

Michigan Tech

2019 • VOLUME 56 NUMBER 2

MAGAZINE



INTRODUCING THE COLLEGE OF COMPUTING

Where building blocks of research, teaching, and service are pathways to create, code, and question the digital world we live in.



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MICHIGAN TECH MAGAZINE

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Study hard. Ski harder.
Students gain a new
perspective from the
top of Mont Ripley's
440' vertical drop.



ANATOMY OF...

OCULUS-ASR

January 2011. Albuquerque, New Mexico.

A team of 25 Michigan Tech undergraduate students, advised by mechanical engineering professor L. Brad King, took first place in the University Nanosat 6 competition, earning the rare privilege of having the US Department of Defense (DoD) launch their custom-built satellite into orbit.

The competition earned the team a two-year contract from the Air Force Office of Scientific Research to prepare the satellite and construct a ground control station on campus. Repeated delays postponed the launch, however, and what was supposed to take two years stretched into more than eight.

But just before 3 a.m. on June 25, 2019, the Husky-built nanosatellite launched into orbit. Aptly named for its role as an orbiting eye, Oculus-ASR rode the SpaceX Falcon Heavy rocket into a nine-month mission to assist the DoD with more efficient and accurate monitoring of the myriad of objects circling the globe.

“OVER THE PAST 10 YEARS, MORE THAN A HUNDRED STUDENTS IN THE AEROSPACE ENTERPRISE AT MICHIGAN TECH HAVE WORKED ON THE OCULUS-ASR AND ARE NOW MICHIGAN TECH ALUMNI FROM A WIDE VARIETY OF MAJORS. I AM EXTREMELY PROUD OF THE TEAM, AS WELL AS THE TEAM’S ADVISOR, PROFESSOR BRAD KING. HE TAUGHT THEM, AMONG MANY OTHER THINGS, THE GREAT VALUE OF PERSEVERANCE.”

Janet Callahan,
Dean of the College of Engineering

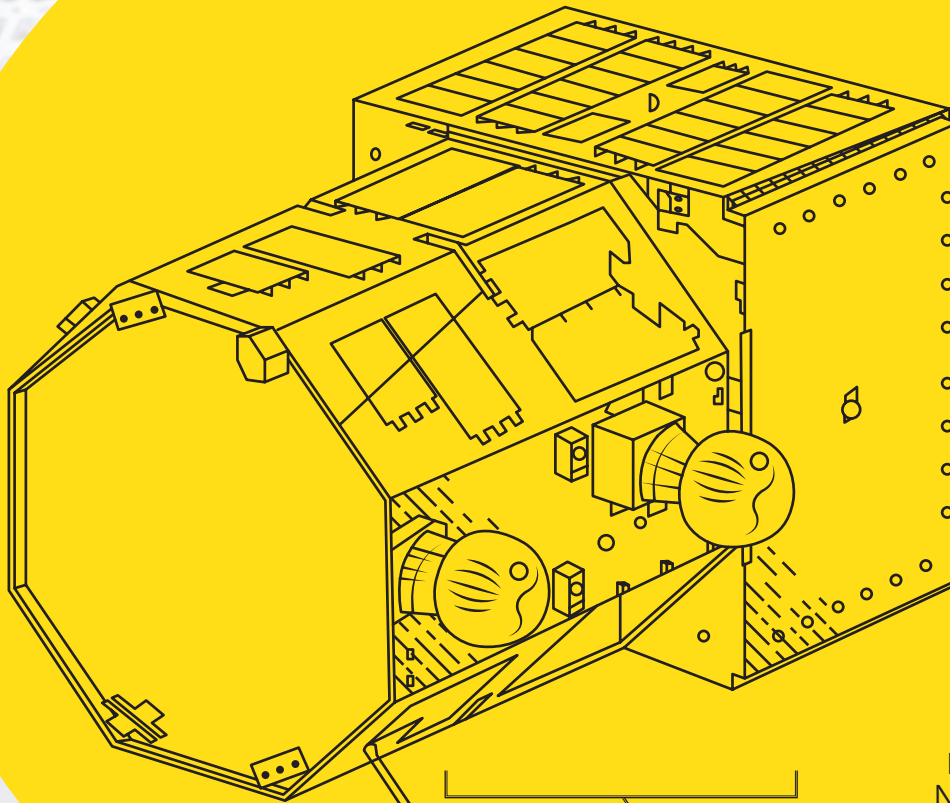
WEIGHT
150 POUNDS

**NUMBER OF
TECH STUDENTS
INVOLVED**

100+

**APPROXIMATE
ALTITUDE AT
LAUNCH**

315 KM



1
NUMBER OF WEDDINGS
ATTENDED*

2
QUARTER-WAVELENGTH
MONOPOLE WHIP
ANTENNAS
LOCATED ON EITHER
SIDE OF THE RELEASABLE
SPHERES, ORIENTED 90
DEGREES FROM EACH OTHER
AND ORTHOGONAL FROM
THE VERTICAL AXIS OF THE
SATELLITE

*Aerospace Enterprise alumni took Oculus to the 2013 wedding of fellow alumnus Jeff Katalenich in Boise, Idaho.

PAD39A

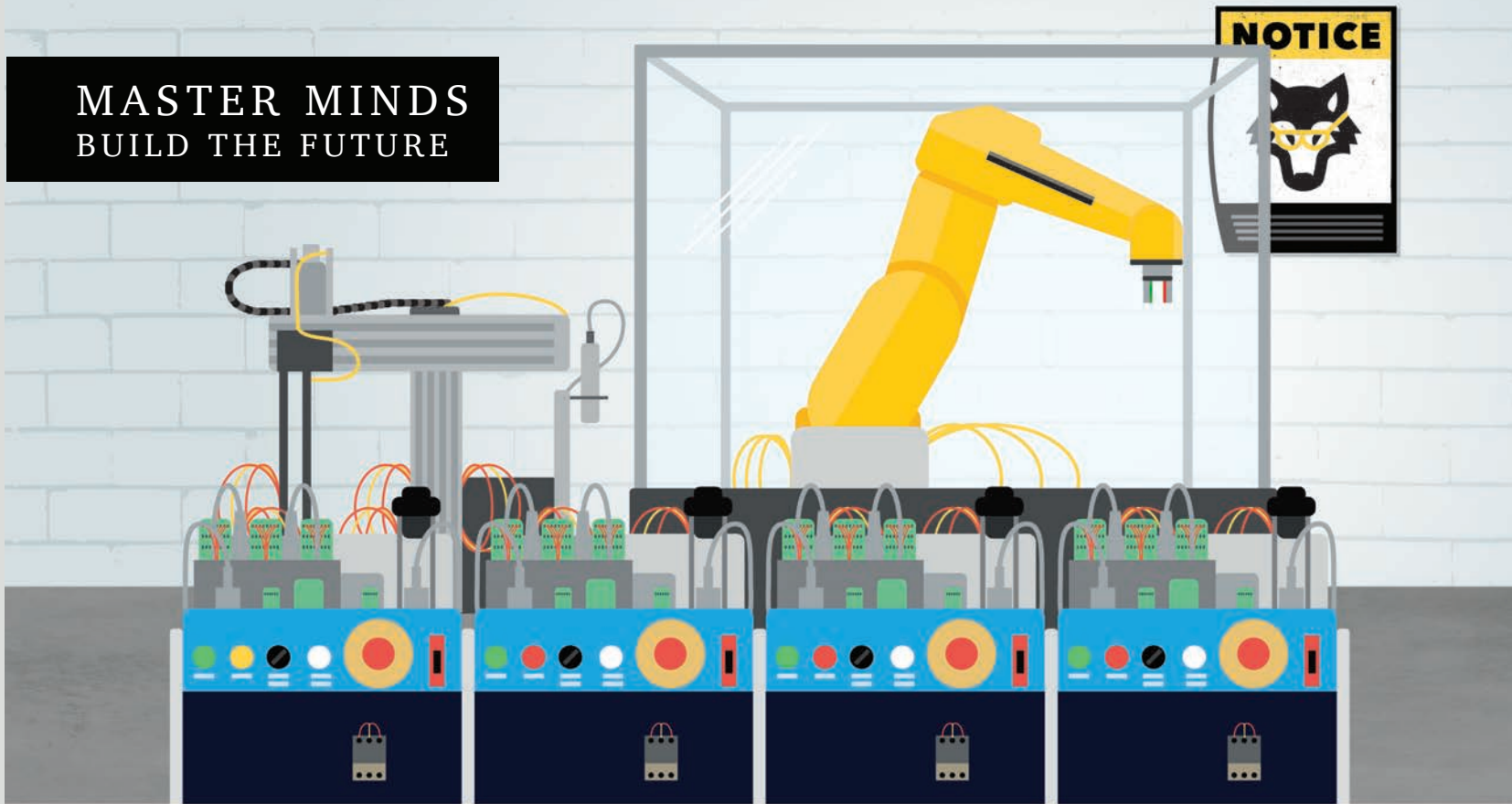
LAUNCH SITE AT
NASA'S KENNEDY
SPACE CENTER

(FUN FACT: PAD39A
WAS ALSO THE LAUNCH
SITE FOR THE HISTORIC
APOLLO MISSIONS)

**RELEASABLE
SPHERES**

10 CM IN DIAMETER
AND MADE OF 6061-T6
ALUMINUM, THEY'LL BE
DISCHARGED ONE AT A
TIME TO CHANGE THE
SHAPE OF THE SATELLITE

MASTER MINDS BUILD THE FUTURE



MECHATRONICS: MORE THAN MEETS THE EYE

Master Minds spotlights one of Michigan Tech's 43 master's degree programs

While the discipline of mechatronics is quite complex, the name is extremely straightforward. Mecha- is borrowed from mechanical and -tronics from electronics to create a supremely accurate moniker that still leaves people perplexed. Mechatronics? What is that?

Mechatronics is the engineering of sophisticated, automated mechanical and electrical processes delivered sequentially—with or without active human participation—using an approach that unites multiple branches of engineering in order to solve a particular problem or simplify a process.

Think of an automated teller machine (ATM). There are mechanical, electrical,

and software components that must sync up precisely. It seems like such a simple exchange, but countless, carefully orchestrated maneuvers are taking place inside. And someone had to design that. Someone had to design, code, build, test, and improve each iteration from the mid-1960s to today's convenience-store staple, making all-hours banking a simple and secure process.

Mechatronics engineers have been compared to conductors leading large orchestras through highly complicated pieces of music. Like the conductor, the engineer may not personally touch each instrument, but they must understand and unite each part of the process.

Michigan Tech's master of science in mechatronics program is preparing the next wave of highly skilled, imaginative, creative, and capable mechatronics engineers. They're going to keep pulling tech forward, uniting the array of advanced engineering capability under the same (possibly autonomous, flying, climate-controlled, bluetooth-enabled) umbrella. But, whatever the future holds for automated tech, mechatronic engineers will be pushing at the edges of the next frontier.

Tomorrow needs prodigious synthesizers, tinkerers, and thinkers. Tomorrow needs Michigan Tech.



Technical degree programs have changed. Traditional degrees leading directly to closely aligned positions in industry are a thing of the past. Mechatronics studies combine the concepts of engineering, robotics, automation, and controls. That matters because artificial intelligence helps businesses stay competitive. And employees with this specialized knowledge have a competitive edge in the hiring process.

Watch to learn more at mtu.edu/magazine/mechatronics

ALUM ATTEMPTS EVEREST

Earlier this year, Michigan Tech alumnus Sirak Seyoum '93, an electrical engineer living in San Francisco, took time off from his position at Cargill to climb Mount Everest. His goal: become the first Ethiopian to conquer the highest mountain in the world.

Seyoum started climbing in 2008 while living in Las Vegas, Nevada; to date, he's climbed 21 mountains, some more than once. In his bid to conquer Everest, Seyoum and his rope team began their trek from Lukla to Everest Base Camp on April 5. Their bid for the summit took place 41 days later.

Starting at Camp 4 at 9 p.m. on May 15, the team climbed throughout the night. By 9:54 a.m. the next morning, Seyoum was less than 300 meters from the summit at 28,210 feet. "I could literally feel the summit and how beautiful it was," Seyoum says, "but I obeyed the order from my Sherpa, telling me to go back down."

The number of deaths on Everest were high during the 2019 climbing season, and numerous news reports highlighted overcrowding. Seyoum says overcrowding has been a constant issue over the years, but 2019 was a stand out due to the number of inexperienced climbers and Sherpas.

"The combination of both together is deadly," Seyoum says. "This year there were only a few days to plan the summit bid due to bad weather. Our team went for the summit during the coldest period of the 2019 season, which didn't attract most climbers; hence, traffic was minimal."

Now back home in the Bay Area, Seyoum is already preparing for next year. He's planning to climb Everest once again, but this time via the north face in Tibet—a more challenging and difficult route.

Read more at mtu.edu/magazine/mt-everest

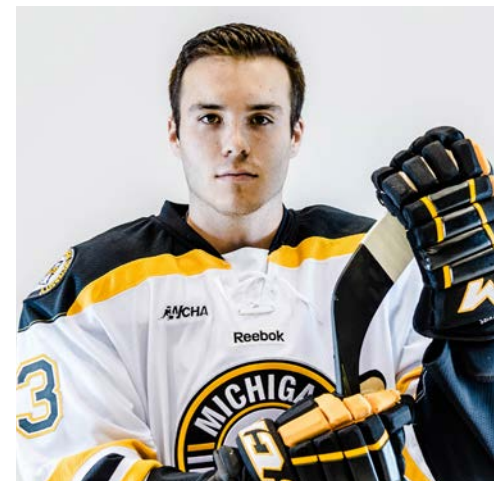


Alumnus Sirak Seyoum wants to be the first Ethiopian to conquer Everest.



TECH PAYS OFF

CNBC recently ranked Michigan Tech the number 8 public university on its list of "The Top 50 US Colleges That Pay Off the Most." The list spotlighted 50 schools—25 public and 25 private—that provide students the highest average salaries for their tuition dollars. According to CNBC, the median salary for Michigan Tech alumni with up to five years of experience is \$64,600 and the median salary for alumni with 10-plus years of experience is \$110,200.



HUSKIES IN THE CROWD: MATT ROY

Matt Roy left Michigan Tech during his junior year in 2017 to play professional hockey for the Los Angeles Kings. Despite the demands of his career, Roy continued to pursue his undergraduate degree in sports and fitness management. This fall, he received his diploma.

KEARLY STADIUM DEDICATION

On September 28, 2019, the Michigan Tech Department of Athletics dedicated the renovated football facility as Kearly Stadium at Sherman Field, in honor of the Kearly family. Ted and Tom Kearly (father and son, respectively) have been instrumental in the success of the Tech football program for decades.

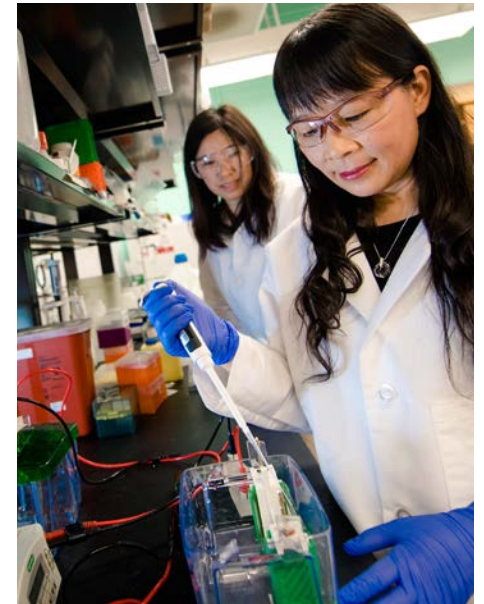
Combined, the Kearlys produced an NCAA Playoff Appearance, three Northern Intercollegiate Conference championships, two Great Lakes Intercollegiate Athletic Conference titles, and 13 NCAA All-American players. In the history of MTU football, there have been 15 teams that have won seven or more games, and nine

of those teams were coached by the Kearlys.

“It is a privilege to name our football facility in honor of the Kearly family,” says Suzanne Sanregret '93 '06, Michigan Tech's director of athletics. “Ted and Tom are two of the greatest coaches in the history of Tech football and have made a tremendous impact in the lives of our student athletes, both on and off the field. We are grateful for their dedication to Michigan Tech and the many contributions they have made to Athletics and the University as a whole.”

Fundraising is underway for Phase Two of the football stadium renovation project. Want to offer your support?

Visit mtu.edu/giving/athletics/priorities/football



Feng Zhao and her team conduct research in stem cell and tissue engineering.



The Kearly families attended the September stadium dedication.

NEW RESEARCH INSTITUTES

In fall 2019, Michigan Tech launched two new research institutes.

The Institute for Policy, Ethics, and Culture (IPEC) promotes research, policy engagement, and teaching that address the ethical and cultural challenges, implications, and strategies unique to the emerging technocultural environment. IPEC kicked off its inaugural year with its Algorithmic Culture speaker series in fall 2019. In the spring, IPEC will host a series of events focused on the topic Design the Anthropocene.

Michigan Tech researchers tackle a variety of health-related challenges. They develop innovative materials for better wound care, create vaccines, study alcohol's effects on the nervous system, and grow stronger heart muscle cells faster with less chance of rejection. Their research is translational, interdisciplinary, and increasingly convergent. The Health Research Institute strives to maintain this thriving environment for health-related research and inspire education and outreach activities.

BEND IN THE ROAD

While road rash would lead us to believe otherwise, roads are indeed made of flexible materials that change shape over time. Hot days, cold snaps, and heavy trucks wear and tear roads.

Old transportation material models approximate the elasticity of an asphalt mix—its flex, how bendy it is. Zhanping You uses newer models, material testing, and highway-sized construction projects to show that a road is not all it's cracked up to be. You is the 2019 Michigan Tech Research Award winner and a professor of transportation engineering; he studies asphalt, as well as more sustainable options, for ensuring that roads do not crack in the first place. One solution: recycled rubber tires.

Read more about how to make sweaty, freezing, and versatile bituminous materials on Unscripted: mtu.edu/magazine/pavement



In his lab, You focuses on sustainable materials and construction.

HUSKY INVESTMENT TOURNAMENT

Debt levels of young Americans are rising, and financial literacy is an important life skill for all Huskies. Universities across the country—including Michigan Tech—are now teaching basic financial life skills to undergraduates.

In fall 2019, the College of Business launched a new outreach initiative—Husky Investment Tournament—to expose high school students to the basics and excitement of trading, saving, and growth.

Here's how it works: Teams of three to four students receive \$1 million in virtual US dollars

to build a portfolio over a two-month period. The team with the top-performing portfolio is invited to campus to pitch to a panel of current Michigan Tech students and experts. The team also receives \$1,000 in prize money, and all team members who actively participated are awarded scholarships to attend Michigan Tech.

Most importantly, all pre-college students who participate in Husky Investment Tournament learn about the world of investing and business in a fun, dynamic way. Know a high school business educator who may be interested in enrolling students in future investment competitions?

Visit mtu.edu/business to get started.



The first Husky Investment Tournament kicked off in 2019.

Shawn vanDoorn graduates in May 2020 with Michigan Tech's revamped mining engineering degree.

HOW TO REENGINEER A MINE

In 1885, the Michigan Mining School opened its doors. Copper was booming; housing density in Calumet, Michigan, was as thick as in New York City; the Keweenaw's remote Upper Peninsula forests were clear cut and much of the timber went underground in mine shafts and drifts. The school started with 23 students—all mining engineers in training.

Much has changed in the past 134 years: Notably, mining in the Keweenaw "Copper Country" and the purpose of the mining school, renamed Michigan Technological University in 1964. But an industrialized place can never fully escape its roots, and as engineering has changed over the last century so have the practices and uses of mines. From a new but familiar degree to creative energy solutions, mining in Michigan is being reimagined and refurbished.

BACHELOR OF SCIENCE IN MINING ENGINEERING

Amidst development efforts to bring more mining back to Michigan, the state created a new committee to make recommendations to grow the industry. The process is not simple—we do not live in our grandparents' landscapes, neither physically or politically—and the bill's sponsor, Michigan State Representative Sara Cambensy, says the ultimate goal of the advisory committee is to "do things better." Ever ready for a challenge, engineers are the ones who bridge traditional extractive industries and modern expectations.

"Michigan Tech is bringing back its undergraduate mining engineering degree because the industry needs professional engineers who can address today's technical challenges—and to do so in an environmentally responsible manner," says John Gierke '84 '86 '90, chair of the Department of Geological and Mining Engineering and Sciences. "Sure, we're returning to our historic mission, and it's great to honor that path, but we're also reshaping how mining is done by how we will train future engineers."





ROBO-INTERN ONE

Shawn vanDoorn graduates with a degree in mining engineering in May 2020. She interned with global mining companies Barrick and Freeport-McMoRan (and starts a full-time gig down in Arizona at the Safford mine next June).

“I don’t want to be indoors at a desk all the time; I don’t want to be in a factory the rest of my life,” vanDoorn says, adding that she grew up in a logging family in northern Wisconsin and loves the outdoors. “That’s what I like about mining—there’s a balance of design work in the office and somedays you have to visit the dig face. Personally, I’m excited to work on the operations side because I like people and enjoy being in the mine.”

She says safety and adapting to new technology are the biggest changes in mining curriculum over the past century. For example, while working in Nevada at the Goldstrike mine, vanDoorn drove P&H 4100 shovels and helped bring online some of the company’s first autonomous Komatsu 930E haul trucks. Her internship title: Robo-Intern One.

Read more about vanDoorn’s journey on [Unscripted: mtu.edu/magazine/mining](https://mtu.edu/magazine/mining)

“THE FUTURE OF THE MINING INDUSTRY IS TRANSFORMING IN THE DIGITAL AGE.”

Snehamoy Chatterjee,
Assistant Professor of
Mining Engineering

The changes required in new mining endeavors focus on the front end of the work. In the past, mining operations dug deep, tossed first, and remediated later, which is a costly and wasteful process that makes environmental and human health a cheap price for fast economic gain. Best practices in mining now demand thoughtful siting, remediation strategies, community engagement, and more backup plans than an operations crew can shake a shovel at.

“The future of the mining industry is transforming in the digital age through the integration of technologies and innovations that achieve lower operational costs, improve worker safety, and reduce environmental impacts while supporting a global socio-economic system,” says Snehamoy Chatterjee, assistant professor of mining engineering. “That means that our students need to understand the traditional mining engineering techniques that have dominated the industry for generations, but also be technically savvy enough to see how the newest digital innovations might fit into a better decision making or engineering design process.”

Alongside people like Nathan Manser ’01 ’09, mining engineering lecturer, Michigan Tech faculty are inspiring students to get their hands dirty by thinking beyond traditional designs and being willing to confront the challenges that come with yesterday’s waste, today’s technology, and tomorrow’s needs.

No matter what, mines do come at a cost—they are bound to leave an imprint on the earth. However, there are known methods to minimize that impact, which students in the mining engineering program will be steeped in, and Generation Z’s hallmark is wanting to make a real difference in the world. Plus, few people are willing to give up their cars, phones, buildings, air travel, paint, and garden fertilizer. As the old PR tagline goes, if it’s not grown, then it’s mined.

Or perhaps there are more options.

MINES AS BATTERIES AND HEAT EXCHANGERS

Old mines can find new uses: Deep, abandoned shafts can be used for pumped hydropower energy storage. This summer, an interdisciplinary group of researchers began a pilot study in Negaunee, Michigan, to determine the feasibility of repurposing the Mather B Mine into a giant battery.

Roman Sidortsov, assistant professor of energy policy, Chelsea Schelly, associate professor of sociology, and Tim Scarlett, associate professor of archeology and anthropology, are the project leads. They say the effort can help struggling post-industrial mining communities to transform decommissioned mines from environmental and economic liabilities into productive assets. Although pumped hydropower is currently the most prevalent form of energy storage worldwide, permitting new sites becomes difficult due to environmental and aesthetic concerns. Placing these systems into an existing mine takes care of the concerns and the existing mine site infrastructure can significantly reduce capital costs.

“Communities can look at the abandoned mines in their area and consider them more holistically than an energy company or utility provider might,” Scarlett says. “There are many flexible design options at multiple scales, from the household or industrial park seeking energy reliability or independence, up to gigawatt-scale facilities supporting the grid reliability and resiliency for a large region of the national electrical grid.”

Sidortsov adds: “With the rapid growth of renewable energy, the need for energy storage has been increasing at a neck-breaking speed. There are more than enough mines across the United States and the world that could potentially serve as sites for energy storage of different scales. More importantly, such facilities belong to the category of win-win projects as they are capable of delivering environmental, economic, and social benefits for the government, community, and industry, while achieving something that thus far has been out of reach: sustainable mining.”

Within the mines, Michigan Tech faculty and students have been trying to improve ways geothermal energy is harvested from mine water. Assistant Professor of Civil and Environmental Engineering Zhen Liu and the



Old school mining gets an update in Chatterjee's classes with modeling and mapping tools.

Keweenaw Research Center's Director Jay Meldrum have led teams studying the movement of water in abandoned mines, as variations in temperature and salinity cause complex flow patterns in old, flooded workings. Modeling this complicated mixing process is the central challenge to designing systems that maximize the value of harvested geothermal energy.

To that end, Michigan Tech installed a model geothermal system at the Keweenaw Research Center 10 years ago, which has been a model for ongoing research and education, and more recently inspired community discussions on the social acceptability of a mine water geothermal energy system in Calumet, Michigan. Led by Richelle Winkler, associate professor of sociology, a group of student researchers also put together the first comprehensive guidebook communities can use to explore the feasibility of using mine water to heat and cool buildings.

MORE THAN A MINE

Mining techniques learned in Michigan reach beyond the state. The lessons learned here may help astronauts get back from Mars—research being explored by mechanical engineer Paul van Susante by producing rocket propellant from gypsum rock on Mars. Or help reduce coal dust in mines around the world and inspire new ways to use old technology to recycle lithium batteries—projects led by chemical engineer Lei Pan. Tim Eisele '84 '87 '92, associate professor of chemical engineering, sees other opportunities in mining technology, specifically waste products.

"The technology for separating valuable minerals from mined material is always improving, and so

there is much opportunity for reprocessing former tailings materials," Eisele says. "This material is already mined, crushed to a fine size, and stored accessibly on the surface, so there is a lot of room for recovering metal that it was not formerly economical to extract."

He adds there are ore bodies that used to be considered too low-grade to work with, but that now could potentially be mined safely and economically. For example, there are new processes in the works to source materials that Michigan mining has historically concentrated on, like cement, clays, copper, iron, limestone, gypsum, salt, and sand/gravel.

There is also the attraction of developing markets for all of the minerals mined, not just the key mineral. If in addition to selling metal ore concentrates, a mine can also sell other products like aggregates, agricultural supplements, and byproduct industrial minerals, then the quantity of remaining tailings can be reduced while also increasing profitability.

"To do this, we need a much better understanding of what is actually being mined and who might potentially want to buy it," Eisele says. "In a perfect mining operation, all of the minerals dug out of a mine would eventually be converted into useful products and the mine tailings would become nonexistent."

Michigan's mines, old and new, aren't going away. To break boom-bust cycles, it takes collaborative and creative thinking to delve beyond what mining used to be and reengineer the training, tools, and spaces to meet the needs of modern extraction and consumption.



One in every seven
Michigan Tech graduates is
part of an Enterprise team.

20 YEARS OF ENTERPRISE

Michigan Tech Enterprise teams partner with industries on real projects, make real product breakthroughs, and run real businesses, workflow to cash flow.

A MULTITUDE OF MULTI-YEAR PROJECTS

Enterprise students design and build satellites and hybrid electric cars. Develop better hockey blades and roof tiles. Create and share low-cost alternatives to expensive hardware and software. More innovations from the 53 teams in program history: mass-water rescue craft and bird-window collision-avoidance systems. Better prosthetics and vaccine-transport carriers.

“There’s something for everyone,” says Enterprise Program Director Rick Berkey. And if the selection of teams is missing something, students are welcome to propose it. That’s how many of the teams started.

STUDENTS WITH SKIN IN THE GAME

Enterprise isn’t required. It’s a choice. Students who join tend to be as passionate about their area of interest as most Huskies are about broomball. They discover that Enterprise isn’t a typical university course—it’s like the work they’ll do when they graduate. The business, communication, and practical skills Enterprise adds to their technical capabilities is well known to companies who prefer to hire Huskies. Many of these companies are involved in Enterprise as advisors, partners, and individual team sponsors.

While faculty and industry advisors are integral, Enterprise puts students in the driver’s seat

(literally, in the case of mobility teams). Students handle the full scope of projects, even if that means making (and learning) from mistakes. “They see the plus side, and the frustrations,” says long-time Consumer Product Manufacturing Enterprise co-advisor Tony Rogers ’94.

That ability to independently problem solve is foundational to the program’s origins.

HOW ENTERPRISE STARTED

Rewind to Michigan Tech’s switch from quarters to semesters. The restructuring was about more than calendar dates; it was a chance to enhance real-world learning experiences. A proposal, “Redesigning Engineering Education with Active Learning and Integration Through the Engineering Enterprise,” was funded through a National Science Foundation initiative to create systemic change in engineering education.

WHERE ENTERPRISE IS GOING

Home base is Pavlis Honors College, a hub for interdisciplinary entrepreneurship as unique as Enterprise itself. Enhanced Enterprise Experience is one of six College pathways on which students craft their own journeys backed by personal and professional development resources that open doors to success. Just as Enterprise has been doing for more than two decades.

MAKING HISTORY

1998



Three-year \$749,000 National Science Foundation grant kickstarts the project. Principal investigator is current professor emeritus Mark Plichta '74 '79, regarded as the Father of Enterprise.

Pilot year with three teams.

First Design Expo, undergraduate showcase of Enterprise and senior capstone projects.



1999-2001

2002-2003



New 20-credit Enterprise minor is offered. Program grows to 17 Enterprises, 400 students, 19 disciplines—76 percent of teams supported by industries.



Rick Osentoski/AP Images for Shell

MILESTONES

A few—of many—Enterprise highlights.

2004 - Blue Marble Security Enterprise forms as a Wireless Communications spinoff to engage students in homeland security innovations.

2011 - Husky Game Development launches Arcane Brawlers on Xbox Live.

2017 - Supermileage Systems wins a technical innovation award at Shell Eco-Marathon Americas.

2019 - The first satellite built by Aerospace Enterprise is launched by SpaceX at Cape Canaveral as part of the Department of Defense STP-2 mission.

2020 - Clean Snowmobile Challenge also celebrates 20 years; it's one of five Enterprise teams involved in the SAE International Collegiate Design Program that impacts more than 10,000 students annually.

2006



The new Institute for Interdisciplinary Studies expands Enterprise accessibility to students from all majors. Institute Associate Director Mary Raber, key to Enterprise growth since its inception, serves as the program's director.

Pavlis Honors College established, becomes Enterprise home base.



2014-2015

2019-2020

Enterprise remains a unique model for multi-year, interdisciplinary, experiential learning under guidance of current director Rick Berkey.



\$10M
in lifetime external support



4,821
Enterprise alumni (and counting!)



91.7%
graduation rate for Enterprise students



24
Enterprise teams



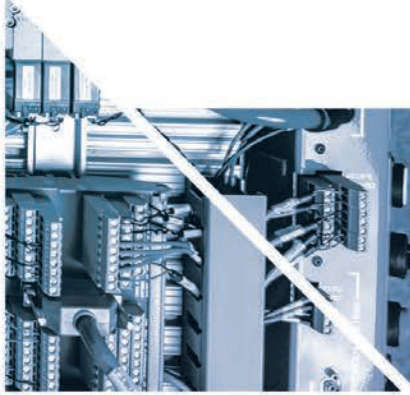
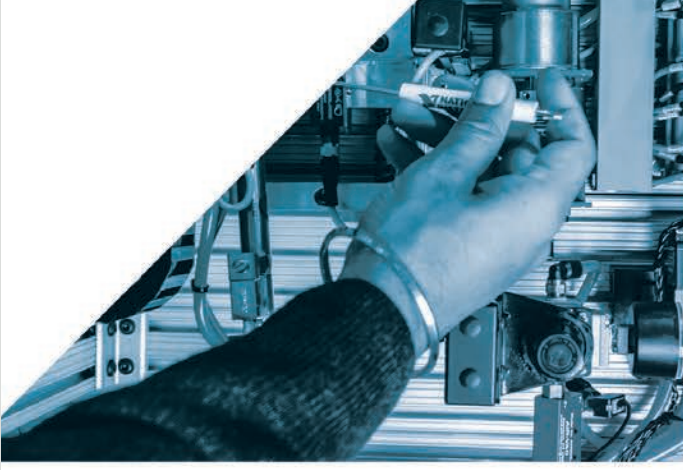
1 in 7
students enrolled in Enterprise



900+
students (2018-2019)



30+
majors represented



“COMPUTING IS MORE
THAN JUST CODING.”

Emily Gochis,
Local MiSTEM Network
Regional Director



HELLO, WORLD!

Computing is the fastest-growing sector across all industries. The National Science Foundation estimated that science and engineering jobs increased by 18.7 percent over the past decade, and 59 percent of that growth was in computing. This upward trend continues. We have a plan for this future: Say hello to the new College of Computing.

When the Association for Computing Machinery (ACM) dug into the 2016 US Bureau of Labor Statistics data, they found that 76 percent of new STEM jobs—careers that didn't exist previously—are in computing. Each year, most new jobs in STEM fields peak around 4,000 new positions. In computing, there are more than 20,000 new jobs opening each year in software development, systems analysis, computing support, and network administration.

Many companies, from Ford to Plexus to Google Cloud, have told Michigan Tech recruiters that computing skills are at the top of their list. With overall job placement rates above 90 percent in nearly all disciplines at MTU—specifically 92 percent in computer science—responding to industry demand means thinking forward to students' future jobs and the preparation those students need now.

"Technological is our middle name," says Adrienne Minerick '98, dean of the College of Computing and professor of chemical engineering, adding that a name is a core identity, not an end product. "The national data reveals how much the T in STEM now means computing, and computing skills bridge all STEM fields."

To connect today's students to tomorrow's jobs, the College of Computing builds on what we already do well: teach students solid programming and data management skills,

execute innovative interdisciplinary research, and run outreach programs to boost K-12 computer science literacy. The first of its kind in Michigan, the College opens up new opportunities like degree programs, specialties in health informatics and cybersecurity, and entrepreneurship—and does so by drawing on the University's existing strengths. From collaborating with the new Institute for Policy, Ethics, and Culture to connecting students to real-world problems through the Enterprise program, senior design, and undergraduate research experiences, the College does not shirk the social challenges that tomorrow's coders, inventors, artificial intelligence (AI) developers, data managers, and artists will face.

"Michigan Tech has always been a university where teaching informs research and innovation, and simultaneously where advanced research enriches students' education," says Tim Havens '99 '00, director of the College's research arm, the Institute of Computing and Cybersystems (ICC), and the William and Gloria Jackson Associate Professor of Computer Systems. "From first-year to PhDs, all of our students are rolling up their sleeves and solving hard problems: They collaborate across degree boundaries in an Enterprise that builds self-driving cars, or new pathways in a large interdisciplinary research project on early detection of Alzheimer's using AI. These are the types of experiences that make Michigan Tech students so sought after by employers."

Minerick and Havens agree: Teaching and research in computing are soldered on the same circuit board. And the connections are many. The College of Computing actively collaborates with 18 other colleges and departments; the ICC's five research centers house 50 members from 15 different academic units to tackle cybersecurity, data sciences, cyber-physical systems, scalable architectures and systems, and human-centered computing. In other words, whether it's healthcare data, virtual reality tech, corporate IT, or climate change modeling, almost every modern system has a computing aspect.

The College offers five undergraduate degrees, four graduate degrees, and the vision is to establish programs that enable every Michigan Tech student to learn the computing skills needed for their dream job regardless of their major. The team has termed these convergence programs; they're not a double-major but a hybrid program at the intersection of disciplines. So, if a mechanical engineering student wants to specialize in robotics, she needs Python programming courses; if a sound designer wants to push music to the limits, understanding acoustic digitization helps him; if a biomedical engineering and pre-med double major wants to improve telesurgery practices, they need to know the principles of human-computer interface design and wireless networking.

"We pride ourselves at setting our first-year students up to succeed and at preparing our graduates to hit the ground running," Minerick says. To do that, Havens says the College has to work with the reality that computing is ubiquitous: "Nearly all innovations are computational. Computers and the language of computing are essential tools for STEM graduates."

Also, the College of Computing faculty recognize that first exposure in an introductory computer science course can be intimidating. So within the computer science degree there are initially two tracks; one that assumes the first line of code a



student writes is in class here on campus and a second track that builds on previous coding knowledge. By the end of year two, both tracks converge to the same classes and challenges.

To help bridge the gap before students reach college, faculty partner with K-12 schools to enhance digital literacy to pique student's interests and increase confidence: Afterschool outreach, summer camps, teacher training, and coding events are all part of the ecosystem. Professors Yu Cai and Guy Hembroff '98 '16 teamed up with the local school district with funding from the National Security Agency and National Science Foundation to put together the GENcyber camp for high school students and their teachers, as well as a career tech education course on cybersecurity. Emily Gochis, director of the local MiSTEM Network office, works alongside Copper Country Intermediate School District Superintendent George Stockero and educational technologist Steve Cass.

"We want to open the eyes for students and their teachers, and create opportunities for students that might not traditionally have access to these programs," Cass says, which Stockero echoes: "We want to get kids excited, inspire them to go to a place like Tech, then hire them back in our community."



Enthusiastic teachers like Nilufer Onder make digital worlds real to students.

Whether students choose to stay in the Keweenaw or pursue careers around the globe, the career alignment and pathways that the College and its collaborators foresee are versatile. The challenges, opportunities, and surprises of spaces where digital meets physical are too numerous and enticing to be fixed on a neat conveyor belt. The assembly-line age of converting students into professionals for the workforce is ending. Instead, the drive of this multi-limbed, semi-autonomous educational machine is fueled by self-authorship, customization, excitement, curiosity, and the strong desire to make a positive difference. A programmer's journey may start with the language basics of the ("Hello,World!") program, but the journey rapidly progresses to real conversations and implementation grounded in a balanced code of ethics, social justice, and resource consciousness. The College of Computing is where they begin.



“COMPARED TO OTHER COLLEGES, THE CS COMMUNITY HERE IS OUTSTANDING—LIKE WE HAVE OUR OWN [DORM] HALL FOR CS PEOPLE AND THAT’S WHERE I LIVED MY FIRST YEAR OF SCHOOL.”

Hunter Higdon,
computer science major



CONVERGENCE

Convergence brings the far-reaching influence of computing back to a core set of research and teaching values. The work redefines the digital interfaces of classrooms, labs, citizen and scientist, manual labor, and automagical processes. The examples are many. Here are a few plugged into the College of Computing.

DRIVE AUTONOMOUS AND CONNECTED VEHICLES

The Prometheus Borealis student team streamlines and vets their AutoDrive Challenge competition car in the same space as industry prototypes, military test vehicles, and farm equipment in the Advanced Power Systems (APS) LABS and on the Keweenaw Research Center’s test tracks. Something most vehicles in the shop have in common: Fixing them up, tweaking designs, and making them road-ready is no longer done simply by popping the hood. Of course, there is no replacing a good mechanic and handling the intricacies of today’s vehicles through models, sensors, and simulations requires a lot of digital elbow grease. To get an autonomous vehicle rolling requires a span of disciplines—mechanical and electrical engineering, human factors, remote sensing—and computing is what gets each part to talk to each other.

Read more at mtu.edu/magazine/mobility

PROTECT HEALTHCARE AND POWER GRIDS

What do energy systems and patient records have in common? Lots and lots of data.

Both are also vulnerable. Cyberattacks can greatly affect energy and health systems and the current technologies they rely on are not up to code, so to speak. While protection and privacy are a big part of the challenge, efficiency and accuracy are also important. Laura Brown, associate professor of computer science, studies how to streamline electricity generation, distribution, and use—and how to help the rapidly evolving grid handle distributed generation from renewables and other sources. Guy Hembroff, associate professor of health informatics, focuses on streamlining healthcare systems.

“While there are many challenges associated with rural healthcare delivery, there is a dedicated passion from medical practitioners to improve care delivery and decrease the expense of healthcare in their community,” Hembroff says. “If technology is done right, it can help support this passion by overcoming many of the barriers of rural healthcare.”

Read more at mtu.edu/magazine/rural-medicine

SUSTAIN PERFORMANCE, EFFICIENCY, AND PRIVACY

Computers and data storage have changed a lot since Sony released the first floppy disk in 1981. As computers and processors have shrunk in size and maximized power, businesses and consumers race to keep up. What has lagged behind, however, is not creating the latest and greatest version but rather improving what's already at hand.

Data management and thoughtful networking is as much art as science in the sense that anyone can write a line of sloppy code like it's finger painting but keeping a program tidy is more than coloring inside the lines. Clean, efficient code affects how much juice a program needs to run, which affects how much electricity the processor demands, which affects the bottom line and environmental footprint of seemingly invisible digital work.

Professor Yu Cai and others work to enhance this efficiency through green computing while others like Bo Chen, assistant professor of computer science, do so by thinking about black hats. That is, more streamlined ways to beat hackers.

"Malware is more and more difficult to detect and analyze," Chen says. "Likewise, our techniques need to be intelligent, too."

Read more at mtu.edu/magazine/malware

DEGREES AND RESEARCH

Research Areas

- Artificial Intelligence and Machine Learning
- Cyber-Physical Systems
- Cybersecurity
- Data Sciences
- Education, Society, and Profession
- Human-Centered Computing
- Programming Languages and Software Engineering
- Scalable Architectures and Systems
- Security and Privacy
- Systems and Networking

Degrees Offered

- Computer Network and System Administration—BS
- Computer Science—BS
- Cybersecurity—BS
- Electrical Engineering Technology—BS
- Software Engineering—BS
- Computer Science—MS, PhD
- Cybersecurity—MS
- Health Informatics—MS
- Mechatronics—MS

MAP HISTORY

Much of the hard work of computing happens behind-the-scenes. But occasionally some projects highlight the beauty of a digital interface. One such example is the Keweenaw Time Traveler.

A collaborative project between computer scientists, historians, geographers, and social scientists, the Keweenaw Time Traveler brings history to the fingertips of local residents and visitors. Using the principles of deep mapping—an understanding of a place through pinpointing culture and stories over time—the National Science Foundation-funded project is brought to life through an online portal where people can look up the history and old maps of a home, business, street, or town.

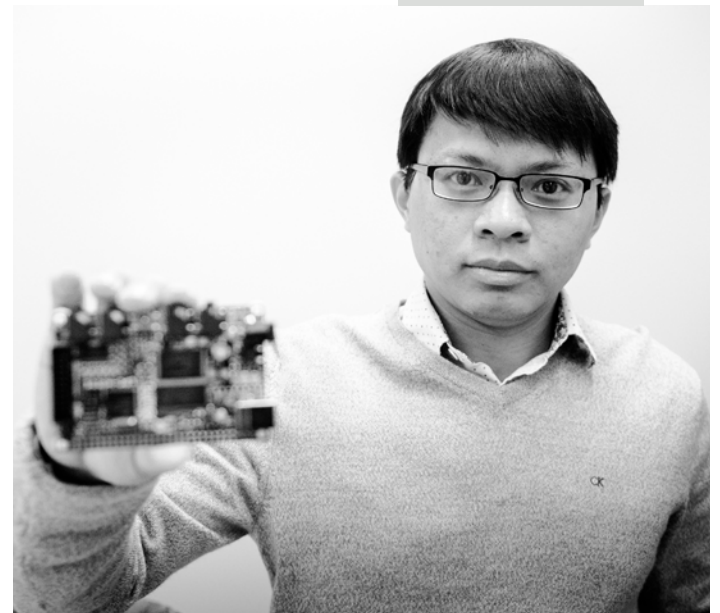
Read more at keweenawhistory.com

REACH OUT AND INTRODUCE

Formal and informal classrooms help students see the whole style sheet for a line of code (a digital way of saying the forest for the trees).

In the community, lecturer and CS learning center coordinator Leo Ureel '95 '03 teams up with enthusiastic undergrads, inspired grad students, and eager K-12 students to pull together coding events like Code Ninjas and maintain groups like the Copper Country Coders.

Bo Chen studies cybersecurity, including hardware solutions to keep mobile devices safe.





CS undergrads hosted Code Ninjas to get local middle schoolers excited about computing.

In first-year courses, professors like Linda Ott build up student skills and interests: “I match up each of my nearly 200 students in CS1000 with department alumni to learn about their careers. Each student writes a report where they show how surprised and excited they are about the diversity of places alums work, from the giants like Amazon, Microsoft, and Google, to small start-ups in all types of industries, to government agencies. That goes for the wide variety of jobs they hold—from software developer to president—and the variety of industries from the auto industry to telecommunications.”

And “student” is not defined by age. In a collaboration between CS and the Department of Cognitive and Learning Sciences, researchers Chuck Wallace and Kelly Steelman work with a team of students to help teach older adults on Saturday mornings at the Portage Lake Public Library. Digital literacy is a challenge across ages. Each group and setting requires the kind of tailored and thoughtful approach built into the College of Computing curriculum and outreach.

Read more at mtu.edu/magazine/transdisciplinary

START WITH A HANDSHAKE

When he couldn’t find the internship he wanted, Garrett Lord decided to put his computer science skills from class to good use. He founded Handshake with two fellow Michigan Tech students, Scott Ringwelski and Ben Christensen.

Handshake is a career network and recruiting platform for students that seeks to level the playing field. As the company puts it, they’re more than a job board, and a job search should work for you. Collaborating with 800 universities and 400,000 employer partners, Handshake has quickly become a competitive app for a competitive job market.

And the skills needed to pull off a bold business venture like Handshake come out of experiences in and out of the classroom. Computing extends a hand and shakes up the norm.

Read more at joinhandshake.com

“WE ARE THRILLED TO BRING THE GOOGLE CLOUD HERO EXPERIENCE TO MICHIGAN TECH, AND LOOK FORWARD TO CONNECTING WITH STUDENTS TO HELP THEM EXPLORE CAREER OPPORTUNITIES IN TODAY’S TECHNOLOGICALLY ADVANCED WORLD.”

Leslie Redd,
learning services,
Google Cloud



CS job placement



jobs are STEM-related in Michigan

(State of Michigan Bureau of Labor Market and Strategic Initiative)



computing job growth rate 2010-20

(National Science Foundation)



of new jobs in STEM fields are in computing through 2024

(US Bureau of Labor Statistics, Association for Computing Machinery)

MEDITATION WALK

Stand. Feel your feet on the earth. Listen. Hear birds call, pine needles drop. Breathe. Inhale and exhale deliberately. See. Choose your focus, with the lens of eyes or camera. Notice how you complete the circuit.

The Contemplative Forest Art Walk at Michigan Tech's Ford Center in Alberta, Michigan, is open to all. But it was created for students. The installation, a series of panels (the largest roughly 10 feet long and 73 inches wide) by public artist and visual arts professor Anne Beffel, is a five-minute walk from the dorm.

"Students can be in the forest in a way that is highly integrative," says Beffel of her latest work, which was created at the invitation of the College of Forest Resources and Environmental Science.

"The project is a collaboration, hand-in-hand with the forest," says Beffel, whose process, often a one-drop-at-a-time medium layering with custom-mixed fabric paints, evokes and complements nature's blue-green horizons. Like science, and meditation, it required patient experimentation. The complex simplicity of an evenly distributed focal point left space for the forest to do its work.

"Putting panels in the forest requires engineering," Beffel says. She tested materials for drape and durability; hemp behaved best in the wind. There are a dozen parts to the copper armature used to hang the works. The design took longer to innovate and build than the paintings themselves.

The walk demonstrates how the well-documented mind-body health benefits of meditation also apply to education.

"THEY'RE DOING THE DRAWING—THE TREES, THE WIND, AND THE SUN."

Anne Beffel,
Artist and Professor of
Visual and Performing Arts

"Students are learning different ways to notice and choose how they use their minds. That's an invaluable skill," says Beffel. Especially for digital natives, accustomed to staring at screens. The walk challenges the eyes to see in different ways, moving from single-pointed focus to open awareness, consciously regulating what is taken in.

"The banners offer a different kind of screen," says Beffel.

The time-based installation opened in July and remained in place for months. Beffel, who created a similar community-oriented project in Shoreline, Washington, with a circuit installed for nearly a year, views the inevitable weathering process with boundless curiosity and no deadline.

"I'll know when it's time."

Access the meditations at annebeffel.com



Director of Esports Kaitlyn Roose is a doctoral researcher in the University's Games, Learning, and Decisions Lab.

GAME CHANGER

Deep strategy. Fast-twitch muscle mechanics and memory. Peak mental and physical fitness. Teamwork, communication, and problem solving. Welcome to the world of esports, where technology amplifies competition and success is a matter of speed, precision—and complex, critical thinking. In fall 2020, Michigan Tech will be the first public university in the state to offer esports at the varsity level.

On October 19, 1972, Stanford University students gathered in the school's artificial intelligence lab to wage war. Their battlefield was virtual: a sci-fi rocket-combat video game called Spacewar. To the victor went the spoils: a one-year subscription to *Rolling Stone* magazine.

Fast forward to 2019, and video game competitions are much more than an isolated one-off.

Esports programs—organized, multiplayer, online competitions viewed by nonparticipants both in-person and via livestream—are a burgeoning trend in collegiate athletics. As of October 2019, more than 170 colleges and universities (including Michigan Tech), as well as 5,000-plus student-athletes, belonged to the National Association of Collegiate Esports, the only association of varsity esports programs in the US.

"Esports is an emerging field, and it's also one of the fastest-growing areas of competition internationally," says Suzanne Sanregret '93 '06, Michigan Tech's director of athletics. "Gaming and computing are an integral part of the culture at Michigan Tech. As a leading technological university, we think it's a perfect fit."

Esports also form the basis of a flourishing industry. According to a recent report from Newzoo, a market research company that's forecasted the gaming industry for more than a decade, the global esports market is expected to reach \$1.1 billion in 2019, with a global audience of roughly 454 million.

The popularity of esports is no surprise on Michigan Tech's campus, where approximately 70 percent of the student body identify as gamers. Husky Game Development is one of Tech's most popular Enterprise programs, and the University boasts multiple student gaming organizations, some of which participate in conventions and conferences.

In October 2019, Michigan Tech Athletics named Kaitlyn Roose '18 as director of esports. Roose will soon finalize the list of games in which Tech will compete—options include League of Legends, NBA 2k, Overwatch, and Super Smash Bros—and begin recruiting players. "I intend on creating a collaborative and empowering culture within the esports program," Roose says, "inspiring students to challenge themselves and each other, while succeeding inside and outside of the classroom."





Skiplane flights support the researchers as they count moose and wolves and observe wolf behavior.

SUPPORTING WINTER STUDY

Winter research on Isle Royale is done on skis and by plane.

A line of spruce trees stark against the white. On every horizon, indigo ice honeycombed or wind-polished. Snow dunes echo the ridges of the island.

From densely clumped balsam fir, a dark shape emerges. An elderly moose struggles through deep snow, its breath rapid clouds of desperation. Moments later, smaller shapes burst through the tree line, their own breath the vapor of hope. The wolves and moose of Isle Royale have for decades engaged in this dance of survival, keeping each other in check.

The moose stumbles and the wolves see their chance. Soon, they will eat a meal that will satisfy their hunger for a week. Soon, the ground will bear evidence of the life-and-death struggle, circles of scarlet on the snow.

The silence is broken by the low hum, growing louder, of an airplane's engine. In the pewter sky, just above the trees, a pilot and an ecologist stare down on the scene below. The ecologist frees a camera from her heavy coat, where its battery is kept warm by her body heat. The cockpit of the 1946 Champ is cold as subzero air arcs over the fuselage. The pilot expertly tilts the plane while the ecologist presses her finger to the shutter button.

Across the island to the east, the snow is crisscrossed by two pairs of skis. Two figures, bundled against the chill, climb a ridge, scrambling over fallen trees and skirting tree wells. They stop, and one kneels to examine snow packed into a bed of sorts. The pair collects moose pellets into a bag and takes clippings of a recently browsed fir tree. Samples collected, the man and woman pause. They reach for insulated water bottles, and the sharply sweet odor of Tang rises in the air. They nibble peanut butter sandwiches, then put their

gloves back on and drop down the backside of the ridge, their skis etching easily through the snow.

Michigan Tech's Winter Study is the longest running examination of a predator-prey relationship in the world—2020 is its 62nd year. The data collected over the decades on Isle Royale, a 45-mile-long island in Lake Superior, has shaped the way humans understand how wolves and moose interact. The island's remote and wild nature makes it the perfect laboratory to understand predation, herbivory, and genetic adaptation. But the remote and wild nature also make the work difficult to conduct.

Supporting the Winter Study research and Michigan Tech ecologists are the National Park Service, the National Science Foundation, and the donations of hundreds of people. But the project heavily relies on four people—two pilots and two wildlife biologists who also happen to be incredibly talented skiers. Don Glaser and Don Murray fly small prop planes to study the wolves and moose from the air. Ky Koitzsch and Lisa Osborn Koitzsch have expanded the use of backcountry skiing for winter fieldwork in Isle Royale and Yellowstone national parks.



Ky Koitzsch collects a moose pellet sample.





Lisa Osborn Koitzsch records moose foraging data.

BLAZING TRAILS

Koitzsch and Osborn Koitzsch have been skiing for science since 2008, first in Yellowstone and now Isle Royale. In both national parks, the couple has aided researchers by collecting fecal and urine samples as well as samples of what the studied animals eat. In the winter, there is only one road through Yellowstone; on Isle Royale there are no roads across the island. The fastest way to travel through the backcountry is on skis.

“In Yellowstone and Isle Royale, much of the winter work was done on snowshoes, but it was slow and inefficient,” Koitzsch says. “We’ve improved the way the fieldwork is conducted and expanded the range where data is collected. It’s fun. We’ve been teaching people to travel more efficiently in the backcountry.”

This work includes using proper equipment—the pair use Madshus Epoch light backcountry telemark skis fitted with skins to allow them to go uphill as well as down—and knowing how to layer against the elements in order to ski for eight hours and cover six to 10 miles daily in temperatures ranging from 10 degrees below zero Fahrenheit to 20 degrees above.

“We love the cold and the peace and solitude of the wilderness,” says Koitzsch. “There’s really nothing we’d rather be doing than learning about the wildlife we enjoy in a setting like Isle Royale. For us, it’s exhilarating.”

The daily work of collecting samples on Isle Royale includes skiing a grid around Windigo, on the western side of the island, or near Daisy Farm, on the eastern side. These locations are nearest where the moose congregate in the winter, and consequently where the wolves spend the most time, too.

Koitzsch and Osborn Koitzsch collect matched pellet and urine samples from as many different moose as possible to help Michigan Tech researchers conduct microhistology, the study of fecal matter under a polarized light microscope to determine what an animal ate and how that plant affects the animal’s physiology.

“Every day is different because we’re always going to different places,” Osborn Koitzsch says. “Our tasks are the same: collecting vegetation samples, moose pellet and urine samples. But our days are never the same. We’re skiing across, climbing up and down based on the topography and terrain.”

At night, the skiers rendezvous with researchers and pilots at Windigo, where the business of tucking into a fortifying dinner is taken seriously. Over the snap and spark of the fire in the woodstove and the warm, comforting smell of bread baking, the tiny group of humans—separated from their own species by many miles—read, play cards, and plan the days ahead. Winter Study is just seven weeks each year, yet it is a cocoon of focused research and the basis of lifelong friendships.

“Finding such adaptable people who are willing to work incredibly hard for eight hours a day in bitter cold and live under such primitive conditions, yet also be such a pleasure and fun to work with, that’s why Don Glaser, Don Murray, and Ky and Lisa are so important to this project,” says Sarah Hoy, research assistant professor in the College of Forest Resources and Environmental Science (CFRES) and the newest ecologist on the project.

AERIALS IN THE SKY

Though the skiers are efficient, an essential form of travel to track the wolves and moose of Isle Royale is by air. Since the beginning of the predator-prey project in 1958, small aircraft and the pilots who fly them have played a pivotal part. Don Glaser, who is in his 80s, has been a part of the project since nearly the beginning. Don Murray is the grandson of another Don Murray, who was the first long-term pilot on the project.

Rolf Peterson, CFRES research professor and the project’s longest-serving scientist, came to Isle Royale first as a graduate student in the 1970s, borne through the sky in Murray’s Aeronca Champ. John Vucetich ’94 ’99, CFRES distinguished professor and the project’s lead ecologist, cut his teeth on the project from the cabin of Glaser’s Supercub.

“Everything that I have learned about how to observe wildlife from an aircraft, I’ve learned from Don Glaser,” Vucetich says. “For the first few years (of the Winter Study aerial survey), I felt like a secretary. I just wrote down what Don told me to write down.”

Murray was raised on his grandfather's stories of the island, and so it's hardly surprising that one day he would also serve as a pilot for the project. Murray works as a game warden for the state of Minnesota and takes vacation time every year to fly the skies above Isle Royale.

"My wife likes to joke with our friends that I'm out lounging on some island," Murray says with a smile.

In reality, Murray and Glaser spend their days flying ecologists on aerial survey, maintaining their airplanes and making sure the plane skis don't freeze to the ice, chopping wood and hauling water, and taking turns with the rest of the crew making dinner.

"We're always looking for tracks," Murray says. "We're flying, zigzagging in and out of bays. Sometimes we come around the corner, and there are the wolves on the ice. Or we find a moose kill. On every flight there is some kind of find, whether a kill we didn't know about or wolf tracks.

"It's hard to see the tracks from the plane. Windblown areas give you a time frame on

whether the tracks are fresh or if the wind picked up and filled them in. It's a bit of an art I'm still learning. My grandfather had it perfected."

Murray's grandfather retired his wings when his eyesight began to fail and sold the 1946 Champ airplane. Years later, Murray's father by chance found the plane parked unused in a Minnesota field. Murray bought the plane back, and with its restoration and newly updated red-and-white paint job, the aircraft looks like not a moment has passed since its first flights above the island.

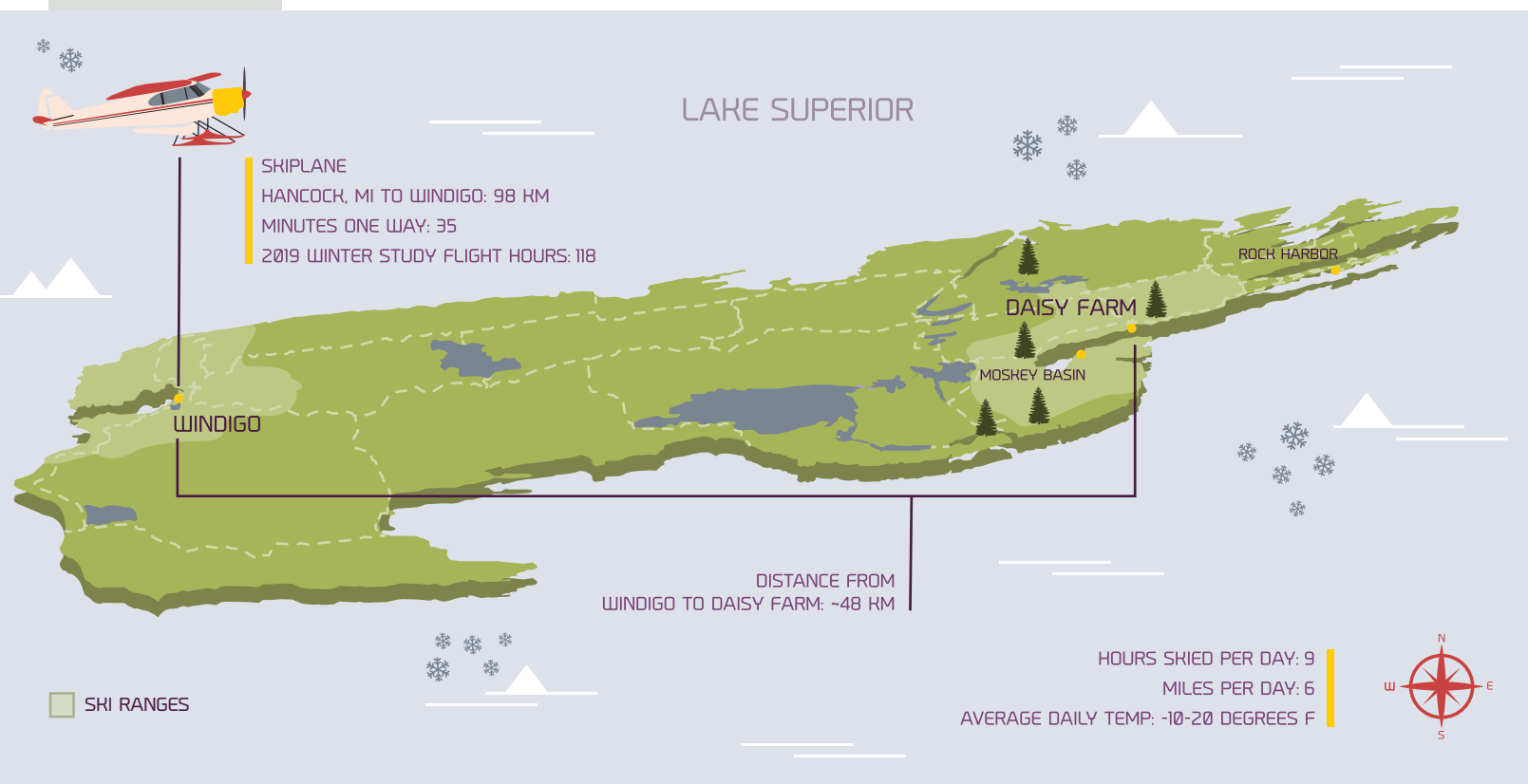
"The airplane I fly is a time machine. It's as close as walking in my grandfather's footsteps as I can possibly get," Murray says. "We're flying the same airplane, flying the same ecologist. My grandfather flew Rolf as a PhD student, and I've got Rolf as an old wise-hat teacher."

Murray's affection for the island is heartfelt.

"I like flying along the coast looking for wolf tracks, all the islands and bays," he says. "The big ice formations, the high cliffs, the way the water puts big icicles that hang off the cliffs. The wind comes along and pushes the ice chunks up in heavens. They become beautiful blue-colored pyramids, a mosaic."

Like tracks in the snow, the island's moose and wolves have cut paths through the field of ecology. Alongside them are the tracks of skis—telemark and airplane—written into the story of Isle Royale.

Aerial and ground surveys of moose and wolves occur annually during the winter.



A student programs
theatre sound cues in
QLab software.

SOUNDS OF SCIENCE

At Michigan Tech, students take one of the oldest art forms known to man and give it some high-tech juice.

Modern theatre dates back to sixth century BC Greece when the poet Thespis won an oratory contest and became the first ... thespian. Yet the art of performing likely began in Indigenous cultures with the oral tradition of storytelling.

Of course, no matter the century, those early performances look nothing like today's. Take a stroll backstage at any Michigan Tech production and you'll see that computers are as common as spotlights. But ancient theatre does share a common bond with theatre today—a reliance on science.

Josh Loar, professor of practice in Tech's Department of Visual and Performing Arts (VPA), says the science of sound is complex. "There is so much science involved in sound design—acoustics, electronics, physics, data networking, computer programming, and on and on."

Loar says the marriage of art and science is not a modern phenomenon. "Storytelling in a cave relied on an understanding of acoustics. Storytellers would make sure their backs were to the wall to enhance their sound. The Greeks built their theatres on hillsides, taking advantage of natural acoustics. Science has always been a part of theatre."

A TECHNOLOGICAL ART AND CRAFT

At Michigan Tech, the science of sound, and in particular sound design, is serious business. World-renowned sound design and audio production and technology programs boast a 100 percent job placement rate. "Our graduates get hired, period," Loar says. Many of those graduates walk right into high-level jobs throughout the entertainment industry. And each of those jobs, whether it's running a mixing console at an arena rock concert, designing sound for a video game, or working with a regional opera company, demand knowledge of and training in many scientific disciplines.



The sound control board is an essential part of a live performance.

"Sound design and production in all its forms is a technological art and craft," Loar says. "While the discipline of acoustics is the foundation of how we experience sound, we can't understand how to produce it if we don't understand the fundamentals of electrical theory, of digital audio theory, of transducer design, computer and networking practice, and so on. The better they understand all the technological underpinnings, the more able students are to truly create and innovate in sound."

Perhaps the biggest difference between ancient theatre and today's entertainment industry came about in 1975 when *A Chorus Line* incorporated



GO

S2 - (Untitled Group Cue)

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Preshow

/layer1/clip2/connect 1

Deck 01

/layer8/clip/connect 1
/layer9/clip/connect 1
/layer10/clip/connect 1
/layer11/clip/connect 1
/layer12/clip/connect 1
/layer8/clip/connect 1

Deck 01

Media

Number

00:00:00

00:00:00

00:00:00

00:00:00

Target: (not specified)

Plugin

Notes

Auto-load

Insert

AudioLab iMac 4

58:b0:35:a3:18:86



David Brown hard at work on the score for *On the Verge*.

computers into live theatre for the first time. Today, students often run all the sound cues for a rehearsal or performance from a tablet that allows them to hear the show from various parts of the house without being tethered to a control setup.

“An understanding of computer science is a prerequisite for sound design. Virtually everything we do involves computers. Sound recording, audio processing, editing, and even pre-show sound checks and the running of the show itself are all done with computers,” Loar says.

BEGIN WITH NATURE

An understanding of the technical aspects of sound design isn't enough when you're dealing with art, especially an artform as intimate and personal as theatre. Loar says the study of sound design starts with listening in great detail to the world around us: “We must first pay very close attention to the sounds that surround us, both human-made and natural. From there, we must begin to ground ourselves in the storytelling traditions of theatre, film, television, and video games.”

He says where reality and fantasy mesh is where the real beauty of sound design can be found, and of

course science plays a huge role. In the movie *Raiders of the Lost Ark*, for instance, Loar says the sound of Jones' handgun was a blend of sounds made in real life by much heavier weaponry.

According to Loar, to make the appropriate connection with an audience, it is essential to understand how they feel and how you want them to feel. That's where an understanding of the science of human factors and psychology come into play. “If we observe how sound is used, how it makes us (and others) feel, we start to use our creative tools to shape an audience's perception and emotional experience.”

If you don't know that a creaking hinge makes people feel creeped out in a horror movie, then you can't manipulate that perception. “But if we do know that, then we can put a creaking hinge where we wouldn't expect it and subvert the expectation, change the mood of a moment. On the flip side, if a gate-opening scene in a creepy cemetery makes the sound of a squeaking rubber ducky, we can elicit a laugh from the absurdity of the unexpected.”

Knowing when to give an audience what they expect or want, versus when to cut against that, is a huge part of the art form. This, of course, is another area where art and science come together.

“WHAT A HANDGUN SOUNDS LIKE IN REAL LIFE IS NOT WHAT WE WANT INDIANA JONES' HANDGUN TO SOUND LIKE—HIS MUST BE BIGGER AND MORE POWERFUL BECAUSE HE'S THE HERO.”

Josh Loar,
Professor of Practice of
Visual and Performing Arts

The Quincy Mine plays host to the Haunted Mine Tour every year, featuring designs by MTU students.



HIDING IN THE MINE

Senior sound design student Aaron Christianson, one of the lead sound designers for VPA's Haunted Mine project at the Quincy Mine, uses a knowledge of psychology when determining speaker placement.

"As sound designers, we know that audio is perhaps the most triggering human sense," Christianson says. "We are very aware of that when we design a show or system. The goal is to make sounds come from a place that makes sense, so it seems more believable to the audience. We also don't want them to really know that it is coming from this speaker in this place, so we do our best to hide them in a way that gives us the highest possible sound quality to facilitate our intent."

Christianson says several scientific aspects come into play for the Haunted Mine; however, when the goal is to scare people, psychology comes to the forefront, as the sound designers need to understand what sounds truly scare people.

"Most children have a shared traumatic experience that is pretty common—creepy clowns, large-scary-monster noises, spiders, snakes, to name a few. We know a bank of real-world, easily obtainable sounds that can be sourced and edited slightly to make them even more creepy. One of the best parts is having a sound come from something you can't see, and a sound that is altered enough so you can't really tell what it is."

While theatre is an expressive, intimate, and personal art form, sound design and audio production and technology students at Michigan Tech know that science is the driving force behind the art.



ON THE MIC

By Mark Wilcox

I've been in dozens of plays since the early 1970s. However, it wasn't until a 2013 Michigan Tech production of *Fiddler on the Roof* that I wore a microphone on stage. I certainly understood why; singing over a full orchestra to a packed 1,000+ seat house, I needed all the help I could get.

A year later I was in a production of *Antigone* in the McArdle Theatre, a "black box" theatre in the Walker Arts and Humanities Center. It was a small and intimate setting where the actors were within feet of the audience. As a matter of fact, my character sat in the audience and rose several times to comment on the action of the play.

Once again, I was mic'd up. And to be honest, I was offended. While my college drama-major days were a few decades behind me, I was trained to "hit the back wall" from the stage of pretty much any auditorium.

It was at that point when I really understood what sound design at Michigan Tech was all about. In my limited experience with sound design for live theatre, I assumed microphones were only used for amplification.

What I didn't know was that sound design students do much more to the human voice than make it louder.

"We'll use voice processing software to create special effects," Josh Loar says. "It's not about making it louder, but shaping the sound." For *Antigone*, the voice processing melded with the other digital sound effects to create a mystical ambiance in the telling of the Greek tragedy.

In a production of Steve Martin's *Picasso at the Lapin Agile*, the digital voice processing blended in with a myriad of other sound effects.

For a 2018 production of Shakespeare's *A Midsummer Night's Dream*, voice processing was used on actresses' voices so the fairies sounded just like fairies—or at least what I would expect fairies to sound like.

Couple voice effects with strategic speaker placement, and audiences are treated to an "out-of-this-world experience," even when the actors are 10 feet away.

A NEW LINE OF DUTY

From left, Heather Knewtson, Mari Buche, and Glen Archer are among faculty who served in the military.

Veterans of the US military find Michigan Tech a great place to learn—and teach.

Glen Archer came to Michigan Technological University as a major in the United States Air Force to work with the University's Air Force ROTC detachment. After he retired from the military, Archer '13 stayed at Michigan Tech, earned a PhD in electrical engineering, and joined the faculty.

Michigan Tech is routinely ranked a great school for veterans. And, like Archer, dozens of men and women who have served their country find it is a great fit in civilian life as well.

THREE CAREERS

"I actually had two careers in the Air Force," Archer, interim chair in the Department of Electrical and Computer Engineering, says. He enlisted in the Air Force in 1972 and spent the first half of his nearly 30 years in the military as an enlisted person. "As I was nearing the 15-year mark, I enrolled in the Airman Education and Commissioning Program (AECP) at Texas Tech." AECP gives enlisted personnel the opportunity to complete their bachelor's degree and subsequently earn a commission. Archer spent the next 14 years as an officer in the Air Force, retiring with the rank of major.

Archer says his military service shaped his world view. "The first thing you'll find (in the military) is a focus on the mission. We let other considerations take a secondary role, and we're really willing to bring the resources necessary to complete the mission." Archer's wife Ruth '86, the director of continuous improvement at the University, is also an Air Force retiree.

Archer feels a military background is an advantage in the classroom. "The military gives you a sense that you are part of something bigger than yourself. You tend to look at communication and leadership differently than civilians."

Archer says he often recommends military service to his students and has written several letters of support. He took that support a step further last year when he flew to Texas to help administer the officer's oath to a former student.

TRAINING GROUND FOR LEADERSHIP

Heather Knewtson finds similarities between serving in the US Army and on the Michigan Tech faculty. Knewtson, an assistant professor of finance in the College of Business (COB), says she has carried the leadership skills she observed and learned in the military into civilian life. "As a professor, the context has changed, yet soldiering skills are put to direct use—establish trust, teach skills, make the mission clear, and hold people accountable."

Knewtson served from June 1988 to June 1992. She served in the 701st Military Intelligence Brigade in Augsburg, Germany, at the end of the Cold War. She says she learned leadership from great leaders among both officers and enlisted. "I learned that authority is both formal and informal."

She says her squad sergeant, Staff Sergeant Mike Walz, was an accomplished leader who entrusted his squad members to perform beyond their rank. "For example, as a private first class I took the initiative to serve my unit as the training sergeant. Sergeant Walz extended me this authority, although I was not a sergeant. Competence and initiative were recognized and informal rank was extended to accomplish the mission."





Heather Knewton, center, with her NCO development course graduating class.

She sees that same quality among students at Michigan Tech. “Many will show initiative and yearn for more. This is to be encouraged and developed. We need leaders in business as well as in the military.”

Knewton says she is, above all, “grateful for the opportunities to serve my community, Michigan Tech, and the US Army.”

AN EDGE

Shane “Sully” Sullivan is manager of merchandising operations (Campus Store and University Images) and oversees Campus Store daily operations. In that capacity, he leads full-time and student staff responsible for sales and inventory of course materials, school supplies, University apparel, and even snacks and beverages. It’s the kind of job that demands flexibility and the ability to think on one’s feet—skills Sullivan picked up serving in the US Air Force. His tour of duty took him from Ramstein, Germany, to Gwinn, Michigan’s KI Sawyer AFB. During his six-year stint, he served as a security policeman, rising to the rank of sergeant.

“My military career provided me a lot of opportunities to experience a wide range of cultural aspects, from food, history, art, and architecture,” he says. “Professionally, the military broadened my leadership skills and taught me how to handle stressful situations and think quickly on my feet with little or no information.”

Sullivan says the specialty training he received in the Air Force “stressed the importance of teamwork, hard work, attention to detail, and strong communication.” Most importantly, he says, the military made him even more trainable for whatever career path he chose. “For employers who were hiring, even though they weren’t seeking someone with military experience, I’d like to believe having that experience gave me an edge.”

MISSION: ACCOUNTABILITY

Like many Michigan Tech faculty, Mari Buche’s service in the military began in college. Buche, associate dean and professor of management information systems in COB, was commissioned as a second lieutenant through the Air Force ROTC program at the University of Georgia. Her career field was ICBM missile operations.

“My military service has shaped me as a professional and, in turn, has impacted my academic career. Some of the most obvious areas are leadership training, time management, and integrity,” Buche says. “As military officers, we were trained to accept responsibility and to look out for our people—simultaneous attention to both mission and personnel. The less obvious outcomes of military service are loyalty and empathy, two traits that are equally important today. We worked closely as a unit and we held each other accountable. When work needed to be done, we worked together to meet deadlines.”

SUPPORT AND ADVANCEMENT

Unlike others interviewed for this story, Nancy Seely did not start at Michigan Tech following military service—but during it. Seely joined the US Coast Guard Reserve in 1983 while living in Texas. Three years later, when she and her family moved to Houghton, she transferred to the USCG Reserve Unit Portage located in Hancock.

Despite coming to work for Michigan Tech in 1993, Seely's Coast Guard career continued to thrive. "I found myself invited frequently to address Army and Air Force ROTC students about the mission and responsibilities of the Coast Guard."

Seely began to move up in the enlisted ranks and was assigned in 2009 to Coast Guard Sector Sault Ste. Marie. As her military career grew, so did the support she received at Michigan Tech. "Bill Kennedy [then director of what was known at the time as the Center for Teaching, Learning and Faculty Development] and Mike Meyer [director of the William G. Jackson Center for Teaching and Learning] always supported my Coast Guard activities and allowed me the flexibility to adjust my work schedule when necessary. It was great to work for those who understood my efforts to balance two careers."

Seely retired as a command master chief. "I became a role model and mentor for other female members of the Coast Guard. It was most satisfying to watch women whom I worked with and counseled advance in their own careers."



Nancy Seely retired after serving more than 30 years in the Coast Guard Reserve.

She says what worked for her certainly would work for others. "For those interested in military service but not able to pursue their interest full time, I would highly recommend the reserves. I found myself doing so many things I had never imagined and working with great people in rewarding ways. For those working at Michigan Tech, it helps that the University has a strong reputation as a military-friendly institution."

The reputation of Michigan Tech as friendly to veterans is what attracts both those who come to learn and those who come to teach. As Archer puts it, "There are enough comrades here to provide mutual support, but not so many that it becomes oppressive. We can blend in here. Michigan Tech is a good place."



Mari Buche during combat crew commander training for Minuteman II ICBM weapon systems. (Whiteman AFB, Knob Noster, Missouri)

Q+A

:NICOLE LOPEZ



Before she became an FBI agent, 2008 Michigan Tech graduate Nicole Lopez guarded terrorists in military prisons and conducted night raids as part of an elite military team identifying High Value Targets in Afghanistan. None of the accomplishments came easy. Hearing loss, discovered in early childhood, presented extra hurdles.

But the psychology major, who minored in military arts and sciences and Spanish (later earning a master's in forensic psychology), knew that figuring out what you want and pursuing the goal for as long as it takes will take you where you want to be—from Army ROTC cadet and setter on the Michigan Tech Women's Volleyball team to a fulfilling career investigating violent crime.

Q: You experience moderate hearing loss in your left ear. Is there technology that's been helpful?

A: My parents noticed my hearing loss when I was young. I was missing a bone in my middle ear and needed an ear drum replacement. I underwent several surgeries. By the time I reached high school, a hearing aid was recommended, but a standard aid didn't make a significant difference. During my college years, a new bone-anchored hearing aid (BAHA) was found to have great success for those with single-sided hearing loss. Because I was an ROTC cadet, it was recommended I wait

until the Army officially approved the device. In 2013, the Army paid for my BAHA implant; I receive follow-up treatment through Veterans Affairs. In recent years advancements have been incredible. My device allows for Bluetooth connection (I can answer phone calls and listen to music through my hearing aid!).

Q: When you couldn't enlist after high school and programs including West Point turned you down because of hearing loss, what kept you going?

A: Once I had my mind set to be an Army officer, I refused to accept rejection, especially when I knew there was a chance to pay for college. I researched all the options and exhausted every avenue until ROTC granted my hearing waiver during the national application process. During my medical screening, I submitted additional paperwork to show that I could perform the duties required to pursue a military career. The waiver allowed me to be a cadet at whatever school I was accepted to.

Q: Why did you apply to Michigan Tech?

A: When I started looking at colleges, I narrowed my list to schools where I could pursue a civil engineering degree, play on the volleyball team, and join ROTC—a very limited number. Michigan Tech offered me full scholarships for both volleyball and ROTC, but it was my recruiting visit that landed the deal! I fell in love with Tech the minute I stepped on campus. While I changed majors after my first year, I never regretted the decision I made for choice of school.

Q: You call the Cultural Support Team “the coolest job I’m ever going to hold in the military.” What was so impactful?

A: The Cultural Support Team (CST) was a new program when I applied. Most people weren’t aware of the impact women were having on the battlefield in Afghanistan. During selection, I was up against women just like me: the top females in their units with the highest physical fitness scores. But rather than competition, I found a support system that encouraged each of us to be our best. After training, each woman deployed with a separate all-male Special Operations team considered the military’s best of the best. Our job was to help teams access half the population that was previously unreachable: the women and children. In Afghanistan, it is culturally inappropriate for a male to talk to a female, much less search a female. When teams went on night raids looking for High Value Targets we accompanied them to search and question women and children. CST work contributed greatly to the mission. The program still exists. More doors have opened, including removing the ban on women in combat and allowing us to pursue careers in any branch of service.

Q: After Afghanistan, you set your sights on the FBI Academy. What appealed to you about a job with the Bureau?

A: I left Army active duty in 2013 because I’d already held the exciting positions I strived for. It was time to build a life beyond constant deployment. I’d been a military police officer for over five years, so I knew I enjoyed law enforcement. Working for the Army Reserves as a civilian while I went through the federal application process confirmed my need for a job that was not desk-centric. Looking back, I have no idea how I was able to wait four years to receive an offer, but I don’t regret waiting now that I am in this field.

Q: You investigate violent crime. What’s satisfying about your profession?

A: Violent crime investigation is exciting because of the fast pace and variety of cases. Every day is different. I work a wide range of investigations—from gangs and drugs to bank robberies and extortion. I am not at my desk every day, or completing monotonous tasks. The job requires strong self-initiative and drive, but is very rewarding when you see positive outcomes and get to hold individuals accountable for their crimes.

Q: Is it true that watching Hallmark movies is one of the ways you de-stress?

A: Completely true! I love a cheesy Hallmark classic. So much of my work life is unpredictable and can contain a lot of stress or adrenaline. Sometimes I crave predictability, knowing that there is always going to be a happy ending. I also work out and play sports to relax. I find my way to a volleyball court as often as I can; I still dabble in broomball and other sports when leagues are available. I try to keep my fitness level steady so I can stay mentally stable and physically fit for my career and the Army Reserves.

Q: What does it feel like to be in *People* magazine?

A: It’s still pretty unbelievable. I was hesitant because I knew my entire life would be exposed to the internet once the interview published. But the feedback I’ve received is nothing short of amazing! Most rewarding is how many friends and acquaintances showed their daughters the story.

My grandfather, drafted as a marine in World War II, was my hero. I was honored to follow in his footsteps into the military—but his generation didn’t talk about their experiences. I went into the military without truly understanding what I was getting myself into. My hope is that the article will give women who have never considered these career fields a fresh perspective from someone they can relate to. I also love that I can share the story with my son when he’s older.



“NICOLE WAS ONE OF THOSE STUDENTS WHO BEST EXEMPLIFY HUSKY TENACITY. HER MOTIVATION, DETERMINATION, AND WORK ETHIC AS A STUDENT, ATHLETE, AND MEMBER OF THE ROTC PROGRAM WAS EXCEPTIONAL.”

Susan Amato-Henderson,
Chair of the Department
of Cognitive and Learning
Sciences

There’s no such thing as a regular day on the job for Nicole Lopez.

2019 ALUMNI UPDATES



Michigan Tech's 2020 Alumni Reunion takes place August 6-8.

Visit mtu.edu/reunion for more details.

SAVE THE DATE FOR ALUMNI REUNION 2020

Michigan Tech alumni and friends are invited back to campus August 6-8 for Reunion 2020. Featured classes for next summer's event are 1970 (50 years = Golden Ms), 1980, 1990, 1995, 2000, and 2010.

Catch up with your classmates, enjoy a pasty or pickled egg, and see what's new on campus. Reunion programming includes great opportunities to explore Michigan Tech and the area.

Contact your classmates now, and spend a summer weekend on campus and in the Copper Country reminiscing.



Alumni gather at the annual Reunion pasty dinner.



A Michigan Tech alumnus invented and patented the paintball.

HELP US IDENTIFY HUSKIES WITH PATENTS

The US Patent and Trademark Office has issued more than 10 million patents in its existence. No doubt thousands of those are held by Michigan Tech alumni.

Some of the more famous patents we're aware of: the paintball (Charles Nelson '36), the tunnel-boring technology that dug the Chunnel (Richard Robbins '56), and touchscreen technology (Hal Philipp '75). There are others in materials science, computer components, automotive parts, and even human prosthetics!

We know there must be many more. Unfortunately, there's no way to search the patent website by alma mater.

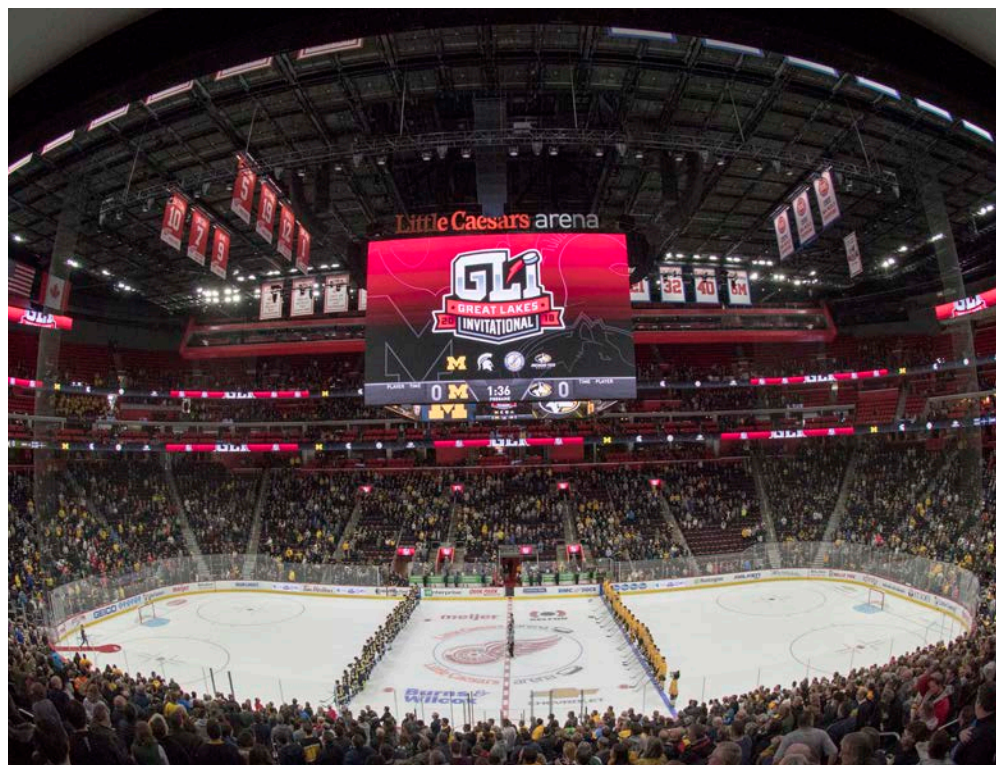
We need your help! Email us at alumni@mtu.edu if you or someone you know holds a patent.

JOIN US AT GLI

Michigan Tech will host the 55th annual Great Lakes Invitational on December 30-31, 2019 at Little Caesars Arena in Detroit. The Huskies will open against Michigan State in the first semifinal at 1 p.m. on Monday (Dec. 30). University of Michigan and Ferris State will play in the second game at 4 p.m. The GLI semifinal and championship games will be played at 11:30 a.m. and 2:30 p.m., respectively, on Tuesday (Dec. 31).

Michigan Tech alumni and friends are invited to connect with fellow Huskies in the 1701 Pub (Little Caesars Arena, upper concourse, SW corner near the Meijer entrance) an hour prior to each Michigan Tech game.

Visit events.mtu.edu for ticket information.



GLI takes place at Little Caesars Arena in Detroit.



Our snowfall contest begins as soon as the snow does.

2019-20 SNOWFALL CONTEST

Huskies know snow. Put your snow knowledge to the test by entering our snowfall contests. Last year's winner guessed our season snowfall total of 192.38 inches to within an eighth of an inch. Visit the alumni website at mtu.edu/alumni to get in on the fun!



MyMichiganTech

Alumni can log in to MyMichiganTech at mymichigantech.mtu.edu to:

- Reconnect through our exclusive online alumni directory
- Share your accomplishments and milestones with classmates
- Reach out—update your contact info for fellow Huskies

DREAM JOBS



A degree from Michigan Tech can land you the career of your dreams. Just ask these alumni.

Send us details about your dream job or that of a Husky you know at alumni@mtu.edu.

TOYS NEED ENGINEERS, TOO

You never know where a Michigan Tech degree may take you. Aaron Arvia '99 certainly didn't imagine he'd be in Rhode Island working for Hasbro, one of the world's largest toy companies.

Arvia is a senior project engineer in Hasbro's Advanced Technology and Innovation Department.

"This is about as close to my dream job as I can imagine," he said. "I really get to use a lot of my skills and talents—more than just engineering: art, music, and performance to name a few." His team creates and utilizes new technology and integrates that into Hasbro's products. "We're involved in all phases of a project including development, testing, manufacture, and even marketing.

"The level of talent in all areas of this company is absolutely amazing. It's inspired me to explore and develop entirely new skills."

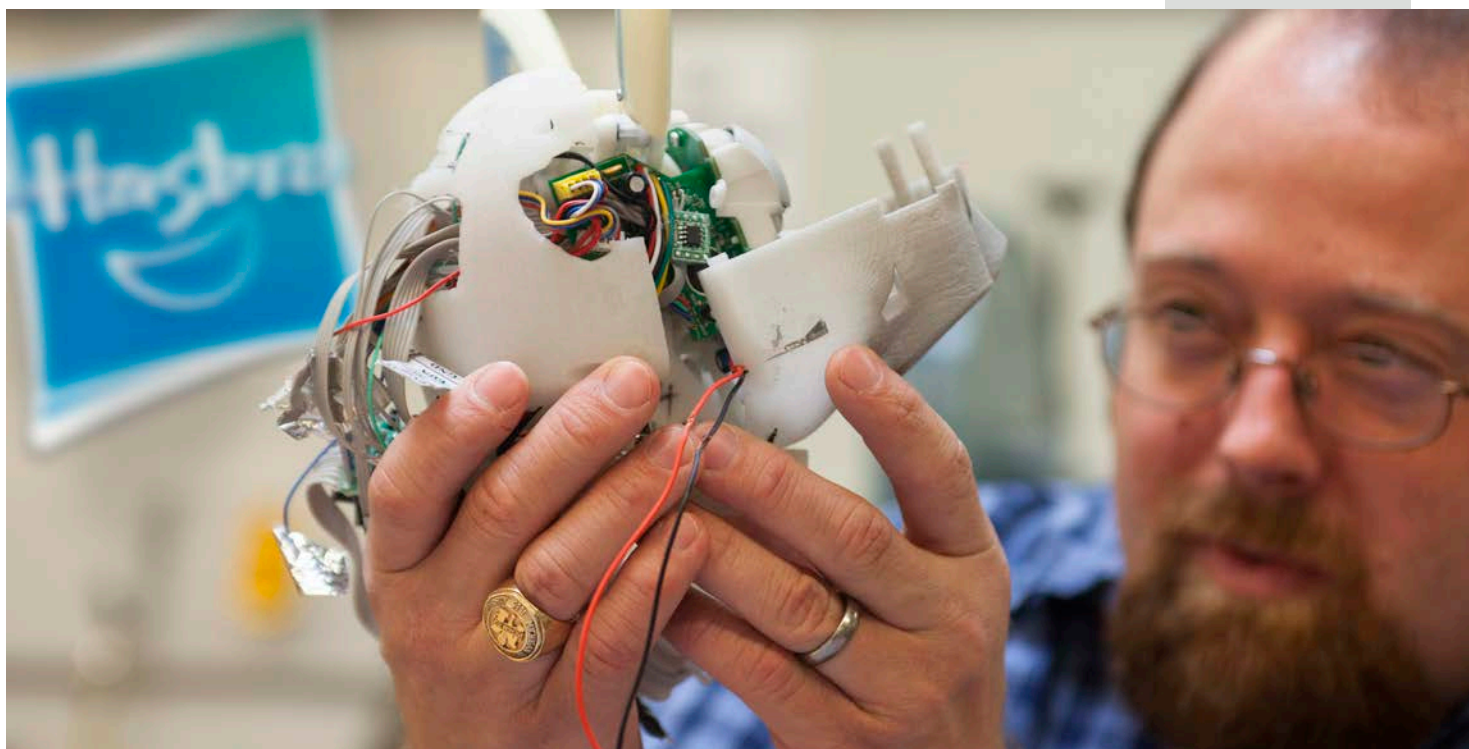
The Twin Lakes, Michigan, native had a lot to learn about engineering when he chose to attend Michigan Tech. He knew he was good at math and science, but didn't have an understanding of where that might take him.

"Once I got to Michigan Tech and began studying engineering, it was really then that I understood what engineers did. Innovation is a lot about connecting dots from multiple industries, multiple sciences, and the arts. I can't think of a more fitting background than the education I received in mechanical engineering."

Arvia worked for a major appliance brand helping develop residential refrigerators in South Carolina prior to his move to Hasbro. He credits that experience with fueling a passion for innovation and new product creation.

"I like the sense of achievement and accomplishment that comes from solving unique problems. Hasbro is a great fit for me, and the icing on the cake is seeing a child interact and build memories with a toy that I've created. The smiles and giggles are priceless."

Arvia gets to play with toys every day.





Smith stands in front of the Hallgrímskirkja Church in Iceland.

MAKING A SMOOTH SHOW

In just one year since graduating with a BS in Audio Production and Technology, Eric Smith '18 has more stamps on his passport than most folks get in a lifetime. The Battle Creek, Michigan, native has traveled to work on projects in Iceland, China, the United Arab Emirates, and Angola in addition to many domestic locations.

The work Smith is doing is unique. As a project engineer for his employer, Smart Monkeys, he's helping design entertainment experiences at theme parks, airports, museums, cruise ships, and theaters.

"We work on medium- to large-scale show control systems," he said. "We collaborate with the creative team, technical

designer, and integrator to build the system that will allow the operators to run their show and get the most out of their technology. We work with every element of the show or attraction."

Some of the places and projects Smart Monkeys has been involved with include Universal Studios Orlando, the Rockettes in New York City, the African American Museum in Washington, DC, and the Tom Bradley International Airport Terminal in Los Angeles.

Smith, who goes by the nickname Smooth, credits his time at Tech for preparing him for the fast-paced environment. "Christopher Plummer and Josh Loar in the Visual and Performing Arts Department's audio program constantly presented me with situations where our troubleshooting was tested and time was of the essence. Now when those situations happen on the job, it's quite familiar territory.

"I was also able to work for Michigan Tech Athletics and Michigan Tech IT running broadcasts for sporting events and the in-game experience for hockey. That experience was the closest thing to what I do in my current position. Running events. Working on systems. Troubleshooting on the fly. All of that directly applies to what I'm doing now."

Approximately one-third of Smart Monkeys' employees are Michigan Tech alumni, further speaking to the value of Tech's program in the industry.

Smith can see himself working long-term for Smart Monkeys, which is based in Miami. "I do miss Michigan and the changing seasons sometimes, but we have a great team and environment here. The work I get to do on a day-to-day basis is exciting."

Smith and friends work onsite at Warner Brothers World in Abu Dhabi.



DREAM JOBS

DENTIST X3

What do a dentist in Scottsdale, Arizona, a dentist in Waukesha, Wisconsin, and a dentist in Manitowoc, Wisconsin, have in common? More than you'd think. Kris Alpers, Derek Schmidt, and Tara (Ferris) Stream are Michigan Tech alumni, former Huskies student-athletes, and graduates from Marquette University School of Dentistry (MUSOD)—all in 2014.

Alpers earned a BS in Exercise Science from Tech in 2009 while playing basketball for the Huskies. After finishing his education, the Minnesota native worked for three years as dental director of the Neighborhood Christian Clinic, a non-profit clinic in downtown Phoenix, Arizona, focusing on underserved groups. He was a finalist for *Phoenix Business Journal's* Healthcare Heroes award. Alpers now is owner/dentist of Alpers Family and Cosmetic Dentistry in Scottsdale.

“THIS IS MY DREAM JOB FOR SEVERAL REASONS: I GET TO WORK WITH MY HANDS AND DRAW UPON MY ARTISTIC SIDE, I ENJOY THE CHALLENGING NATURE OF THE JOB, I HAVE THE OPPORTUNITY TO BUILD CONNECTIONS WITH PATIENTS, AND I HAVE THE SATISFACTION OF OWNING MY OWN BUSINESS.”

Kris Alpers '09,
dentist,
Alpers Family and
Cosmetic Dentistry

Schmidt graduated from Tech in 2010 with a BS in Biological Sciences. While a Husky, Schmidt was an offensive lineman on the football team. He is now owner/dentist of Spring City Family Dental in his hometown of Waukesha. Schmidt is a member of the American Dental



Derek Schmidt, Kris Alpers,
and Tara (Ferris) Stream

Association, the Academy of Osseointegration, and the International Congress of Oral Implantologists.

“Dentistry was always something I wanted to do,” says Schmidt. “Michigan Tech gave me the tools to get here. Being my own boss and positively interacting with people makes it fun to get up and go to work every day.”

Stream earned a BS in Biological Sciences in 2009, and she was a starter for the Huskies as they won three consecutive conference championships and made back-to-back NCAA Elite Eight appearances. (Fun fact: Stream is now sisters-in-law with former teammate Sarah Stream.) Upon graduating from MUSOD, Stream accepted a position with the National Health Service Corporation, treating underserved patient populations. She is a partner/dentist at Dental Park in Manitowoc.

“Dentistry allows me the opportunity to interact with people on a daily basis, while using my skills to positively impact their lives,” she says. “Also, being one of the owners of a local group practice provides a work-life balance that allows me to spend time with my family and friends.”



ALUMNI TAKE TIME FOR STUDENTS

Michigan Tech students who want to become entrepreneurs or innovators recently had access to a critical resource: Time with a group of successful Michigan Tech alumni experienced in venture capitalism, innovation, and leadership.

The group—called 14 Floors because of its association with Silicon Valley (silicon is an element with an atomic number 14)—comprises alumni who are entrepreneurs in the field of technology.

The alumni held “office hours” to connect with students and share insights and experience. The group also provided feedback at the Husky Innovate Series: Idea Pitch Competition. There, students had two minutes to share their favorite innovation and/or disruptive idea in front of the alumni and other campus and community members.

“I enjoy being around the students and seeing that hunger and willingness to take risks. It gives me goosebumps,” says Paul Fulton ’84, an



Students and alumni connect during “office hours.”



MENTORING OPPORTUNITIES

Other alumni-student mentoring opportunities are available, and the University continually seeks industry sponsors and mentors. If you are interested in sharing your experience and expertise with Michigan Tech students, contact us at alumni@mtu.edu.

electrical engineering graduate and current CEO of Nwave Technologies in Los Gatos, California. “I’m excited that Michigan Tech gives students resources to be innovative. I love the Pavlis Honors College. If I’d had that program, I would have had a mentor, would have had more social skills, and would have been more confident.”

Tom Nye ’03 earned a bachelor’s in electrical engineering and later earned his MBA. He’s now an investor with Generation Growth Capital.

“I’m here because I want to help foster the entrepreneurial spirit. Michigan Tech does a great job of preparing students for the technical side of things, but there are more possibilities out there that I want to help students see. There’s a huge opportunity here to help connect the dots between the business and technical aspects of industry.”

“I ENJOY BEING AROUND THE STUDENTS AND SEEING THAT HUNGER AND WILLINGNESS TO TAKE RISKS. IT GIVES ME GOOSEBUMPS.”

Tom Nye ’03, investor, Generation Growth Capital



Alumnus Kanwal Rekhi offers his time and expertise.





A SUPERIOR CLASSROOM

Lakers. Surfacing sturgeon. Lava flows and water samples.

A boatload of Huskies, ranging from undergraduates to doctoral candidates, learned and practiced research techniques in the Lake Superior Exploration course led by ecosystem ecologist Amy Marcarelli. The group traveled the shoreline of Upper Michigan's Keweenaw Peninsula aboard the University Research Vessel *Agassiz* during the summer of 2019, taking dozens of water samples and performing other fieldwork that helped lay groundwork for future Michigan Tech research projects and their own careers.

Exposure to the what, how, and why of research included more than a dozen guest scientists and other experts who shared their work, ranging from offshore nutrients and water column characteristics to river-plume sampling and the near-shore dynamics of Lake Superior, which has thousands of tributaries. Marcarelli wanted her students to cultivate the big-picture critical thinking behind research, considering the human decisions about what is important, and also the inherent constraints of the work researchers choose to pursue.

"I've always been interested in water chemistry," says Sarah Kiszelik, an undergraduate student in environmental chemistry. "Being on the boat has solidified what I want to do for a living."

IN MEMORIAM

**1939**

D. Kelly Campbell
James R. Cooper

1940

Barnard O. Wilcox

1942

Herbert H. Alvord

1946

Mary A. Paoli

1947

Edwin B. Johnson
Richard C. Vandeweghe

1948

Layton C. Binon
David F. Chimino

1949

Jack H. Bellack
James A. Klungness

1950

William E. Bergdahl

1951

Joseph A. Becia

1952

Lina T. Taskovich

1953

Dr. Robert J. Nominelli
James E. Robinson

1954

Richard B. Little
Lloyd F. Lockwood
Preston R. Spencer
Walter H. West

1955

Herman C. Brunke Sr.
Philip N. Parks

1956

Donald A. Daavettila
John E. Rice
Richard J. Robbins
Elmer J. Warren

1957

Glenn E. Ehle
Carlo W. Maki, PE
Glenn M. Maki

1958

Clifford L. Harrington
Roy E. Hoyer
Richard L. Pichette

1959

Donald M. Godell, PE
John I. Jukuri
Dale J. Kempainen

1960

William D. Egerer
Peter D. Farm

1961

David R. Carlson
Jo Ann M. Hauswirth
William C. Rosenthal, PE

1962

Stuart W. Bowman
John F. Jewell
Thomas J. Richter
Ronald J. Wysynski

1963

Willis J. Fontaine

1965

Kenneth A. Gervais
L. John Gunter

1966

David Balzarini
Lenord F. Brady
Bruce D. Mattern, PE, TE

1967

Daniel B. Taylor

1968

Paul J. Erspamer

1969

Michael C. Coleman

1970

Linda J. Beckner
Paul T. Dzakowic
Deborah Michael

1971

David A. Niemi

1972

A. Michael Hill
Robert E. Pintarelli
Jack F. Poynter

1973

Ann Y. Courchaine
Bruce W. Norell

1974

Robert G. Tracy, PE
Bruce E. Wallace

1975

Julianne M. Ager

1978

Sally A. Beckett
Holley M. Linn

1980

Joseph G. Karpenski
Daniel J. Reilly

1985

Paul K. Alexander

1987

Robert E. Dool
Emanuel Z. Manos
Douglas J. Thompson
Michele J. Wreggelsworth

1996

Mitchell A. Lane

2000

Kimberly D. Demos
Joshua G. Mathieu

2003

Joseph J. Schripsema

Counting every gift because every gift counts.



“Michigan Tech catapulted my career and jump-started my personal growth. I will forever be thankful for the depth and breadth of opportunities that were afforded to me. I want every future and current Husky to have access to the same opportunities, if not more.”

Britta Anderson '15
906 Club member

“I have always supported Tech and will continue to do so. My Michigan Tech experience gave me the tools I needed to be successful in my career. I give back because I believe in Michigan Tech.”

Pat Horvath '67
annual donor for 48 years



A simple way for young alumni to give. Become a member of the 906 Club by making a gift based on your graduation year. Alumni from class years 2010 to 2019, go to mtu.edu/906club for more information.



A giving club that acknowledges donors for their consistent annual support. We appreciate those who, regardless of the amount, have shown their loyalty to Michigan Tech through years of giving.



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or 906-487-2310



Future-proof vehicles for the connected world

Unstructured environments are the gray zones of mobility—where chaos enters the picture. From our remote, snowy region in the Upper Peninsula, we're equipped to handle the unexpected, and that carries over into our research. At the multidisciplinary Keweenaw Research Center, we maintain more than 900 acres of proving grounds to prepare autonomous and intelligent vehicles for the less-than-ideal: Snow. Combat. Hacked systems. Human error. Because mobility needs more than a smooth road to move the field forward.

Mobility for the future. Tomorrow needs Michigan Tech.

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