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Chemical. Civil. Computer Science. Electrical. Geology. Geological. Mechanical. Petroleum.

Big Data Hub at Babcock

School Of Electrical Engineering and Computer Science





# UND COLLEGE OF ENGINEERING AND MINES DEPARTMENTS AND PROGRAMS

**Biomedical Engineering** MS, PhD, Minor **Chemical Engineering** BS, BS/MEngr, BS/MS, MEngr, MS, PhD **Civil Engineering** BS, BS/MEngr, BS/MS, MEngr, MS, PhD **Computer Science** BA, BS, BS/MS, MS, Minor BS, MS, Minor **Cyber Security Data Science** BS, MS **Earth Science** BS **Electrical Engineering** BS, BS/MEngr, BS/MS, MEngr, MS, PhD **Energy Systems Engineering** MEngr, MS, PhD **Engineering Science** Minor MEngr, MS, PhD, Certificate **Environmental Engineering Environmental Geoscience** BS **Geological Engineering** BS, BS/MS, MS, PhD BS, MA, MS, PhD, Minor Geology **Mechanical Engineering** BS, BS/MEngr, BS/MS, MEngr, MS, PhD Petroleum Engineering BS, MEngr, MS, PhD, Certificate Scientific Computing PhD **Unmanned Aerial Systems Engineering MS**, MEnger



# NFFRING

Chemical. Civil. Computer Science. Electrical. Geology. Geological. Mechanical. Petroleum.

### Dean

Hesham El-Rewini College of Engineering and Mines

### Editor

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# MESSAGE FROM THE DEAN \\\\\\\

"The solutions to our current problems cannot be found from the level of consciousness that created them." This quote, commonly attributed to Albert Einstein, suggests that adopting the same old mindset to address new challenges will not produce adaptive solutions capable of effectively addressing these challenges.

Higher education today is facing many new challenges that require an entirely fresh mindset to overcome them. With the explosion in low cost online course providers, more voices are questioning the value of a traditional college education, especially in light of soaring tuition rates and increasing student loans. Many universities across the nation are battling stressed budgets due to declining enrollment and shrinking state and federal funding. In order to confront these challenges, we must be ready to change - change in higher education has become inevitable. We must reinvent ourselves to stay relevant for future students. We must revolutionize teaching and learning methods to accommodate the different types of students. We must provide students with the best educational experience regardless of the delivery mode. We must create new learning opportunities and enhance student retention and graduation rates. We must find innovative ways to diversify our revenues including innovative programs and funded research.

In engineering, we embrace a "We've got your back" attitude to promote innovation at all levels and across all activities – from increasing access and growing enrollment to retaining and creating more opportunities for students, and from improving efficiency and developing new resources to elevating research productivity. Our faculty, staff, and students are incentivized to leave their comfort zones and adopt an entrepreneurial mindset when seeking solutions to new problems. They are empowered to take risks and try new ideas without the fear of failure. Our strategic plan CEM-2022 is our roadmap during this time of transformational change to position our college on the right path for the future.

In addition to our strong on-campus programs at both undergraduate and graduate levels, we are committed to expanding our online presence to create more learning opportunities for diverse groups of future students not limited to the traditional 18-year old high school graduates. We are increasing our program offerings and research activities in strategically important areas. We established the new School of Electrical Engineering and Computer Science, which brought several programs under one umbrella. The new school will enhance our ability to develop interdisciplinary strength in several important areas including data science, cyber security, artificial intelligence, machine learning and robotics.

We are also establishing "The Big Data Hub at Babcock", which is the next big thing for our college. Babcock Hall, the original home of the School of Mines (now the College of Engineering & Mines) will become the hub for big data research on campus. Named after UND's first engineering dean and interim president from 1917 to 1918, Babcock Hall is slated for renovation and repurposing, pending approval by the State Board of Higher Education. The restored historic building will include collaboration space for faculty and researchers from CEM and other colleges at UND, state-of-the art labs, and innovation/tech transfer space. I am so excited about the opportunity to highlight an important piece of our history in the heart of campus as we look forward to a brighter future for our college and university

As a dean for a decade now, I have come to believe that to lead a transformational change, all stakeholders must rally behind a common vision that they all take a part in shaping and play a role in realizing. This is what I call the "power of togetherness." Harnessing the power of togetherness is the most effective way to lead a meaningful change. I invite all of you to join our efforts to embrace positive change, to foster innovation, and to prepare our college for the challenges that we know and those that we don't.

Hesham El-Rewini, Ph.D., P.E. Dean and Professor

# LETTER FROM THE CEM'S EXECUTIVE BOARD



Terry Severson Board Chairman



Steve Burian Board Vice Chairman

The CEM Executive Board, now in its 6th year of operation supporting Dean El-Rewini and the UND College of Engineering and Mines, held its mid-year meeting in April in Minneapolis. Our focus for this meeting was CEM research activities and opportunities—how to promote, support, and facilitate that CEM objective. CEM research supports the UND Strategic Plan Goal 4, Research, addressing societal grand challenges demands through cutting-edge research. Bio-Techne Corporation hosted the meeting, thanks to Board member and Bio-Techne CEO, Chuck Kummeth.

We convened a Bio-Med Panel to explore bio-medical engineering and how CEM and UND could leverage that technology and engineering discipline. The panel addressed one of the UND Goal 4 Grand Challenges—to address health challenges through basic, clinical and translational discovery.

Chuck, working with Shaye Mandle, President & CEO of Medical Alley Association which represents the world's most densely populated medical technology cluster, organized and hosted a panel of Twin-Cities area bio-med executives as part of our meeting. The Twin-Cities area is the recognized global epicenter of health innovation and care—a distinction few of us were aware of before the meeting. It comprises 15,000 health establishments including six Fortune 500 health technology companies, e.g., 3M and Boston Scientific. Entrepreneurship and startups abound. Clearly the Twin-Cities bio-med industry can be of tremendous importance and potential to UND CEM. In the next two years, the Twin-Cities projects a 100K-200K workforce shortage. It'll need interns and graduates from CEM's new graduate Biomedical Engineering program (established in conjunction with UND's School of Medicine and Health Sciences and NDSU's College of Engineering), as well as CEM's chemical, mechanical, electrical and computer science, and civil engineering programs. The bio-med firms have extensive research needs that CEM can support. Bio-med is a thriving and rapidly growing regional, national, and international business sector. There's clear and significant potential for a close, collaborative, mutually beneficial relationship between Twin-Cities bio-med and CEM.

The panelists emphasized that an interdisciplinary approach by a university is valuable and likely necessary—universities need to be willing and able to take that approach—to create spaces for students to innovate and collaborate. UND advocates and facilitates that approach among its CEM, Medical, EERC, Business, Entrepreneurship, and other programs. Bio-med has major and increasing data science needs—big data—this is a great area for research and student projects.

To further his bio-med engineering and research goals, the Dean will be looking for executives from the Twin-Cities biomed sector to join the Executive Board to help CEM effectively collaborate with this vital, near-by technical business community. Stay tuned for further developments in this sector, along with all the other advancements and growth in your CEM.



# ENGINEERING'S NEW ERA

# Dean: added school, labs and degrees forecast 'bright skies ahead' for College

It's a new year with a new school, new degrees, and brand new labs at the College of Engineering & Mines.

With the return of the computer science department to the College of Engineering and Mines, the State Board of Higher Education approved a proposal to combine departments into a new School of Electrical Engineering & Computer Science in December.

The move, part of a larger goal to expand degree offerings and research, has been in the works for some time, said Hesham El-Rewini, dean of the College of Engineering & Mines. "This will give our students greater learning opportunities," he said.

With the new school and just-approved degree programs in cybersecurity and data science, the College expects an expanded era of student opportunities, faculty research and collaboration.

"These changes allow UND to offer programs and conduct research in interdisciplinary areas like never before, including cybersecurity, data science, machine learning, biomedical engineering and bioinformatics," said EI-Rewini.

### Fresh beginnings

The State Board of Higher Education approved new bachelor's and master's degrees and a minor in cybersecurity at its meeting Jan. 25, along with graduate certificates in behavioral data analytics and cybersecurity and behavior.

In July 2017, the computer science department was moved from the Odegard School of Aerospace Sciences back to its original home in engineering. Most computer science programs in the U.S. are housed within engineering colleges, said El-Rewini, and the goal of the move was to place UND's program on par with others across the nation and make computer science graduates more competitive in the job market.

In December, the State Board approved a proposal to combine departments into a new School of Electrical Engineering & Computer Science.

And over the winter break, faculty, classrooms and labs moved from Streibel Hall to the main campus.

### **Opportunities galore**

"The School opens doors for a lot of new opportunities," said Ron Marsh, associate professor of computer science and associate director of the School of Electrical Engineering & Computer Science. "Overall, this is a good thing for everyone."

Marsh said that most students, especially undergraduates, won't see much difference at first, except for the new location.

"The difference for graduate students and faculty is that it will make it easier for departments to collaborate on research," Marsh said. "Down the road there will be more opportunity for that, and we can enjoy the fruits of our labor. There will be opportunities to work together on research, grants and degrees."

"The new school allows computer science to borrow from the expertise the College of Engineering has in online programs to offer their own online programs," said El-Rewini. The College's ABET accredited engineering programs were the first in the nation to be offered online.

"The new entity will allow greater opportunities for collaboration in interdisciplinary areas that overlap, such as computer science and electrical engineering," El-Rewini said. "This idea is not new, and has been done before at several large universities."

### **Best and brightest**

"We created two new state-of-the art multipurpose computer labs that could be used as classrooms or labs in Leonard 110 and 112," El-Rewini said, adding that all computer science faculty were outfitted with new computers.

El-Rewini credited the engineering IT team and students who built the labs, created computing environments for students, and made sure everything was ready for the spring semester. "Sometimes they worked until 4 a.m.," he said.

El-Rewini sees bright skies ahead.

"Having computer science and electrical engineering in one college will help us cover the entire continuum of subjects in data, hardware and software," he said. "It will make it easier to collaborate in the areas of cyber security and big data.

"Our projection is that this school will allow us to recruit the best and brightest faculty and new students in new interdisciplinary programs and increase our external funding and research productivity," continued El-Rewini.

The College is conducting a search for the founding director for the School of Electrical Engineering & Computer Science. CEM Associate Dean Brian Tande is serving as the interim director.

– Jan Orvik





# **CEM ACADEMY INDUCTION**

# **NN ERWINW**. MARTENS BSCSci'83





### Awards

- Member of Manitoba Athletic Hall of Fame. 1974 National Canadian Junior A Championship Team
- Member of UND Athletic Hall of Fame, 1980 NCAA Championship Team
- Asset Management Risk Manager of the Year, Putnam Investments, 2000 Risk Magazine
- Activities
- Skiing and hiking in Switzerland
- UND Fighting Sioux Men's Ice Hockey, Co-Captain, 1980 NCAA Championship



## ACADEMY **Erwin W. Martens**

March 8, 1956, Cartwright, MB, Canada Education: University of North Dakota, B.S. Computer Science 1983

University of North Dakota, M.S. Economics 1985

### **Career Experience**

Born:

1985-1991	Founded Analytic Information Management, Inc., Coopers & Lybrand - Toronto, Ontario
1991-1997	Head of Global Market Risk Management, Deputy Head of the Global Risk Management Group, Credit Suisse Group - Zürich, Switzerland
1997-2000	Lehman Brothers - New York City, New York
2000-2003	Managing Director, Chief Risk Officer, Putnam Investments
2003-2011	Chief Risk Officer, TIAA-CREF
2011-present	Retired, Risk Management Advisory consulting

### **Professional Boards**

- TIAA-CREF Trust Board
- TIAA-CREF Product and Client Governance Committee
- TIAA-CREF Asset Liability Management Committee
- · TIAA-CREF Risk Management Committee
- UND Alumni Board (2003 -2010)





# HOMECOMING 2017



- · Junior Achievement of Eastern Iowa, Regional Executive Board
- Junior Achievement of Eastern Iowa, Cedar Rapids Area Board of Directors
  Orchestra Iowa, Board of Directors
- Orchestra Iowa, Board of Directors
  Economic Advisory Council, City of Wilsonville, OR
- Jane Boyd Community House. Board of Directors
- Four Oaks Child and Family Services, Board of Directors
- Executive Sponsor, Rockwell Collins New Hire Network
- Armed Forces Communications and Electronics Association (AFCEA) Young AFCEAN Of The Year
- 20 Time Ironman Finisher

Rockwell Collins



# CRAIGS. \\\\ Olson

**BSEE** '88

# CEM ACADEMY INDUCTION

# **SCHULTE**

# Ph.D. '72



**UND** College of Engineering and Mines

### ACADEMY Frank J. Schulte

Born: Education: March 25, 1945 University of North Dakota, BSGE 1965 University of Canterbury, Fulbright Scholar 1966 University of North Dakota, Ph.D. Geology 1972

# No.

### ExxonMobil

**Career Experience** 

	1972 -1978 Exploration Geophysicist, Eastern Division Exploration	
978 -1982	Frontier Geophysicist/Chief Interpreter - Europe/Africa Division	
982 -1984	Chief Geophysical Interpreter/Frontier Explorationist - Far East Division	
984 -1986	Frontier Manager - Far East Division	
986 -1993	Global Studies Coordinator - Exxon Company International	
993 -1996	Science and Operations Advisor, Technology Department	
996 -2000	Senior Scientist, Europe/CIS Frontier-Special Studies	
Global Ventures/Consultants Inc.		
000-2012	CEO/Senior Scientist	

### **Professional Associations**

2

- · American Association of Petroleum Geologists, International Liaison Committee
- · American Association of Petroleum Geologists, Publication Committee
- Society of Exploration Geologists
- Houston Geological Society





JOSEPH HARTMAN ON BEHALF OF FRANK SCHULTE AND DEAN HESHAM EL-REWINI

# **HOMECOMING 2017**



**UND** College of Engineering and Mines ACADEMY

### **Barbara Ann Walz**

### Awards

- Electric Power Research Institute, 2002 Technology Transfer Award for Groundwater Management Software
- Electric Power Research Institute, 2009 Technology Transfer Award for Greenhouse Gas Management Program
- Manufacturing Institute, 2013 Science, Technology, Engineering and Production Award

### Activities

- Testified before U S Congress on numerous occasions regarding electric energy and . environmental policy issues
- Team Captain for Komen Race for the Cure of Breast Cancer for 15 years Completed 17 Triathlons
- (to date)



University of Denver M.S. Environmental Policy and Management, 1994

### **Career Experience** search Assistant, UND Energy and Environment

Born:

1985-1986	Research Assistant, UND Energy and Environment
	Research Center - Grand Forks ND
1987-1989	Environmental Engineer, North Dakota Department of
	Public Health and Environment - Bismarck, ND
1989-1991	Assistant Director of Environmental Affairs - National Paint
	and Coatings Association, Washington DC
1992-1997	Corporate Manager of Environmental, Safety, and Quality,
	Foster Wheeler Environmental, Denver, CO
1997-2007	Manager, Environmental Services, Tri-State Generation and
	Transmission Association, Denver, CO
2007-2011	Vice President Environmental, Tri-State Generation and
	Transmission Association, Denver, CO
2011-present	Senior Vice President Policy and Chief Compliance Officer,
•	Tri-State Generation and Transmission Association,
	Denver, CO

### **Professional Boards**

- UND CEM Board, 2014-present
- Colorado Association of Commerce and Industry Board of Directors, 2016-present
- Electric Power Research Institute, Policy Council, 2006- present, Executive Committee, 2009-present
- Carbon Utilization Research Council, Leadership Committee, 2010-present
- Utility Air Regulatory Group, Policy Council 2005-present, Steering Committee, 2010-present
- American Coalition for Clean Coal Electricity, Leadership Committee, 2009-2016
- National Rural Electric Cooperative Association, Board Technical Advisory Committee, 2007-2011
- Colorado 4H Foundation Board of Directors, 2013-2016





BSChE'86



# **CEM ACADEMY INDUCTION**

# CEM ALUMNI ACADEMY MEMBERS



Front Row: Gary Sanders, Fernanda Philbrick, Lisa Barnes, Barbara Walz, Sherri Bonacci, Mike Lodoen, Jim Albrecht Back Row: Dean Wieland, Tom Owens, Everett Sondreal, Keith Moe, Erwin Martens, Hesham El-Rewini, Craig Olson, Terry Severson, Chuck Kummeth

CHUCK KUMMETH, PRESIDENT & CEO, BIO-TECHNE, CORPORATION PRESENTS TO CEM FACULTY.

# HOMECOMING 2017

# CIVIL ENGINEERING GOLDEN GRADS



### **CLASS OF 1967**

Jim Stanhope, Darnell Blume, Gary Sanders, Cal Moon, Dean Wieland, Ron Blaufuss, Hesham El-Rewini, Larry Braund, Dave Gilbertson, Allan Huseth, Randy Rohman, Dave Kalinovich, Duane Blanck





# COLLABORATION FUELS INNOVATION

UND faculty bus tour buddies collaborate on aviation invention

Call it a sound decision: an invention developed by Kouhyar Tavakolian, Electrical Engineering, and Nick Wilson, Aviation, is set to significantly improve communication—and safety—in the cockpit. Their headset contains embedded technology that monitors aircraft operational signals and pilot brain activity for signs of mechanical problems and pilot mental fatigue. This aviation communications invention is set to make the world's skyways a lot safer.

The inventors met on the University's annual New Faculty and Administrators Bus Tour in 2014.

The two, with the help of colleagues, students and private industry partner Rockwell Collins, are developing "Smartsealz," a patent-pending cockpit integration technology designed to alert pilots to dangerous situations by gauging an aircraft's spatial orientation or the pilot's physiological state.

The innovative part derives from how the pilot is alerted, in this case, through signals and sensors working in parallel with an aircraft's equipment as well as in the pilot's Smartsealz communication headset.

Sensors set within a plane's control panel monitor deviations in altitude and navigation and send vibrating signals to the Smartsealz headset when necessary. Headset sensors are intended to monitor a pilot's cardiac signals–with a monitor Tavakolian is working on. Possibly in the future, the wearer's brain waves will be monitored for signs of fatigue or the onset of hypoxia, a serious condition brought on the by lack of oxygen to the brain that causes pilots to lose consciousness. Through UND's unique setup of having a world-class aviation education and research center in the John D. Odegard School of Aerospace Sciences and the Biomedical Engineering Research Complex at College of Engineering & Mines, Wilson and Tavakolian were able to develop a system that provides pilots with subtle but noticeable "haptic" feedback in the form of vibrations in the Smartsealz headset when a plane's operation or pilot's physiological state deviate from preset limits—sort of a "highway rumble strip" embedded in the Smartsealz headset.

"We are quite ahead of the game when it comes to the navigation sensors on the plane because these are sensors that have no touch with the human body – you can get a very accurate signal recorded," Tavakolian said. "But when it comes to cardiac signals from the head or brain signals from this little space (on the headset), that is where things get complicated."

Wilson said the Smartsealz sensors could tap into either a plane's flight-management system to monitor things such as altitude, desired course and other navigation metrics, or the physiological signals of the pilot for signs of fatigue and other problems. But the technology is stronger and more useful when the navigation and physiological signals are combined, reducing the chance for false-positive alerts.

"When you are having these cross-disciplinary opportunities, there is a lot of value in it for the general consumer and for safety. Obviously, the University has benefitted from this as well," said Tavakolian.

- David Dodds, Editor, UND Today



# **OLDEST ICE**

### UND geomorphologist Jaakko Putkonen continues hunt for Earth's oldest ice.

December expedition in Anarctica delivers new take on summer

A large drilling rig that took several helicopter flights to move was one of Jaakko Putkonen's major challenges in his latest expedition to Antarctica, completed early this year.

"It took a whole day to take it down and move it to a more remote location from where we started," said Putkonen, a geomorphologist and director of the UND Harold Hamm School of Geology & Geological Engineering. With PhD student Marie Bergelin, Putkonen and his team of colleagues and students from other universities were in the cold continent to extract ice cores from a desert-like valley where there's little snow cover.

"We received funding from the National Science Foundation to drill ice for first time to obtain samples of the interior of a glacier to establish age without any hesitation," said Putkonen, an experienced cold zone researcher. "We have dated dirt on top of the ice, which by definition is younger than ice; now want to date ice itself; we've been dating only by inference to this point."

The ice cores extracted this trip have a long journey back from the valley, to the U.S. station at McMurdo, then by ship to California, then by refrigerator truck to North Dakota.

"We expect those samples by early May," he said.

This expedition was a big first for Bergelin, who is from Norway. She's working on a PhD in geology, likely following Putkonen's path into geomorphology, which studies changes in the Earth's surface over long periods of time.

The next step: establish age of ice to mark oldest ice on Earth.

Why is "oldest" significant?

"It's a stepping stone to understanding changes—current and past—in the Antarctic environment," Putkonen says. This will add to our knowledge about changes in the Earth itself and to phenomena such as climate change.

"Let's not forget that 12,000 years ago, we had a mile of ice over this part of North America," Putkonen said. "And 50 million years ago we were under several hundred feet of water—glacial Lake Agassiz."

- Juan Pedraza

The ice samples arrived safely at UND in May as scheduled

# SCHOOL OF GEOLOGY & GEOLOGICAL ENGINEERING

continental

# GIVING BACK HAROLD HAMM

### Bakken drilling pioneer and major UND benefactor Harold Hamm answers questions from students

If you want to succeed, you're in the right place to earn that degree.

That was the advice from Harold Hamm, founder and CEO of Continental Resources, as he answered student questions about success, finding that first job, and the future of the oil industry.

"I'm honored to be here today," said Hamm to the standing-roomonly crowd of students in the atrium of Leonard Hall, home to the Harold Hamm School of Geology and Geological Engineering. "Some of my best memories are of sharing my experiences with students."

Hamm pioneered the development of the Bakken oil fields in western North Dakota and is a UND benefactor. He answered questions from students Jan. 26, and visited campus while in Grand Forks for the North Dakota Petroleum Council annual meeting. Pictured above: Jaakko Putkonen, Director, HHSGGE, Hesham El-Rewini, Dean CEM, UND President Mark Kennedy, Vamegh Rasouli, Chair & Continental Resources Distinguished Professor of Petroleum Engineering, and Stephan Nordeng, Harold Hamm Distinguished Professor of Petroleum Geology

### Life's worth of knowledge

"Like lots of you, I grew up on a farm," said Hamm. "My first employers were my parents, and I grew up milking cows and doing chores, raising crops and caring for livestock. You can't get better mentors than that.

"Look for subtle things that work for you – special talents and interests," Hamm said as he responded to a question about how to be successful. "What are you passionate about? There's a saying that you will never work a day in your life if you're doing something you enjoy. For me it was the oil patch. I'm excited to go to work every day. You're doing the right thing by developing yourself and your mind to prepare for the future."



"The Harold Hamm Scholarship has provided me with full tuition along with enough money for books and rent, my entire junior and senior year at UND. It has taken a huge weight off my shoulders and has allowed me to focus on my education rather than worrying about my finances." DANIELLE ZINSMASTER

First impressions are really important, Hamm said about meeting new people. "Be interested in the person you're meeting." Prepare for the meeting, learn about their interests, focus directly on them, align your thoughts with that person and show your best side," he said.

To be more marketable in the oil industry, Hamm said, you need to learn everything you can. "We are looking for superstars. Do well in school, have a clear path to success, don't give up." Even if no job is open he said, use all the resources you can, including social media and friends. "It will happen."

Wherever you are, there are always people willing to mentor and teach you, Hamm said. "Ask questions, and people will go out of their way to help you. I had a lot of mentors. That's why I like to talk to students like you. I want to give back."

### Why UND?

In response to a question about why Hamm has given millions to UND, he replied, "We wanted to hire local people. If we had a school that could teach the skill sets at home, we knew we'd have a lot of great people. There are no better workers than North Dakotans."

"You have a great environment at UND," Hamm said. "You have a great school, a great president, administration, and wonderful opportunity. One of your questions was what I would have done differently. I couldn't go to college after high school. I did it when I could, and it meant a great deal to me. Don't waste this opportunity. You're here and doing the right thing. You couldn't be in a better setting anywhere."

> – Jan Orvik (Exerpt)

# **NNIN AROUND CEM**



Bruce Dockter, Angie Reinhart, Harry Feilen, Jill Schroeder, Jordan Eberhardt, Jennifer Lunde, Jade Gourneau, Jessica Cadreau, Darin Buri.













# INTERDICTING Nord

### UND Electrical Engineer collaborates with key industry partner to build innovative UAS cybersecurity systems

Don't let the dollar number fool you: it's a \$25,000 exploratory grant signaling an innovative public–private partnership in the arcane world of cybersecurity.

Rockwell Collins, an aerospace tech company based in Cedar Rapids, Iowa, and an employer of more than 140 UND alums, recently awarded University of North Dakota Electrical Engineering faculty member Prakash Ranganathan \$25,000 to open an exploratory UASrelated research initiative.

"This is a unique research project, and follows a key interest cybersecurity—of North Dakota University System Chancellor Mark Hagerott," said Ranganathan, who is employing several students on the project.

The Rockwell Collins grant, which Ranganathan received after following up one of the company's annual Call for Proposals, will set up a geo-defense detection system for unmanned aircraft systems.

Unidentified small UAS can pose a serious risk to key infrastructures. While used mostly by the military, small drones are now widely available. With increased availability comes increased risk. Traditional defense mechanisms against small UAS, such as shooting them down, pose safety risks in many situations.

"We want to learn how to set up parameters for drone swarms that can enable them to detect and catch rogue drones—that's to protect critical infrastructure such as airports and power grids," said Ranganathan, who graduated from North Dakota State University in



2013 with a Ph.D. in software engineering and has since developed an expertise in cyber-physical systems.

"That's anything involving the nexus of sensing, communications, computation, security, and control," said Ranganathan. "So with this grant we want to develop the advanced UAS swarm technology to control, rather than shoot down, rogue drones. We want to gain access and control of such drones and land them safely, then do postanalysis as well."

"We anticipate building our own drone as well because current off-theshelf models have limitations, such as software that prevents them from flying into restricted areas," Ranganathan said.

This grant is important—and signals another industry vote of confidence in the UND UAS enterprise—because there currently is very limited or no technology out there that addresses the issue of intercepting rogue drones in a manner consistent with public safety.

The grant officially is titled "Geo-Fence Detection System (GFDS) for Unmanned Aerial Vehicular Airspace to provide Counter Autonomy"; it was one of 15 selected of 45 submitted.

"We believe Ranganathan's proposal thoroughly addressed the criteria and that this project will further the educational excellence of students while preparing them for rewarding engineering careers at Rockwell Collins," said Elise Loan, university relations liaison with Rockwell Collins.

"We are very excited about the proposed project and appreciate the effort extended by the University of North Dakota to align the project to Rockwell Collins criteria," said UND Electrical Engineering alumni Roger French, a Rockwell Industry advisor for the project.

– Juan Pedraza

# PREDICTING Floods

### Taming the water monster: UND research teams looks at innovative ways of predicting and mitigating flood events

The impressive concrete spillway at the western end of the English Coulee in Grand Forks looks more like a World War I battlement. But this structure is not a defense against cannonades: its main purpose is to control the flow of flood water.

It's where Yeo Howe Lim, a faculty member in the UND Department of Civil Engineering, and his team of graduate students do a lot of their research.

"The main focus of our research now is in the hydrology of the snow melt," says Lim. "We use computer modeling that we developed ourselves to help us predict flooding based on what we observe with the snow melt." And that's the key word: flooding.

Anyone who's lived on the Northern Plains knows lots about the perennial risk of floods, big, small, local and region-wide.

"Sure," says Lim, "North Dakota—and northwestern Minnesota is unique because of the combination of its flat terrain and cold conditions. That often leads to lots of water stored in ground and frozen before winter starts. Then you get the snow piling on and melting in the spring. Often the upstream snow melts before the downstream snow melts, then you get ice jam formation—so the water backs up during the spring melt."

Lim and his team also do flood frequency analysis—how often it floods and the magnitude of the flooding.

"We also look at changes such as climate and land use—and we use modeling again to predict what may happen. We use both hydrology—the movement of water above and below ground—and hydraulics—how fluids behave in pipes and channels—to make our predictions."

Lim's research strategy involves three areas of inquiry:

Flood hydrology—studying large scale water movements, that is, across large landscapes such a whole basin or catchment. The team looks at this scale to determine at how much water is flowing across the landscape.

Hydraulics—what happens to flood flow on structures such as culverts, bridges, dams and impoundments.



Transport of sediment particles and location of deposition, such as Devils Lake, the Red River, and the Sheyenne River. Lim notes that special membranes are needed in water treatment, for example, to catch sediment. And in events such as flood, sediment transport and deposition accelerates as the movement of water—the flow—increases.

Lim works collaboratively with other disaster and water experts across campus, such as Geography's Paul Todhunter, an expert in hazards who has extensively studied flooding, including in the Devils Lake basin. He also collaborates with Earth Systems Science on a NASA grant to research the hydrology of Devils



Lake, with a view to predict what's going to happen there—i.e., is that lake going to rise some more or will it start receding.

Part of what Lim studies are the major differences between lake flooding—such as the decades-long rise in the Devils Lake basin—and river flooding.

"The water that flows into Devils Lake stays there—there is no natural outlet there now like there was many thousands of years ago. There's no continuous flow out or it's very slow. It's a big lake with lots of streams flowing into it. Eventually that water spills into Stump Lake and Sheyenne River." "We need to create a spill to control outflow—including pumping it out—because we need to protect areas downstream," Lim says. Lim also works with the North Dakota State Water Commission, the Garrison Diversion Water Conservancy District, and U.S. Army Corp of Engineers.

Ultimately, Lim and his student team and their on-campus and state collaborators are looking at a key goal: improving the prediction of flooding. "That's a big deal in North Dakota," Lim says.

– Juan Pedraza

# STEM OUTREACH BRINGS KIDS ON CAMPUS







26 UND College of Engineering and Mines









# UND ONLINE **A WELCOME PORT IN A STORM**

### Navy civil engineer sailing toward career goals while building bridges along the way.

When she left the Philippines in 1997, Majellen "Coco" Changcoco knew she was leaving for a better life. "When I was young, I thought of the U.S. as having opportunities to make something of myself," she said. "I wanted to be independent. I wanted my own life."

Twenty years later, Changcoco has accomplished that and more. Now, she's closer than ever to achieving her ultimate dream, thanks to the flexibility of a UND online education.

### **Naval career**

Changcoco had earned a degree in chemical engineering in her native Philippines, but she didn't have the money to earn an official accreditation.Not long after immigrating to the U.S., she found herself at a recruiting station, at the behest of her brother-in-law, who was in the U.S. Air Force. According to Changcoco, it seemed like the best way, at the time, to start her new life.

It also provided a way to rescue her educational dreams. "I knew I didn't want to rely on everyone else for pursuing my education," Changcoco said. "I wanted to take care of myself and the military allowed me to pursue my studies."

Navy Lt. Majellen Changcoco currently lives in Annapolis, Md., where she serves in the Civil Engineer Corps (CEC). As a production officer, she helps oversee maintenance and services for military bases — a job that's taken her around the world.

### **Online flexibility**

When she first joined the Navy, she worked in surveying, construction and materials logistics. She loved it. Her bosses were civil engineers, and she quickly developed a deep desire to one day build bridges both literally and figuratively. "Everybody has their own dream or goal in life," Changcoco reflected. "I feel like I'm going to build a bridge to connect communities, uniting two distant villages or tribes. Once I realized that was my dream, I communicated that to my bosses."

It wasn't until 10 years later, when she discovered UND, that she found the ability to complete her goals. UND's online civil engineering degree is one of the few in the country that's accredited by the Accreditation Board for Engineering and Technology (ABET), an important factor in Changcoco's goal of licensure. "Without it, there's no outlook for my career," she said. "UND gave me that education I need to pursue my career. It played a crucial role."



Also, with ABET accreditation on her bachelor's degree, the required experience in civil engineering is cut in half to four years. Since 2011, Changcoco worked on her online bachelor's degree in civil engineering from many different ports around the world. While doing so, she melded her work-life experiences with her educational pursuit. "Constantly traveling means you juggle your situation," she said. "Sometimes that means no internet access. I've downloaded lectures and other files ahead of time; I've also had a dropped connection during a test. I think no matter how you try to perfect the system, you always have challenges."

### Lasting loyalty

Through it all, Changcoco's developed an affinity for UND's quality of education. It's now the benchmark by which she compares most institutions of higher learning.

"The program is unique," she said. "The UND package required me to be on campus for a two-to-three-week period in the summer. When I [went] on-site to be there with classmates and professors, it felt right. The curriculum is really geared toward what is needed as an engineer and what you need for your license. "UND always seems a notch higher than other universities."

Changcoco's been on campus three times doing work in labs. Right now, she only has a couple essential studies courses to finish off seven years of effort. She said most people could probably finish the degree in five years or less, but ... "I'm working in the field and taking studies, so mine took a long time."

Now that she's soon to complete her degree, and already passed the professional engineering exam this fall, she's well on her way to building bridges.

### Valuable advice

Changcoco has three bits of advice for anyone considering pursuing an online degree from UND: keep a good attitude, stay committed and on schedule, and contact professors whenever there are questions.

"Traditional classes have immediate access to professors, but you can make up for that by being proactive," she said. "It's all a matter of perspective. The personal drive can make up for (challenges with) nontraditional coursework."

# FROM MENTORSHIP TO FRIENDSHIP

Dwight Wendschlag met Merry Tesfu in early 2015 via a phone call. It was the second semester of her sophomore year, and a former colleague and friend, Scott Johnson, forwarded him an email that Scott had received from Merry.

Merry, a native of Ethiopia, had been in the US for about three years at that time. Her email expressed an interest in connecting with someone who could provide some mentorship as she pursued her dual degrees in Petroleum Engineering and Geological Engineering at UND. Dwight is a 1971 and 1975 Mechanical Engineering (BSME and MSME) UND graduate, a member of UND's Engineering Alumni Academy and a member of the Petroleum Engineering Department's Industry Advisory Council. When he first met Merry, he was doing some petroleum reservoir engineering consulting work after working many years for two different oil companies. He retired in April 2016 after nearly 41 years in the oil and gas industry. He lives in northwest Montana with his wife, Peggy.

Though meeting in person only a couple of times a year when Dwight came to UND for Advisory Council meetings, Dwight and Merry communicated almost weekly by phone since that first phone call. Topics of discussion ranged from support on resume preparation and interviewing for employment (both summer internships and a permanent job after graduation) to advice on the purchase of a used car. Merry consulted Dwight about class registration and how to best prepare for tests and presentations for class projects. She was also active on campus in non-class activities such as the UND African Student Union and the Student Chapter of the Society of Petroleum Engineers, and Dwight enjoyed hearing her share those experiences. In the summer of 2017, Merry visited Dwight and Peggy in Montana. They shared the beauty of Glacier National Park with her, and Merry shared a bit of Ethiopian culture with them, including cooking them some delicious traditional Ethiopian food.

Both Dwight and Merry agree that the mentorship relationship has been mutually rewarding. In April of 2018, Dwight was proud to hear that Merry had received her US citizenship. In May, Dwight was in Grand Forks to attend Merry's engineering ring ceremony and her UND graduation with honors. It was truly a pleasure to see her receive the benefits of her hard work. Merry will start a job in the Williston Basin this summer after she completes her Geologic Field Camp. Dwight looks forward to hearing about her continued success. He encourages anyone who is looking for a rewarding experience to consider mentoring a student who is looking for such a relationship. The small amount of time it takes is amplified many times over in the benefits it offers, and it may result in a friendship that lasts well beyond the college years.



# FRANK XIAO DEVELOPS AG-BASED CARBON TECHNOLOGY FOR WATER FILTRATION

The little black specks in your filtered water pitchers are nothing more than particles of activated carbon.



### FRANK XIAO, ASSISTANT PROFESSOR, CIVIL ENGINEERING

Bosen Jin (graduate student), Mat Cox (undergraduate student), Ryan Hansen (graduate student), Assistant Professor Feng "frank" Xiao, Nicholas Lindstrom(graduate student), Hailu Alemayehu Bendane(postdoc) and Swetha Mallula (graduate student)

One a much larger scale, communities use granular and powdered activated carbon in their drinking-water treatment systems. Activated carbon is also used sometimes as antidote for extreme poisoning.

The removal of water contaminants by activated carbon in drinkingand household tap-water purification is the major market, which constitutes 79 percent of total activated carbon demand in the United States, says Feng "Frank" Xiao, a faculty member in the Department of Civil Engineering. That's about 277 million pounds activated carbon annually in a market worth about \$1.6 billion.

Xiao, an environmental engineer, and his team are developing a much more sustainable method to produce this vital material in a world that needs ever more clean water.

"Our team is working on activated carbon sorbents produced from biomass materials—we're converting what's usually considered waste into clean activated carbon products for water purification, odor and gas removal," says Xiao, who is collaborating on this project with Julia Zhao, professor of chemistry at UND. "We're using a novel approach to make activated carbon, the quality of which compares favorably with commercially available activated carbon—the main difference is that our method is greener and more sustainable (from agricultural biomass materials) and takes less energy and less time," Xiao says. "And we know that our process is scalable."

"We see practical purposes for this technology: basic use in water treatment; plus it's effective as a means to purify water by removing pharmaceuticals, pesticides and organic materials," said Xiao.

Funding for this research project was provided by Research North Dakota and by the Office of the Vice President for Research & Economic Development. Xiao is the Principal Investigator and Zhao is the Co-Principal Investigator.

– Juan Pedraza

# CEM'S DIVERSE LEADERSHIP DEVELOPMENT AND COMMUNITY ENGAGEMENT PROGRAM

Dean El-Rewini established this program in 2016 to help improve diversity among the leaders of the College of Engineering and Mines (CEM). It serves as the training ground for junior and mid-career faculty and staff members who aspire to leadership positions in CEM and beyond. It also helps engage faculty and staff in solving community problems. This program is expected to impact faculty and staff in two important ways:

- · It provides them with a vehicle to improve their leadership skills and prepare them for future leadership positions
- It expands their positive influence beyond the university boundaries to include the whole community.

# COHORT 1, 2016-2017

Mojdeh Mardani, Electrical Engineering Dr. Sima Noghanian, Electrical Engineering Dr. Risa Madoff, Geology and Geological Engineering Dr. Gautham Krishnamoorthy, Chemical Engineering

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# COHORT 2, 2017-2018











# Dr. Minou Rabie, Petroleum Engineering

**Community Engagement Project:** A Mentorship Program Guiding Middle/High School Students toward 1st Generation College Educations

Target Audience: Middle and High School Students in Grand Forks, ND

**Industry Mentor:** Barbara Walz, Sr. Vice President of Policy and Compliance, Tri-State Generation and Transmission Association, Inc., Denver, CO

# Dr. Frank Xiao, Civil Engineering

**Community Engagement Project:** Fundamentals of Drinking-water Treatment: A Communityinvolvement Program

Target Audience: American Indian Students

**Industry Mentor:** Lillian Stan, Sr. Mechanical Engineer, Tri-State Generation and Transmission Association, Inc., Denver, CO

# Dr. Howe Lim, Civil Engineering

**Community Engagement Project:** Detecting Basement Seepage and Water-related Housing Problems

Target Audience: Low income house owners/renters in Grand Forks, ND

Industry Mentor: Terry Severson, President, TRACE Systems, Inc., McLean, VA

# Dr. Prakash Ranganathan, Electrical Engineering

**Community Engagement Project:** A Workshop for Handling Test Anxieties through Emotional Intelligence

Target Audience: Public/Tribal High School and College Students

**Industry Mentor:** Tom Wos, Regulatory Program Manager, Tri-State Generation and Transmission Association, Inc., Denver, CO

# Dr. Daba Gedafa, Civil Engineering

**Community Engagement Project:** Helping New Americans in Greater Grand Forks Area Get Driver License

Target Audience: New Americans from Bhuttan/Nepal, Somalia, Eritrea, and Ethiopia

**Industry Mentor:** Lisa Barnes, Retired Director, Engineering Business Management, Honeywell Aerospace Engineering Technology, Phoenix, AZ

# FIVE GUYS AND ALAKE!

A new tradition began the summer of 2017 when four alumni asked Dean El-Rewini to join their annual Lake Metigoshe (ND) trip. MIKE LODOEN IS A 2018 SIOUX AWARD RECIPIENT

STEVE LODOEN, DAVE KOLAND, AND TERRY SEVERSON WITH DEAN EL-REWINI, PHOTO TAKEN BY MIKE LODOEN

It is with deep sadness that we acknowledge the passing of our good friend Dave Koland, on May 8, 2018.

# GET CONNECTED

Join us in welcoming Robin Turner to our CEM family! Robin and Deb are excited to share the events, accomplishments and future plans for the College with you. It would be a pleasure to welcome you back to campus to see what's new, meet the dean, take a tour and visit with students and faculty. Our alumni and friends are the best and most generous, sharing their time, talents and treasure to support CEM initiatives, student scholarships, endowed faculty positions and priority needs of the College. Whether you come back to campus, or meet Robin as she travels, we want to hear from you. Please feel free to contact us, let's get connected!



Robin Turner, '89 Director of Development, CEM 800.543.8754 701.777.1428 robint@UNDfoundation.org



Deb Austreng Director of Alumni, Corporate and Public Relations, CEM Ph: 701.777.4249 Fax: 701.777.4838 deb.austreng@engr.UND.edu





UND graduate student Ian Foerster, a PhD candidate in Chemical Engineering, competed—and took home first place--in the Western Association of Graduate Schools Regional 3MT (3 minute thesis) competition on Wednesday, March 21st. Ian's 3MT talk centered on the significance and value of his innovative research in using soybeans as renewable source of carbon fiber.



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COLLEGE OF ENGINEERING & MINES

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