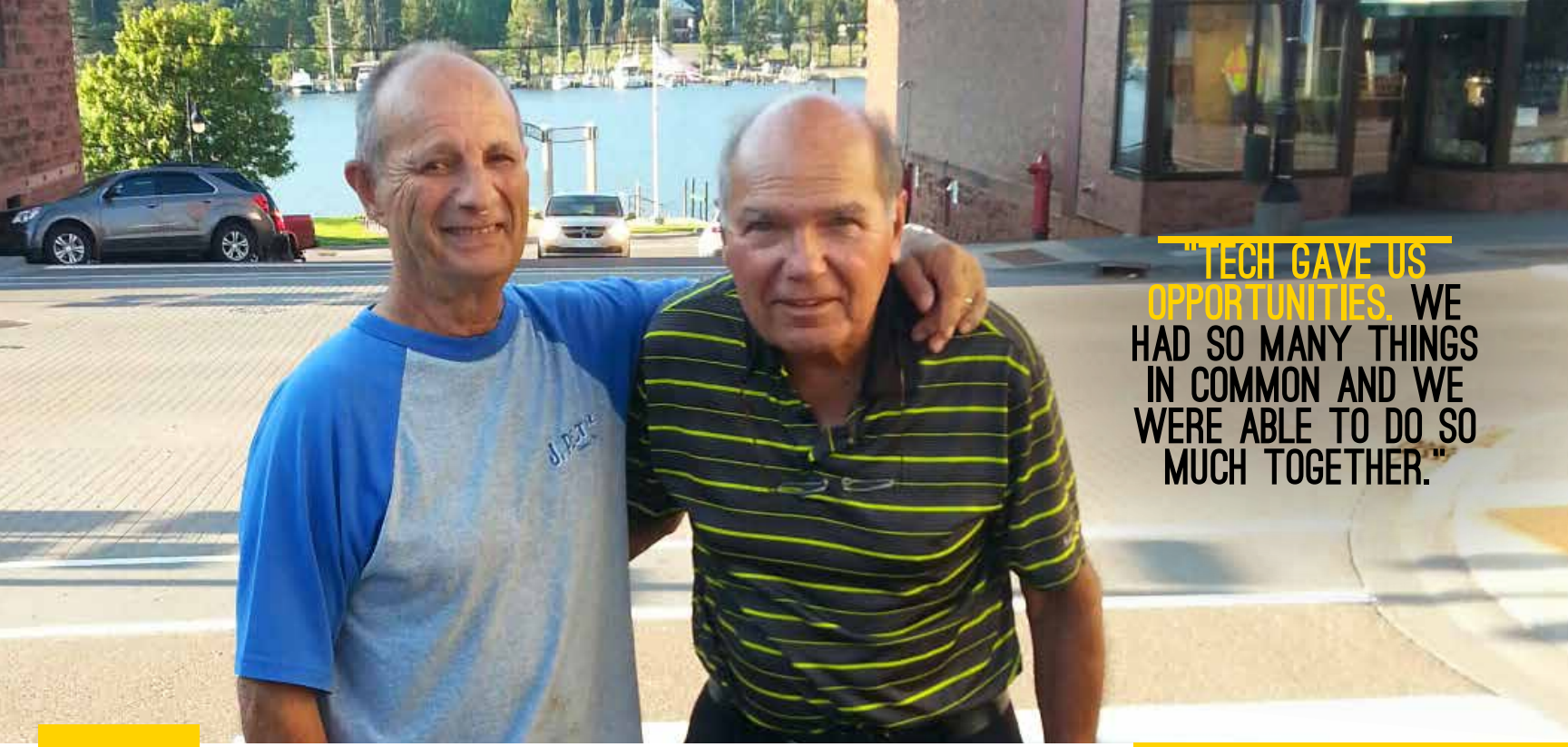
Tech basketball also plays an important role in the lives of five employees in the Birmingham, Michigan, office of Shift Digital, a cutting-edge digital marketing and technology company.

Mike Kissman '98, Chad Bultynck '98, JT Luginski '03, Brian Dukes '99, and Caleb Lamz '03 played basketball at Tech. They weren't all on the same teams, but they are now. "We play on the Shift Digital team in a pretty competitive eight-team league," Luginski says.

Even Huskies who didn't play together knew each other—a connection that paid off. Dukes, Kissman, and Luginski were working at Ford Direct and joined the startup Shift Digital, with Bultynck, and Lamz coming onboard shortly after.

"We had no idea we'd be working together," Luginski says, adding there's a reason for their closeness. "Living in Houghton four or five years isn't for everybody. Unless you lived there, you don't understand what it's like. We get it."


ANNIE (MADDEN) PUDELKO



"TECH GAVE US OPPORTUNITIES. WE HAD SO MANY THINGS IN COMMON AND WE WERE ABLE TO DO SO MUCH TOGETHER."

THE FAMILY YOU CHOOSE

Friends who became family could describe Paul Leach '54 (above, left) and Dr. Hal Williams '54, forestry majors who ended up sharing a family tree for more than 60 years.

Roommates in Douglass Houghton Hall in 1950, they instantly became best friends—a designation they still bestow on each other. "We did everything together," Williams says. "Played intramural hockey, won the handball championship, and joined Kappa Delta Psi fraternity."

After graduation, Leach traveled the country working for the Bureau of Land Management while Williams went to medical school, eventually establishing a practice in Ithaca, Michigan. Despite the differences in vocations and geography, their paths continued to cross.

"I was working in Alaska while he was in med school," Leach remembers. "For a few summers he would come up and work with me in the woods."

Williams remembers those days as well. "We'd work really hard during the day and then spend our nights fishing."

In the late 1950s, the best friends became family when they married the Laine sisters from Hancock. "I met Cathy at an open skate at Dee Stadium," Leach says. "I introduced Hal to her younger sister Betty."

The one-time fraternity brothers became brothers-in-law. "I always considered him more as my best friend than my brother-in-law," says Williams.

The feeling is mutual. "He's as good as they get," Leach says. "When he played football at Tech, I was the manager. He was my hero."

Sadly, Betty passed away three years ago, but the men still remain close. Leach credits Michigan Tech for their friendship's longevity. "Tech gave us so many opportunities. We had so many things in common and we were able to do so much together."

The men still see each other often, during the winter in Florida where Leach lives and Williams spends a couple of months and during the summer where their friendship began.

"We get together in Hancock," Leach says. "We'll go fishing, or just sit on the porch and talk. We're still best friends."

TRAVELING HUSKIES

It's not uncommon for college friends to get together in the years following graduation, but in time, things usually taper off. Two groups of Michigan Tech alumni are making sure that doesn't happen. The 909 Group and some sisters of Alpha Sigma Tau have come up with unique ways to reconnect.

The 909 Group, named for an address on College Avenue, is a group of 12 friends who met at Tech and now vacation together.

All, or at least some, of the married couples and single friends that make up the 909 Group, have participated in trips to the Carolinas, Colorado, Texas, and as far away as Germany and the Czech Republic. That list doesn't include the frequent camping trips members have taken throughout the Midwest.

Natalie (Noha) Bomstad '10 says that following graduation it was important for the friends of the 909 Group to stay in touch. "Your college years have tremendous influence on who you become as an adult. The company you keep is the foundation for who we become as adults," she says.

Bomstad says the nature of life at Michigan Tech fosters such strong connections. "You have the opportunity to get to know people at a deeper level. It's difficult to replicate the strong bonds you build walking through blizzards to class, long hours of homework, numerous team competitions, and late nights that turn into early mornings."

Because of this closeness, Bomstad says the 909 Group members are more than traveling companions. "We have stood side-by-side one another during tough times and popped champagne during times of joy. The 909 has truly been friends that turned into family."

Much like the 909 Group, the annual treks by sisters of Alpha Sigma Tau began as a way to continue getting together. That simple beginning has morphed into a lofty goal of visiting all 50 states in 50 years.

Rebekkah (Bury) Carney '11 says the sisters would see each other at their weddings, "But when the last one of us got married, we realized we had to come up with a plan." A trip to the state of Washington was the catalyst. "It was at that point we decided to dedicate four days each year to our friendship," Carney says.

That decision morphed into a goal to visit a different state each year until the group has traveled to them all. Next came the process of deciding which state to visit next. At first the vacations were chosen at random, but eventually a system was adopted.

"We picked an order and each year one person is responsible for planning it," Carney says. "The most recent trip was to New Orleans last summer with a trip to the nation's capital on tap for July."

Attending Michigan Tech impacts our graduates for the rest of their lives. And whether it's through communal vacations, frequent family barbeques, or fishing with your best friend of more than 60 years, the bonds formed in Houghton last a lifetime.

Led by interdisciplinary faculty that champion convergent research, like School of Technology Dean Adrienne Minerick '98, Michigan Tech is laser-focused on local-to-global health challenges.

HUSKIES HEAL

Michigan Tech's human-centered research improves lives. Here's how.

Self-sterilizing wound dressings. Bone-regeneration systems. Heart muscle cells grown faster and stronger, with less chance of rejection. From enhanced cancer detection to the power sources that supply surgical room equipment, Michigan Tech is a health-care innovator that prepares people and creates technologies to improve lives and strengthen communities. Researchers, inventors, analysts, and investigators pioneer H-STEM, the health- and human-centered aspects of science, technology, engineering, and math. The research is translational, interdisciplinary, and increasingly convergent.

THE TECH SIDE OF MEDICINE

From measuring vitamins in tears to purifying viruses for safer vaccine production, the Tech side of medicine is bench-to-bedside research, with the deliberate aim to improve health outcomes. It encompasses biomedical, chemical, mechanical, electrical, and computer engineering. It incorporates materials science and engineering, biology, chemistry, cognitive and learning sciences, computer science, and kinesiology and integrative physiology.

Convergence expands discovery—think of it as cross-, multi-, inter-disciplinary collaboration to the Nth power. As the National Research Council Project *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*, notes, convergence creates an environment for experts in one field to become fluent in others, freeing researchers to think in new ways, and create new frameworks, solutions, and disciplines.

THE HUMAN EFFECT

Going to the doctor, consulting a surgeon, working with a physical therapist—familiar routines for many, especially as we age. H-STEM work at Michigan Tech encompasses the health needs of people throughout their lives, from wellness checks to diagnoses, to recovery after complex medical procedures.

Researchers on the prevention forefront study the effectiveness of skin creams, standing desks, blueberries in diet, and strength training for all ages and abilities. Other studies quantify the effects of meditation, how alcohol affects sleep, and the cardiovascular ramifications of sleep patterns in postmenopausal women.

Outgoing Michigan Tech President Glenn Mroz '74 '77, who sees Michigan Tech's work in the health field as vital to the University's mission, explains how technology drives care:

"We're thankful for what skilled doctors can do for us with the tools that they have—the procedures, prescriptions, and equipment that they use to keep us healthy," he says. "But where do these tools come from? And who makes them? They're made using other tools—science, technology, engineering, mathematics, and management—by people inspired to make a difference and apply what they know to one of the most challenging issues of our time."

Examples of inspired innovation abound, including research that results in more accurate tests and treatments. Cases in point: a fluorescent probe that detects cancer type as well as malignancy, and the fluorescent dye that marks the line between cancer cells and healthy tissue—a beacon for surgeons who seek to take all of what needs to be removed but no more.

Life sciences is the greatest economic growth sector in Michigan. In 2017, 42 percent of venture capital invested in the state was in health care and life sciences business development: 37 percent in devices, 19 percent in biotechnology and biochemistry, and 12 percent in diagnostics.

Researchers build scaffolds to help nerves reconnect, create smart implants, develop new adhesives for surgery, new materials for stents, and smart artificial limbs and joints. They create an environment where your own heart cells, used to repair heart muscle damage, can grow to fully functional maturity.

Medical informatics and statistical research are also powerful tools for healthy communities.

"Imagine using a supercomputer and vast data sets to help identify those of us at risk for hypertension, type II diabetes, and ALS so that preventative measures can be taken before the illness begins to take hold," says Mroz. "A math professor and her students are doing that work at Michigan Tech."

H-STEM work involves Huskies at every stage of educational and career development. Huskies teach pre-college Summer Youth Program participants the basics of designing and assembling simple heart monitors, and pursue dynamic collaborations across campus and beyond Innovation Shore with other institutions of higher learning and industry.

HEALTHY EDUCATION, ECONOMIC, AND INDUSTRY OUTCOMES

Michigan Tech's reputation for applied innovation draws companies including Plexus, Delphinus Medical Technologies, Phillips-Medisize, MPI Research, RTI Surgical, Teleflex Medical, Boston Scientific, and Medtronic to campus. Leaders in health care technology hire Michigan Tech students—and sponsor research.

A walk down the aisles of Michigan Tech's annual Design Expo, showcasing undergraduate Enterprise teams and Senior Design projects, reveals how the human-health-related side of STEM is infused into the campus life cycle. Student teams are designing, building, and testing safer ways to transport vaccines. Creating low-cost ventilators. Conducting gait analysis to help reduce the amount of time it takes for knee and hip surgery patients to recover. Conceptualizing dynamic heart models.

The latter is one of two Senior Design projects Boston Scientific is sponsoring. The company partners with numerous universities including Michigan Tech. Kate Taylor, Boston Scientific Global Innovation Program Manager, is the university portal; she was keynote speaker at the 2018 Michigan Tech Medical Devices Day during Medical Careers Week. Jon Stinson, Boston Scientific's research and development analytical director for Global Technologies and Services Organization, and a 1982 Michigan Tech metallurgical engineering grad, was on campus for the Biomedical Engineering (BME) Professional Advisory Board Meeting and Design Expo 2018.

"Michigan Tech is known for preparing practical, applied-engineering-minded undergrads. And it's a great sandbox for exploring ideas."
– Jon Stinson, Boston Scientific

"One of our company's core values is meaningful innovation," says Stinson. "We reach beyond internally ingrained experiences for unbiased perspectives and constraints, to get a more open-minded approach to solving new problems and needs for advanced

therapies and devices. We come with what-ifs and how-abouts—we don't know if they have solutions or value yet—and we can hand that to faculty and students with high levels of technical competency and see where it leads."

"We find Tech students to be practical, hands-on, and willing to dig in."
–Carl Wahlstrand, Medtronic

Global medical device manufacturer Medtronic partnered with a Senior Design team working on a multi-coil passive recharging prototype to make the charging process easier for people who use a spinal cord stimulation implant to alleviate suffering from chronic intractable back pain.

"This is our fourth project with the Michigan Tech biomedical department. We came back because of the fantastic teamwork of the students and the department," says Carl Wahlstrand, engineering program director for patient care devices in Medtronic's Restorative Therapies Group. Wahlstrand and Mark Gryzwa, senior program director in the Restorative Therapies Group, are both Michigan Tech electrical engineering graduates (2001 and 1989, respectively). They're among several alumni working with the company in its mission to apply biomedical engineering to research, design, manufacture, and sell instruments and appliances to alleviate pain, restore health, and extend life.

A coil array, rather than a single coil, could allow users to recharge their implants, one to three centimeters beneath the skin, without repeated adjustments and make it easier to incorporate the process seamlessly into their daily routines. It's just one example of how technology is driving the ability to take better care of ourselves and others, and an important one, Wahlstrand notes. More than 25 million Americans suffer from daily chronic pain, according to the National Institutes of Health. It's a major player in health-care spending, and the price paid for opioid addiction continues to mount in lives and dollars. Drug overdose is now the leading cause of death for Americans under age 50, according to the US Center for Disease Control.

A HEALTHY FUTURE FOR HEALTH RESEARCH

Michigan Tech has more than tripled human health research funding from the National Institutes of Health over the past four years. In 2008, about 22 faculty members were involved in health research and education; today, more than 70 work in this arena.

The American Heart and Lung Associations, National Science Foundation, Gerber Foundation, and Portage Health Foundation, among others, also support human-centered research at Michigan Tech.

"Faculty, staff, and students have been increasingly successful in attracting external funding for their health-related research," says Mroz. "The increase has resulted in enrollment growth for degree programs that apply engineering, science, technology, and mathematics to questions related to health and human-centered engineering."

Q+A

A DAY IN THE (WILD) LIFE

Michigan Tech Alumna Dr. Erika Crook Cares for Creatures Great and Small

"There's a lot of things I've never done," says zoo and wildlife veterinarian Erika Crook. But her job includes things most people will never do, like figuring out why a pregnant zebra gets hives, tending to a scarlet ibis with a broken beak, and performing wellness checks on lion cubs.

The 1993 Michigan Tech biology graduate can't predict what's going to shake up the routine on any given day—could be a sneezing elephant, or a snake suffering from bloat. Maybe a monkey with a dislocated wrist, or an ailing sea star in need of an MRI.

From 8,000-pound pachyderms to five-gram toads, Crook attends to the health-care needs of a multitude of species in each cycle of life at Utah's Hogle Zoo in Salt Lake City. In 2016, she eased the passage of the then-oldest giraffe in North America, 31-year-old Daphne. "She let us know when it was time," she says. Crook helped Nora the polar bear recover from both emotional and physical maladies; she vaccinates baby tigers, and helps new residents, like the pair of red pandas that came to the zoo earlier this year, settle in. Crook works with a staff of four in the veterinary department and about 150 employees zoo-wide.

She also pursues field opportunities beyond her home zoo. She surveyed the health of the bird populations of the Galapagos Islands, specifically its penguins and flightless cormorants, and she joined tree kangaroo conservation efforts in Papua New Guinea. Crook also surgically placed radio transmitters in venomous snakes in Armenia (she slept in the Russian mountains with 11 bagged, yet-to-be-released vipers stowed under her bed).

> **"I'M THE MOST GENERALIZED SPECIALIST YOU'LL EVER MEET." – ERIKA CROOK**

Crook earned her Doctor of Veterinary Medicine degree from Michigan State University. A diplomate of both the American College of Zoological Medicine (2008) and the European College of Zoological Medicine (2017), she's qualified to treat every animal on the planet.

For Crook and the zoos and organizations she works for and with, conserving species and habitat around the globe is the overarching mission. "The goal of a modern zoo is to educate the public to care about wild animals and wild places in order to try to save many of the species which are on the brink," she says.

Crook built a solid education foundation at Michigan Tech that resulted in acceptance into medical school. Born in Mexico and hailing from Troy, Michigan, she qualified for a four-year full-ride minority scholarship to Tech. She's grateful for the opportunity, as well as the support she received from inspiring campus educators and leaders, including mentor Gloria Melton.

"I was a member of the minority council Dr. Melton led. She was always so friendly, encouraging, down to earth, and inclusive. She made an effort to get to know students and make us feel important as individuals," says Crook. Then-coordinator of minority student services, Melton served as dean of students from 2004 to 2011.

Q: Did you always know you wanted to be a veterinarian? How did you choose Michigan Tech?

A: I always knew, and it was apparent to my family, too—as a little girl growing up in Mexico City I would get very upset about the stray dogs on the streets. I had Airedale terriers, and worked at a kennel in high school. I learned about Michigan Tech when we visited the campus with my brother, who's a year older than me, looking at engineering schools. I fell in love with the size of the campus, the atmosphere, and the location. I was in Blue Key, Delta Zeta, did campus tours, and worked the front desk at East Coed (now known as McNair) Hall. I spent a couple summers in Houghton and enjoyed the Keweenaw Peninsula. The week before I went to veterinary school, I went backpacking on Isle Royale with a student who worked with Dr. Rolf Peterson on the island. We saw lots of moose and even a wolf!

Q: You work in a zoo but also go way out into the field. What are some of the most memorable experiences?

A: I love my day job at the Hogle Zoo as a zoo clinician, and the icing on the cake is having fieldwork experiences. My entry into this field was an internship at the Shedd Aquarium and Lincoln Park Zoo in Chicago. Some of my first patients were gorillas, warthogs, sharks, stingrays, and beluga whales. During a three-year residency at the Saint Louis Zoo's WildCare Institute, I had unique opportunities for *in situ* conservation.

I've been to the Galapagos three times, to participate with Dr. Patricia Parker's

avian disease surveys to understand what the endemic bird populations have been exposed to. This required me to live aboard a small research vessel while not getting seasick in order to evaluate the Galapagos penguins and flightless cormorants, seen in the Russell Crowe movie *Master and Commander*, around Isabela and Fernandina islands.

In Madagascar, I joined a team working in the northern part of the country doing health assessments on six different lemur species, ranging from the tiny mouse lemur to the critically endangered Perrier's sifaka. We lived in a village; the people shared their dry river bed with us to dig holes to try to collect drinking water.

In Papua New Guinea, I hiked into remote old-growth rain forests (read: leeches and heavy rain) to work with wild Matschie's tree kangaroos, placing radio collars and performing health evaluations. The work, through the Tree Kangaroo Conservation Program, has helped create the first conservation area of tribal land in the country, and helps local villages improve education, health, and sustainability. A highlight was seeing healthy pouch joeys while doing a physical exam on the tree kangaroos.

"AT THIS TIME, PEOPLE ARE THE MOST DANGEROUS ANIMALS ON THE PLANET. SOME OF THE DAMAGE WE ARE DOING MAY NOT BE REVERSIBLE. IN OUR LIFETIME IT IS POSSIBLE THAT CERTAIN RHINO AND BIG CAT SPECIES COULD GO EXTINCT."

Q: Have you ever been bitten or attacked? What's the scariest animal you work with?

A: Yes, I can lay claim to having been bitten by the only penguin species (Galapagos penguin) that lives north of the equator. At Hogle, we do protective contact training with all dangerous species, which means that we're not in the same space with them. But when we're doing procedures on big animals—a tiger, polar bear, or orangutan—it is "game on with a game face." I'm responsible for both animal and human safety. Every zoo vet has scary stories about an animal starting to wake up under anesthesia. I always have extra drugs in my pocket just in case, and I have learned through experience that you need to know where all your exits are. I'm first to go into the treatment area to determine anesthesia level, and it's my call when we mobilize the animal.

Crook with a 53-gram lemur, one of six species of lemur she worked with in Madagascar.

"I loved my time at Michigan Tech! It was a perfect fit for me in many ways."

Q: What's the hardest animal to care for?

A: That's a hard question. Maybe dying giant green anemones, disintegrating into a mess. There was nothing we could do; they were attached to a rock. We still don't know what was happening in that tank. I'm not an expert on invertebrates.

Each species has its challenges. Sometimes the animals need our medical care and sometimes they heal on their own. We had a female orangutan that had lockjaw for days, but luckily she could take liquids via a straw and Tylenol off a spoon. We had a tiger with a severe erosion on the roof of her mouth that was causing eating problems; eventually the issue resolved on its own. We had a giraffe with a degloving injury to her distal tail, leaving exposed bone. This required a standing sedation tail amputation and bandage. We had a Pacific sanddab (flat fish) that had large bubbles of air in one eye. We performed anesthesia and an eye removal with excellent results. One of the most important things for animals in managed care is to try to provide the best environment and diet possible. Zoos don't always get it right but we try our best.

Q: What medical professionals do you consult with?

A: Many specialists, human and veterinary, are willing to lend time and expertise to help with zoo cases. They enjoy the novelty and unique challenge of work on a non-human case. We have excellent veterinary colleagues close by that are board-certified in surgery, ophthalmology, emergency/critical care, and cardiology, to name a few. Specialists have helped us with a polar bear who needed exploratory surgery, an ocelot with a broken leg, a snow leopard with a deep eye ulcer that was patched with equine amnion, a gorilla that needed extractions and a canine root canal, and diagnostics on a sick 600-pound sea lion. On the human medicine side of things, we worked with a hepatologist when our jaundiced tiger had advanced liver failure (we pulled him through it!), a kidney specialist when a snow leopard with kidney stones needed scoping and lithotripsy, a breast cancer surgeon for a lumpectomy on a male orangutan with breast cancer, and an ear, nose, and throat specialist for a howler monkey with a wicked sinus infection who needed to have the pus pockets flushed out. A few zoos are fortunate to have their own CAT scan machines; we aren't one of them yet and work with specialists in advanced imaging for some of our more challenging cases. Some examples are a bloated sea star filled with eggs, a snake with cloacal cancer, and a female gorilla with advanced reproductive disease.

How Animals Take Their Medicine

Hogle Zoo participated with the San Diego Zoo Kids project to make animal-related videos for local hospitals and Ronald McDonald houses. Crook did three videos, including one that shows how zoo animals take their medicine (meatballs for lions, grapes for giraffes). She helped serve a meal and visited with families at the local Ronald McDonald House for the premiere. "It was a very rewarding endeavor, as it helps kids realize that animals go to the doctor and get exams and take medicine just like they do," Crook says. "We have received lots of positive feedback from families who watched the videos while they were at medical facilities."

You can find *How Do Zoo Veterinarians Give Medicine to Animals?* by title on YouTube.

2018 ALUMNI AWARDS

Giving back. Serving others. Helping create the future.

Six alumni and friends will be recognized by the Michigan Technological University Alumni Board of Directors at its annual Alumni Reunion Dinner and Awards Ceremony on Friday, August 3. Here are their stories:

Outstanding Young Alumni Award

Captain Amanda (Taylor) Nerg '10 aims to "be a guiding force in creating a better future for those who come after us." An officer in the US Air Force, Nerg received a bachelor's degree in business administration from Michigan Tech. In 2014, she earned her MBA at the Naval Postgraduate School.

Nerg says the training she received at Michigan Tech prepared her for her military career. "Michigan Tech instilled a passion for innovation and creative thinking. Every class, every extracurricular activity, provided the foundation for who I am today."

Her first assignment was as contract administrator at Grand Forks Air Force Base in North Dakota, where she managed a $7.6 million architect-engineer services program. Nerg is now chief of the contracting office at Moron Air Base in Spain, where she supports multiple Air Force, Marine, and NATO missions.

Nerg has many fond memories from her days in Houghton—like meeting her husband, Steve Nerg '11, to whom she has been married for more than six years.

Outstanding Service Award

This year's Outstanding Service Award recipient, **Sally P. (Pearson) Heidtke '81**, finds great joy in service: "There is nothing more rewarding to me than the success and heartfelt thanks of someone I had a role in coaching."

Heidtke graduated from Michigan Tech with a BS in Chemical Engineering. After an impressive 25-year engineering career with Procter & Gamble, she worked as a human resources director and vice president for nine years. Presently, she is a body code practitioner, helping individuals resolve imbalances in their lives.

While at Tech, Heidtke was a member of Blue Key Honor Society and the Michigan Tech Student Foundation. She currently serves as a leader for Michigan Tech's Iron Mountain, Michigan, alumni chapter. She also served on the Alumni Board of Directors and is now a lifetime director. She helped plan and execute the University's first Women of Tech celebration event and volunteers for the Women in Engineering Learning Community on campus.

Heidtke returns to campus regularly to educate, influence, and inspire the women of Michigan Tech and has helped raise almost $165,000 in scholarship funds to assist women students.

Distinguished Alumni Award

Susan B. (Brechting) Kiehl '83 says Michigan Tech taught her how to think. "An engineering education is incomplete if a student is not given the opportunity to take facts and figures and utilize that information to solve problems," she says. "Michigan Tech has always understood the necessity of linking learning to doing."

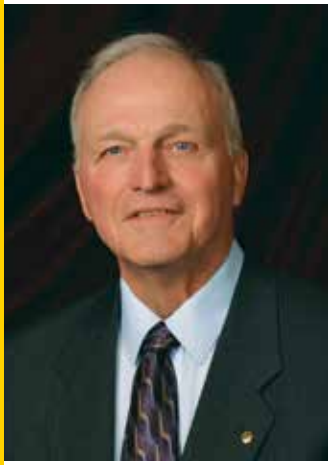
Kiehl began a distinguished career with Lockheed Martin Aeronautics in 1984. She held various leadership roles, including vice president of earned value and performance excellence for the F-35 Joint Strike Fighter and director of F-35 international business development, before retiring as the vice president of product development for the F-16/F-22 integrated fighter group.

Kiehl has a BS in Metallurgical Engineering from Michigan Tech and an MBA in Engineering Management from the University of Dallas. She remains active with Michigan Tech, serving as the first aerospace industry member on the College of Engineering Industrial Advisory Board and as a member of the Presidential Council of Alumnae.

Distinguished Alumni Award

Melvin J. Visser embodies the qualities of a distinguished alumnus, leaving an impact wherever he goes. Inspired by the post-World War II slogan, "Better things for better living through chemistry," he graduated with his bachelor's degree in chemical engineering in 1959.

After graduation, Visser developed the corticosteroid chemistry processes and antibiotic manufacturing at the Upjohn pharmaceutical company. He obtained several technology patents—one for soil vapor extraction, a widely used tool to clean up fuel and solvent spills. In retirement, Visser studied why banned chemicals remain at static levels in Lake Superior and other waters. His work culminated in the book *Cold, Clear and Deadly: Unraveling a Toxic Legacy*.



Visser and his wife have remained closely associated with Michigan Tech and the Copper Country, sponsoring Enterprise projects that improve the lives of elderly residents in the area. One of these projects—launched with Little Brothers, Friends of the Elderly—earned a $25,000 prize from the Ford Foundation and a follow-up prize of $10,000.

Honorary Alumni Award

Igor Kliakhandler, a former Michigan Tech mathematics faculty member, is the 2018 Honorary Alumni Award recipient.

Kliakhandler, born in Moscow, Russia, graduated from the Moscow Oil and Gas Institute in 1983 and started his PhD studies there in 1988. He emigrated with his family to Israel in 1991 and earned his PhD in Applied Mathematics from Tel Aviv University in 1997.

He held positions at Universidad Complutense de Madrid, Lawrence Berkeley National Laboratory, and Northwestern University before joining Michigan Tech in 2001. He was promoted to associate professor in 2005 and left the University in 2007 to work in the energy sector in Houston, Texas.

He now manages a group of companies that trade electric power across the US and is involved in several start-up projects. Kliakhandler remains fond of Michigan Tech and its math department. He generously provides an annual gift to host the Kliakhandler Conference, a University event that stimulates research activity in the mathematical sciences.

Humanitarian Award

Former Michigan Tech Army ROTC member **Don T. Makay '99** graduated from Michigan Tech with a bachelor's in scientific and technical communication, an associate's degree in electrical engineering technology, and a commission from the United States Army.

As a combat officer, Makay served four tours in Iraq and two in Afghanistan. His experiences in Iraq inspired him to do more for the Iraqi people. In 2008, Makay started the nonprofit Iraqi Hope Foundation (IHP) with a mission to help entrepreneurial Iraqis launch businesses through start-up grants. The first recipient started a construction materials business.

"MICHIGAN TECH GAVE ME AN OPPORTUNITY TO PRACTICE THE ART OF LEADERSHIP. IT NOT ONLY SURROUNDED ME WITH GREAT LEADERS, IT INCULCATED A SENSE OF VALUES AND ALLOWED ME TO HONE AND CULTIVATE LEADERSHIP TRAITS AT A YOUNG AGE."
– DON T. MAKAY

In 2014, IHF temporarily closed its doors due to tumultuous times in Iraq. A year prior, Makay left active duty and transitioned to the New York Army National Guard where he serves as Battalion Commander, Lieutenant Colonel of the 1-69 Infantry. Makay says he was born to be a soldier and urges Americans "to give to Iraq in any way they can"—something he plans to again pursue through IHF in the near future.

Join us for Alumni Reunion, August 2-4.
Learn more: *mtu.edu/reunion.*

From the 1950s until its demolition in 1969, Smith House stood at the west end of what is now Wadsworth Hall.

This summer, students in the Archaeology Field School will do fieldwork around the Keweenaw, including the site of Smith House, location of one of the first women's residential dormitories on campus. Students will design archaeological surveys using STEM tools including remote sensing.

Remember the Smith House? Share your memories: *mtu.edu/memories*

MICHIGAN TECH ALUMNI BOARD OF DIRECTORS

Mission: Celebrating Traditions. Creating Connections.

Vision: We are passionate champions of Michigan Tech's unique traditions, and we continuously strengthen our alumni community.

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Representatives from:
Michigan Tech Student Foundation
Graduate Student Government
Undergraduate Student Government

Upcoming meeting: February 7 and 8, 2019

Have a question or suggestion? Contact the Alumni House at 877-688-2586 or *alumni@mtu.edu*.

Brooms. Duct Tape. Bruises. Memories.

The 2018 Alumni-Student Broomball Invitational Tournament during Winter Carnival brought nine teams to campus and more than 80 Michigan Tech alumni and friends together.

Congratulations to tournament champions, alumni team Pirate Sheep, who beat Tenacious Tadpoles to win for the third consecutive year. See photos from the event on our Flickr page: *flickr.com/photos/michigantechalumni*

SAVE THE DATE: 10-YEAR ANNIVERSARY OF THE TOURNAMENT FEBRUARY 8–9, 2019!

MICHIGAN TECH STUDENT FOUNDATION: 40 YEARS OF HUSKIES HELPING HUSKIES

In the fall of 1977, six college students met with Ron Helman, then executive director of the Michigan Tech Fund, to create the Michigan Tech Student Foundation (MTSF). The mission: to inspire student philanthropy.

MTSF established fundraising programs benefiting students: mailings for birthdays and exam treats, a senior giving program, selling mini mascots, and staffing the call center where students phone alumni.

Forty years later, the mission of MTSF continues.

"It was vital to have students become aware of funding, where the money comes from, and how important it is for alumni to support their alma mater," Helman says. "It was great seeing students involved and to share in their enthusiasm."

Helman, known to MTSF students as Uncle Ron, came to Michigan Tech in 1976. He was promoted to vice president for advancement in 1987, serving in that capacity until his retirement in 1996.

While working on campus, Helman enjoyed connecting with students, offering advice, and talking with them about what was happening in their lives.

One of his career highlights was the 1983–87 campaign conducted by the Michigan Tech Fund and the University. The campaign goal was $40 million; $50 million was raised. Another highlight was founding MTSF, getting to know and work with students, and watching MTSF grow throughout the years.

In 2000, Helman helped create Center Court Club (C3) for women's basketball. Each year, local fans support the team by attending games, providing dinners in their homes for the players, and making a financial donation to the team.

Ron and his wife, Lou Ellyn, have a daughter, two sons, and eight grandchildren. The Helmans contribute to Michigan Tech through scholarships and have included Tech in their estate plans. "It's a natural thing for us to give back to the University that played such an important part in our lives," Helman says.

Were you a member of the Michigan Tech Student Foundation? We'd like to hear your story. Connect with us: *alumni@mtu.edu*

From left: Ron Helman, Ryan Menzes '09, Holly Burger '08, Lou Ellyn Helman

MICHIGAN TECH STUDENT FOUNDATION BY THE NUMBERS

- MTSF alumni from 1978 to 2018: 698
- 380 (or 54 percent) alumnae; 318 alumni
- 67 percent donate to Michigan Tech

The Ron and Linda Staley Endowed Faculty Fellow supports continued growth of the new BS in Engineering Management degree.

MAKING AN IMPACT. CREATING THE FUTURE.

RON '77 '80 AND LINDA STALEY

Helping attract and develop the best educators for engineering management at Michigan Tech is just one of the reasons Ron and Linda Staley made a recent gift to the School of Business and Economics.

The couple created the Staley Endowed Faculty Fellow for the continued growth of the new Bachelor of Science in Engineering Management degree.

"A single scholarship can make a major difference to a student, providing the means to obtain their college education," Staley says. "That professor who really helps you learn, who inspires you, whose knowledge-sharing can turn into something special and be a path for your career, that professor is the game changer for potentially hundreds of students."

"Linda and I appreciate people who dedicate their careers to educating future leaders, and we want to support those individuals at MTU." Staley says that when classmate and professor Dana Johnson and School of Business and Economics Dean Dean Johnson (not related) shared their vision for the new degree program, he saw great possibilities for students.

To Staley, it is exactly the path Michigan Tech helped him create when he earned an associate's degree in civil engineering technology in 1977 and a bachelor's degree in business administration in 1980.

"A degree in engineering management can be used in so many engineering fields. I wanted to support the program," he says. "The combination of technical knowledge and business acumen is important to all engineers." Working on engines, old cars, and motorcycles led Staley to a career in engineering. He has worked for more than 30 years with The Christman Company where he specializes in historic preservation for monumental buildings. He serves as senior vice president, regional manager for Southeast Michigan, and executive director of historic preservation.

Staley has worked on state capitol buildings in Michigan, Maryland, and Virginia; President Lincoln's Cottage in Washington, DC; the US Capitol Building; and projects in Morocco, Poland, and most recently, Cuba to work on Ernest Hemingway's historic Finca Vigia. Other memorable projects include Henry Ford's Fair Lane estate and multiple projects for the National Park Service in Calumet.

His time at Tech taught Staley to work hard—and that discipline helped define his life. "I had technical skills that opened doors for unique opportunities. But it was my business background that developed those opportunities into a career."

Giving back to his alma mater that shaped his education and career is important to the couple.

"I'm not ready to retire anytime soon, but Linda and I talked extensively and while we've always planned that Michigan Tech would be in our estate planning, it was this new degree program that helped us really say 'we can make a difference.'"

Dean Johnson says gifts like the Staleys' are transformational—for students and faculty.

"The School has benefited from Ron and Linda's contributions of their time and student scholarships," Johnson says. "The Ron and Linda Staley Endowed Faculty Fellow position propels the School of Business and Economics forward in delivering technology-infused experiential business education."

Staley said he and Linda hope their endowment donation helps Michigan Tech's engineering management program grow.

THIRTY YEARS OF GIVING

When Staley made his first gift to Michigan Tech in 1983, he sent his support to the School of Business and Economics, says Eric Halonen, assistant vice president for advancement. "With that first gift, Staley showed he was supportive and appreciative of his Tech education. Since then, he has continued to grow and establish his giving, most recently with his and Linda's generous estate planning gift."

The Staleys also support the School of Business and Economics with the establishment of a new engineering management scholarship for incoming students. This endowed scholarship recognizes an outstanding first-year engineering management major.

Outside the office, Staley is a pilot with three airplanes: a WWII-era North American T-6 Advanced Trainer, a 1981 Russian Aero L-39 jet, and a Cessna 414. The couple travels across the globe, on trips to Thailand, Greece, Italy, and Mexico.

CLASS NOTES

Share your news! Post your class note and photo online at MyMichiganTech or email to alumni@mtu.edu. New addition in your family? Let us know. They will receive a special gift from Blizzard T. Husky.

1950s

Thomas Coleman '57 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

1960s

Ted Reuschel '64 (Forest Management) recently published his second book, *Michigan's Looking Glass River by Kayak: A Modern-Day Journey Down a Historic River*. Reuschel's detailed narrative recounts his experiences on a small river a few miles north of the state capital and describes the trials and hardships early pioneers experienced along those same banks many years before.

Manfred Phillip '66 (Chemistry) was elected president of the Fulbright Association and assumed his new role in January 2018. He previously served as the Fulbright Association Board of Directors secretary. Philipp also serves as chair of the Association's National Conference Committee.

John F. Calder '67 '76 (Mechanical Engineering, Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

Robert S. Tripp '66 '67 (Metallurgical Engineering, Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

1970s

Richard E. Ten Haken '70 (Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

Roger Crimmins '71 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

David L. Ouillette '71 '73 (Forestry) and Mary Jo Russell were married February 17, 2018, at Resurrection Church in Lakeland, Florida.

Gary Hagstrom '72 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

1 **Kathryn Botsford (Kathy Linder) '73** (Liberal Arts) retired after teaching elementary school for 40 years on Vancouver Island, British Columbia.

Bob Bartosh '75 (Civil Engineering) retired in June 2016 as a senior vice president and chief operating officer of Dakota Coal Company after serving the coal industry for nearly 40 years. He and his wife, Deb, reside in Bismarck, North Dakota, and have three children and four grandchildren.

Glenn F. Lawrence '75 (Chemical Engineering) was inducted into Michigan Tech's Chemical Engineering Academy in April 2017.

2 **Howard Szaroletta '75** (Biological Sciences) received his 30-year pin from State Farm.

3 **Joe Dancy '76** (Metallurgical Engineering) accepted the role as executive director of the Energy Center at the University of Oklahoma College of Law.

James Keighley '76 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

Brian Schwanitz '77 (Applied Geophysics) was recognized for his 36 years of service to the Society of Petroleum Engineers (SPE) with the 2017 SPE Production and Operations Award at ATCE in Dubai, UAE.

Kenneth G. Hafeli '77 (Liberal Arts) presented "Thank God for the Ford Glider. The Waco CG4A: The Upper Peninsula's Marvel of World War II" at the Yankee Air Museum at Willow Run near Ypsilanti on October 4, 2017. The talk was based in part on research he began in 1975 as an undergraduate.

Ronald D. Staley '77 '80 (Civil Engineering Technology, Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

4 **Jeff Brooks '78** (Electrical Engineering) retired from his aerospace engineering career and is living in Norton Shores, Michigan.

Charles Farrar '79 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

John J. Rockwell '79 (Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

1980s

Bruce Lowing '80 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

Kent Johnson '80 (Biological Sciences) received the Dave Ford Award from the University of Minnesota in October 2017. This is Minnesota's most distinguished award for protecting clean water.

William Bertoldi '80 (Biological Sciences) was inducted into the University's Academy of Educators. Bertoldi graduated with a BS in Chemistry in 1980, with Secondary Teacher Certification in Chemistry and Mathematics. He spent 30 years teaching in Kingsford Middle and High Schools. In 1996 Bertoldi established Rockets for Schools, a student organization that designs, builds, and launches high-powered rockets.

R. Dyche Anderson '81 (Chemical Engineering) was inducted into Michigan Tech's Chemical Engineering Academy in April 2017.

Marie Cleveland '82 (Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

Kurt Larson '82 (Mining Engineering) has published his fifth book, *The Takeover Diaries*, under the pen name Rock Svensson. It is a mostly fictional account of the events leading up to the sale of the largest independent company in the UK minerals sector.

Catherine (Kuchta) Leslie '83 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

Xintan Chang '83 '88 (Mining Engineering, Mechanical Engineering) was inducted into Michigan Tech's Mechanical Engineering-Engineering Mechanics Academy in October 2017.

Albert Cipparone '84 (Electrical Engineering) and Mary Cipparone are pleased to announce the graduation of their daughter, Annelle, from George Mason University in Fairfax, Virginia, with a Bachelor of Science in Finance. She is currently employed by Deloitte in Arlington, Virginia.

Charles A. Becker '84 '86 (Forestry) was inducted into the School of Forest Resources and Environmental Science Honor Academy in December 2017.

Douglas J. Hamar '82 '84 (Mechanical Engineering, Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

Kimberly Nowack '85 (Civil Engineering) was inducted into Michigan Tech's Academy of Civil and Environmental Engineering in September 2017.

Tony Altobelli '86 (Mechanical Engineering) was inducted into Michigan Tech's Mechanical Engineering-Engineering Mechanics Academy in October 2017.

Kevin S. Wampler '86 (Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

Carrie Schaller '87 (Business) was inducted into Michigan Tech's School of Business and Economics Academy in September 2017.

Jayne (Reuschel) Nitz '88 (Computer Science) had a second musical work, *Little Offertories for Little Churches*, published by Northwestern Publishing House.

Thomas Bronz '89 (Mechanical Engineering) was inducted into Michigan Tech's Mechanical Engineering-Engineering Mechanics Academy in October 2017.

1990s

Scott A. Moffatt '90 '93 (Chemical Engineering, Metallurgical Engineering) was inducted into Michigan Tech's Chemical Engineering Academy in April 2017.

Christine Roberts '91 (Mechanical Engineering) was inducted into Michigan Tech's Mechanical Engineering-Engineering Mechanics Academy in October 2017.

Mark M. Mleziva '92 (Chemical Engineering) was inducted into Michigan Tech's Chemical Engineering Academy in April 2017.

Eric Obermeyer '94 '97 (Mechanical Engineering) has been promoted to principal manufacturing engineer in the manufacturing engineering group at Emerson Commercial & Residential Solutions.

2000s

Justin Miller '00 (Forestry) was the recipient of the School of Forest Resources and Environmental Science Outstanding Alumni Award.

5 **Kelly Vizanko '00** (Business Administration) and **Steve Vizanko '04** (Business Administration) welcomed baby girl Alina Marie. She weighed six pounds, two ounces and was 18.5 inches long. Addison is a proud big sister.

Sarah (Hiner) Geborkoff '00 (Geology) was inducted into the University's Academy of Educators. Geborkoff, a science teacher at Houghton Middle School, earned a BS in Geology in 2000 with a Secondary Teacher Certification in Earth and Space Science. Since 2013 she has served Houghton Middle School as the lead teacher for the Lake Superior Stewardship Initiative Project. A three-time advisor to Lexus Scholastic Eco Challenge teams, Geborkoff helped land national prize money totaling $20,000.

Ben Almquist, PhD '04 (Materials Science and Engineering) was recognized as a Fellow of the Higher Education Academy in the United Kingdom.

6 **James VanEvery '06** (Business Administration) and Julie VanEvery proudly announce the birth of their daughter, Lily Elizabeth VanEvery, born on October 21, 2017.

7 **Bob Evans '07** (Psychology) and **Trisha Evans '08** (Mathematics) welcomed Jasper Grit on October 19, 2017. Baby Jasper weighed seven pounds, one ounce and was 20 inches long.

8 **Rachel (Misenheimer) Connors '08** (Chemistry) and Patrick Connors are excited to announce the birth of Wyatt Gage Connors. He was born December 28, 2017, at 2:15 AM, weighing eight pounds, 15 ounces and measuring 20.5 inches long. Mom, dad, and Wyatt are doing well and settling into the new adventure!

9 **Brian Edwards '08** (Chemical Engineering) and **Jillian Schubert Edwards '09 '11** (Applied Ecology and Environmental Sciences, Environmental Policy), along with their son August, welcomed a daughter, Moira Alice Edwards, on December 18, 2017.

2010s

Caitlin (Hartley) Dobson '10 (Business Administration) and Drew Dobson '10 (Computer Science) welcomed their first little Husky, Owen James Dobson, born September 22, 2017, at 1:56 PM.

10 **Scott Nelson '10** (Materials Science and Engineering) and **Megan (Knudstrup) Nelson '10** (Civil Engineering) welcomed Lyra Amelia Nelson into their family on December 29, 2017. Lyra is the first grandchild of three Tech alumni, **David Nelson '79** (Geological Engineering), **Ellen Nelson '79** (Liberal Arts), and **Chris Knudstrup '77** (Electrical Engineering).

11 **Rebekkah (Bury) Carney '11** (Civil Engineering) and **Matthew Carney '11** (Mechanical Engineering) welcomed their son, Everett Lorenzo, on August 18, 2017. Born at 5:25 PM, he weighed seven pounds, seven ounces and was 21 inches long. Everyone is happy and adjusting well.

12 **Brian Thompson '11** (Electrical Engineering) and **Jessica Thompson '12** (Biological Sciences, Pre-Medicine), along with their daughter, Lily, welcomed Lydia Joy Thompson on January 21, 2018.

Amber Oja '11, (Forestry, Wildlife Ecology and Management) was the recipient of the School of Forest Resources and Environmental Science Outstanding Young Alumni Award.

13 **Troy Bouman '12 '16** (Mechanical Engineering) and **Andrea (Taglione) Bouman '11 '12** (Exercise Science, Biological Sciences, Business) are excited to announce the birth of their daughter, Harper Kay. She was born November 11, 2017, in West Bloomfield, Michigan.

Rebecca (Sprys) Hayes '12 (Civil Engineering) and Collin Hayes were married in Dallas, Texas, on November 4, 2017.

14 **Anne (Dancy) Maher '12** (Biomedical Engineering) and William Maher were married in Saint Paul, Minnesota, on August 19, 2017.

Nathaniel Schulz '14 (Civil Engineering) and **Anna (VanderKooi) Schulz '14** (Environmental Engineering) are excited to announce the birth of their son, William Ellis. The new addition was born November 7, 2017, in Grand Rapids, Michigan. He weighed eight pounds, 14 ounces and was 22 inches long.

Yonee Bryant-Kuiphoff '14 (Applied Science Education) was inducted into the University's Academy of Educators. Since 2008 she has served as the middle school director for the Michigan Science Teachers Association. From 2011 to 2014, she was a member of the first cohort of the Michigan Teacher Excellence Project and participated in the collaboration of Michigan Tech and urban schools to improve earth science instructional practices.

Jared Timmer '15 (Mechanical Engineering) and Kelly Timmer welcomed baby girl Rebekah Rose (Rosie) on December 19, 2017. She was seven pounds, 13 ounces and 20 inches long.

Alanie (Harmon) Sager '16 (Biomedical Engineering, Environmental Engineering) and Kaleb Sager were married in Alpena, Michigan, on August 19, 2017.


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OUR TIME

Huskies have one less excuse to be late for 8 AM classes. A 35-foot clock tower in the heart of campus was made possible thanks to a generous gift from Bill '69 and Ilene Bernard and their family.

Help beautify campus—support the Alumni Way project: *mtu.edu/giving*

IN MEMORIAM

1944
George W. Swenson Jr., PhD PE

1947
S. Charles Gekas

1948
Walter J. Gabriel

1949
Donald L. Avery
William J. Bero Jr.
Patricia E. Couillard
Louis Iannettoni
Lauri J. Kivisto
Donald P. Saxon
Robert W. Strom

1950
James G. Bennetts
Paul B. Frair
R. Dewey Hansen
Thomas N. Kayfes
Kenneth E. Kueny
Stanley J. Maleska
Roy W. Nagle Jr.
Henry J. Nault Sr.
Harry C. Olson
Charles P. Taylor
John J. Thornton

1951
John A. Halpin
Jack D. Powers
Margaret J. Raisanen
Carl E. Wellman Jr.

1952
Thomas J. Foley
Edmond W. Holm
Dr. Harold S. Jensen
Jacques R. Jorgensen
George E. Langen
Warren B. Peterson
James Stukel

1953
William S. Brotherton

1954
Donald F. McMaster
Joan C. Patch
Robert E. Quilici

1955
Rodney A. Mattson
Lawrence K. Mulholland
Col. Phillip N. Walker (Ret.)

1956
Dr. George R. Alger
Lowell H. Christensen
Ronald C. Liikala
Richard D. Lindberg
Robert G. Trudgeon PE
Richard V. VandeBunt

1957
Frederick B. Bevis
Benjamin J. Holmes
Wesley O. Niemi
Neil R. Paulson
Robert W. Plume
Dennis A. Staley

1958
Rene O. Bunster
William G. Jackson
Robert F. Keefer
Thomas G. LaHaye
William K. McLay
Wayne K. Wheelock

1959
John H. Adams
James E. Arasim
Melvin R. Juhola
Harry P. Kleiman
Edgar A. Larche
Thomas G. McCombie Jr.

1960
John R. Benhart
Gary J. Berntsen
Lary N. Brandner PE
Jerry T. Foster
Robert Y. Grusser
Gerald J. Hill
Edwill R. Jordan
Dr. Michael R. Massie
Donald R. Mouchka
Paul J. Richardson
James D. Thompson

1961
David F. Barnhart
Neal W. Johns PE
Dennis J. Napel

1962
Edwin J. Chamberlain
Ralph E. Duddles
Joan F. Maierle

1963
Jack G. Barton
Floyd D. Roberts Jr
Walter A. Simonson

1964
Robert L. Christy
Guntis Melbardis
Eugene G. Rebellato

1965
Dennis P. Burns
Robert F. Gardner
Albert G. Hicks
Thomas J. Rozich
Erwin F. Stoldt
Ellen W. Vivian
Gary L. Worrall

1966
Dr. Allen E. Kemppainen
Melvyn G. Mikkola
Jack T. Plaistow

1967
Patricia S. Anderson
Carl O. Gast II
Duane W. Roland Jr. PE
Paul S. Talford
Gunnar A. Widerstrom

1968
Henry J. Collins Jr.
William A. Howe
Nancy A. Klingbeil

1969
Gary L. Taylor

1970
John D. Anderson
Lawrence E. Anderson
Daniel F. Provost PE
Robert W. Seasor

1971
Michael D. Bausano
Lynn T. MacDonald
Robert D. Pieti
Jack K. Robinson
John R. Van Ells

1973
Thomas G. Harwood
Roger D. Pitterle
Kenneth A. Tormala

1974
Patricia A.P. Nugent
Mark S. Vizanko

1975
Dr. Martin D. Saine
Glen M. Wirtanen

1976
Fritz M. Heidenreich

1977
Kim S. Aerts
Thomas J. Klemp
Kathryn B. Teter

1978
Gary W. Auge
Julie B. Gades
Walter A. Hulkkonen
John E. Niemela

1980
Mark J. Rich
William J. Traub

1981
Robert T. Gray
Ann Weiler McMahon
David B. Miller

1982
Kelly R. Flaherty
Howard T. Greenley
John G. Sederholm
Terrance L. Tock

1984
Steven G. Loosemore
Allen P. Olson

1985
L. Kelly Sandberg

1988
Todd M. Bush
Dr. Philip E. Kaldon

1990
Jamie M. Antoniewicz

1991
John A. Kopnick

1993
Joelle M. Oberski
Timothy J. Toth

1998
Deborah J. Aho
Jessica J. Zerbst

2007
Diana D. Wadke

2012
Travis P. Baur

2013
Daniel A. Polovich

2016
Ryan K. Werner

2017
Joel W. Olsen

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- 1,043 people have generously given to Michigan Tech every year for the past 10 years
- 11,639 Scholarship Donors

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- More than 200 companies attended Tech's 2018 Spring Career Fair hiring for internships, co-ops, and full-time positions


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