

2016 | 2017



The University of Texas at Austin
Petroleum and Geosystems
Engineering
Cockrell School of Engineering

ENERGY ONE

PAGE 10

DRILLING FOR DATA

TESTING THE ENTREPRENEURIAL WATERS | 04
A BROAD LEARNING EXPERIENCE | 16
THE WATSON EFFECT | 22



DRILLING for DATA

WHAT'S NEXT | 10



4

FACULTY FOCUS

TESTING THE ENTREPRENEURIAL WATERS
Dr. Lake experiences his first company acquisition



16

STUDENT STORIES

A BROAD LEARNING EXPERIENCE
UT PGE launches its first study abroad program



22

CLASS OF 2016

THE WATSON EFFECT

A student works side-by-side with the world's most recognized technology platform

TABLE OF CONTENTS

FACULTY FOCUS | 04

WHAT'S NEXT | 08

ALUMNI IMPACT | 12

STUDENT STORIES | 15

ACCOLADES | 21

CLASS OF 2016 | 22

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ENERGY ONE

2016 | 2017

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ABOUT ENERGY ONE

The University of Texas at Austin Department of Petroleum and Geosystems Engineering publishes stories and news about innovative research, student excellence and alumni leadership annually in magazine format.

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DATA Driven

As a leading petroleum engineering department, demonstrated by U.S. News and World Report's latest No. 1 undergraduate and graduate program rankings, UT PGE is dedicated to arming our students with the best possible education. Our faculty is passionate about developing skilled, productive and innovative engineers who will tackle the challenges that present themselves in the coming decades. Sustainable oil and gas production is still the foundation of our country's energy mix and it fuels the economic growth that supports us.

It is an exciting time in industry right now for technological advancements. In a field that promotes innovation and exploration, there is a lot of room for discovery including a strong demand for utilizing the power of big data.

In this issue, UT PGE recent graduate and current master's student Katy Hanson (BS PE '16) describes how working with IBM Watson last summer is preparing her for success in our graduate program, specifically in the field of artificial intelligence. Our esteemed professor Larry Lake shares how his tech start-up was recently acquired by an Austin

oil and gas firm and UT PGE undergraduate and graduate students discuss their experience working in our state-of-the-art real-time operations center to provide sound recommendations to an industry partner on increasing drilling productivity.

There is also a focus on our students and alumni who are learning and making an impact abroad. In this issue you will see how Statoil's Helge Haldorsen (PhD PE '83) is leading a large corporation through Mexico's energy reform and his vision for the future of oil and gas. The article on UT PGE's first venture into a study-abroad program highlights the value of a global academic experience in preparing our students for a global industry.

Finally, we know this year's low-price environment has been a challenge for our alumni and graduating students. We hope as we forge ahead, it will be a season of renewed growth!

Hook 'Em and Enjoy Reading!

Dr. Jon Olson, Professor and Chair
Frank W. Jessen Professor and The Lois K. & Richard D. Folger Leadership Chair



TESTING *the* ENTREPRENEURIAL WATERS



Professor Larry W. Lake has built an incredibly successful career for more than 40 years as a teacher and researcher. He taught many of today's oil and gas leaders and has written several respected books on enhanced oil recovery. At the age of 70, Lake is expanding his dip into the entrepreneurial waters.

After a decade of molding and shaping an idea into a profitable business model, Lake experienced the first acquisition of one of his technology startups. INTERA Incorporated, an Austin-based geosciences and engineering consulting firm looking to transition into the oil and gas sector, acquired CR Petroleum Optimization Technologies Inc. (CRPOT). Lake's company offers production optimization services and software to industry.

The software developed by CRPOT combines data-driven analytics with physical reservoir engineering principles to increase profitability of oil recovery projects by identifying inefficiencies in operations for conventional and unconventional applications. The software is based on the Capacitance Resistance Modeling (CRM) algorithm developed by Lake.

Lake conceived the plan for the software program while meeting with companies through his research consortium, the Center for Petroleum Asset Risk Management (CPARM). Lake continually heard companies share their desire to obtain the best technologies for their operations. He knew industry would not want it to come at a great expense, so Lake saw a window of opportunity to create a program that utilizes all the readily accessible data streaming in from existing operations.

"Once the software program develops the recommendations through its algorithm all it takes to make a difference is the company adjusting its valves during injection, which has little to no cost," said Lake. "In Texas alone, there are more than 2,500 enhanced oil recovery projects including waterfloods where this technology could be applied."

Lake anticipates companies using the software should see about a five percent increase in their ultimate production and as the program becomes more sophisticated the percentage rate should rise.

"A five percent increase in production might not seem impressive, but when you are producing

"A five percent increase in production might not seem impressive, but when you are producing hundreds of barrels a day that number goes a long way."

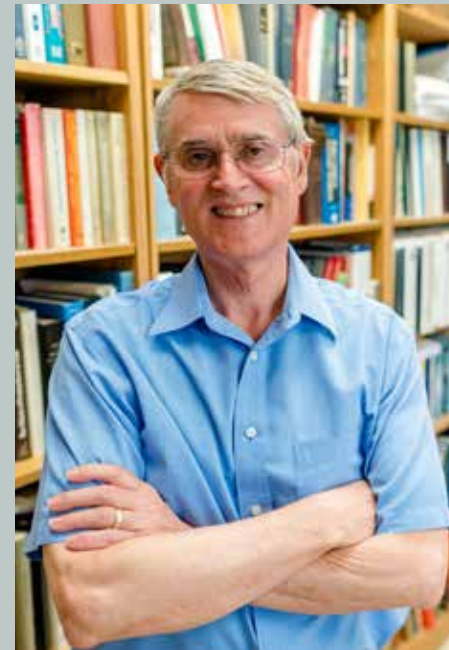
hundreds of barrels a day that number goes a long way," said Lake.

INTERA's president and CEO Marsh Lavenue said, "it is a perfect fit for a company like ours." After seeing the increase in oil production and reduction in water usage, he knew it was the right decision.

Lake's company will change its name to INTERA Petroleum Consultants (IPC) and operate as a subsidiary of INTERA. Lake will serve as IPC's chief technology officer and provide technical leadership for reservoir engineering projects. His research partner at UT Austin, Emilio Nunez, will serve as vice president of technical services.

The hope for the company moving forward is to continue improving the software as well as market the business to expand into other industries.

Experts' Take: SUSTAINABLE ENERGY IN THE 21ST CENTURY



Professor GARY POPE

Challenges: One of the biggest challenges the world faces this century is producing enough energy to improve the standard of the poor, while meeting the demands of population growth and providing the energy in a way that is secure and sustainable.

Solutions: The only way such an enormous supply of secure, reliable energy is possible in the 21st century is through sensible energy policies. They need to encourage energy conservation, scientific and engineering innovation and the development and use of all sources of primary energy that meet environmental standards based on sound science. This goal cannot be met without the inclusion of fossil energy.

The production of fossil energy benefits the environment because it enables the resources needed to economically produce everything else we need in responsible and sustainable ways. The United States has enormous hydrocarbon resources remaining in mature fields that can be economically produced from existing wells using enhanced recovery methods that do not involve hydraulic fracturing. These methods should be further developed and applied. An example is the injection of carbon dioxide to both increase oil recovery and safely store the carbon dioxide in known geological formations.



Assistant Professor HUGH DAIGLE

Challenges: Exploration and production activities will need to continue to reduce their footprints in terms of volumes of chemicals used, trucks on the road, methane emissions related to stimulation and production and resources consumed per well for drilling and completion.

Solutions: The development of new technologies. For example, stimulation and production in shale plays is still a resource-intensive operation. Some of our ongoing research is aimed at how to better target zones in the wellbore that will allow the best production upon fracture stimulation, how to achieve successful fracture stimulation with less water (or none at all!), and how to ensure good zonal isolation so the produced hydrocarbons go only where we intend them to go.



Senior Lecturer PAUL BOMMER

Challenges: The oil and gas business must continue to adopt an environmentally alert strategy on both the upstream and downstream sides of the business.

Solutions: We must reduce and eliminate, if possible, emissions at extraction and transportation facilities. From exploration and production viewpoints we must find ways to be cost competitive especially with the low cost overseas sources. We should also move towards electric power generation as a major use for natural gas. This sounds easy to do except that power generation demands a very reliable source - a unified effort will work best here where gas suppliers operate in concert with the power generators and vice versa. If not implemented supply disruptions will occur, which will be disastrous for both parties. This is exactly what drove the power companies into the arms of coal in the 1970's.



1

2



Lab Launch: DR. ZOYA HEIDARI

In December 2015, assistant professor Zoya Heidari launched her innovative rock physics lab in the CPE building. The goal of her lab is to understand the physics of complex rocks, develop new measurement techniques and create methods to reliably interpret multi-scale formation data. This includes electrical, nuclear magnetic resonance, and acoustic measurements for assessment of rock-fluid properties. This fall, more than 10 UT PGE students will have the unique opportunity to conduct research in Heidari's new lab gaining skills on investigating and discovering rock characteristics to make formation evaluation more reliable and oil and gas recovery more efficient.



1

Circulation System – This device enables NMR spectroscopy under controlled confining pressure of up to 10,000 psi. The system allows researchers to create an environment that reflects the conditions occurring below the earth's surface.



2

MHz Nuclear Magnetic Resonance (NMR) Spectrometer – It contains electromagnets that generate magnetic fields for low field NMR spectroscopy on rock samples. The equipment aids researchers in quantifying the reservoir quality of rocks in the subsurface.



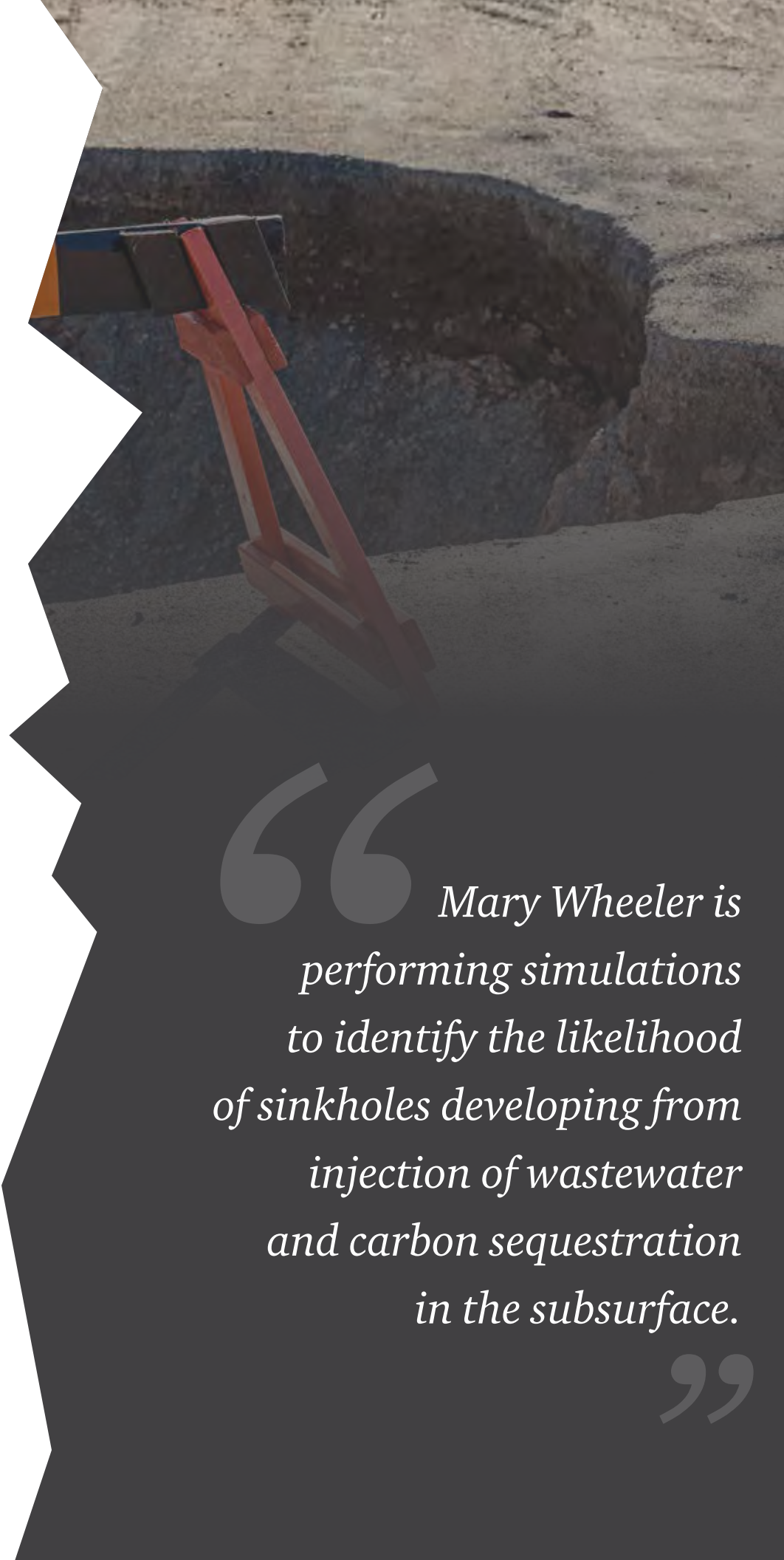
CRACKING the CODE

According to the U.S. Geological Survey, Texas is one of the most naturally occurring sinkhole prone states in the country. The Lone Star State is home to evaporite rocks (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite), which are predisposed to dissolution in water. When these rock types have no natural external surface drainage, sinkholes are created evoking the image of a home or car being swallowed by the earth.

A recent point of interest by geologists and engineers is the correlation of sinkholes to land-use practices. UT PGE professor and National Academy of Engineering member Mary Wheeler is performing simulations to identify the likelihood of sinkholes developing from injection of wastewater and carbon sequestration in the subsurface.

Wheeler's group will conduct computational studies at the microscopic level to determine how sinkholes develop. This includes taking into account rock layering, temperature, flow rates and rock failure mechanics.

The support for this project comes from UT Austin's Institute for Computational Engineering Sciences (ICES) Grand Challenges Award. Grand Challenges are ambitious but achievable goals that harness science, technology, and innovation to solve important national or global problems. Selection for these awards is based on highly compelling research proposals in computational engineering and sciences that affect the competitiveness and international standing of the nation.



“Mary Wheeler is performing simulations to identify the likelihood of sinkholes developing from injection of wastewater and carbon sequestration in the subsurface.”



OIL SOLUTION Fuels MALARIA RESEARCH

Researchers at UT Austin have been awarded a \$100,000 grant from the Grand Challenges Explorations initiative, funded by the Bill & Melinda Gates Foundation. The team is pursuing research aimed at improving diagnostic tests for malaria. Technology used in oil and gas exploration inspired the health-related research.

About 3.2 billion people, or almost half of the world's population, are at risk of malaria, a treatable infection transmitted by animals and insects. In 2015, 95 countries and territories had ongoing malaria transmission, according to the World Health Organization. Dr. Chun Huh, a UT PGE research professor and the grant's Principal Investigator (PI), and his team plan to use the Gates Foundation funding to improve the sensitivity and accuracy of existing malaria diagnostic tools through the use of tiny particles with special properties, called nanoparticles.

“We have a vision to develop a better diagnostic tool utilizing the seemingly unrelated nanoparticle techniques that we developed for the petroleum production applications,” Huh said. “We believe improved malaria diagnostic kits could make a significant impact, particularly in developing nations with limited medical and financial resources.”

To receive funding, Huh and other Grand Challenges Explorations winners were required to present a bold idea in one of five critical global health and development topic areas. Huh and his team are focused on how nanoparticles could help lower the cost and improve the accuracy of malaria diagnostic testing.

Huh's team includes postdoctoral fellows Ijung Kim and Yeonjeong Ha, a Cockrell School civil engineering alumna ('14) whose doctoral research focused on interactions between biological cells and nanoparticles. Cockrell School chemical engineering professor Jennifer Maynard is a key participant, with her expertise in antibodies and infectious disease.

Kim and Ha, a husband and wife team, said the idea for the project stemmed from Huh and Kim's work in oil production, using nanoparticles for data collection, chemical delivery and water management. Kim and Ha were motivated to apply this technology to malaria diagnostic testing because of the nanoparticles' ability to be magnetically retrieved and re-used after they have completed their function. Nanoparticles are employed in fields as diverse as biomedical engineering and environmental engineering.

Today, malaria diagnostic tools, including microscopy and rapid diagnostic tests (RDTs),

largely rely on blood samples, which are invasive and expensive to obtain. Although there are some saliva-based diagnostic tests for malaria on the market, they are not yet as accurate as blood tests.

The UT Austin engineers believe that the versatility of magnetic nanoparticles could be the key to improving noninvasive malaria RDT kits. Magnetic nanoparticles can be coated with specific antibodies, magnetically heated, magnetically collected and magnetically detected.

The team's concept will be developed and tested this year, but the original idea is to coat the magnetic nanoparticles with an antibody that will attach to the malaria antigen. After nanoparticles are added to a saliva sample, heat will be used to incubate or grow malaria that may be present in a sample. Once the malaria has been detected, heat can be generated by the nanoparticles to kill any malaria parasites in the sample.

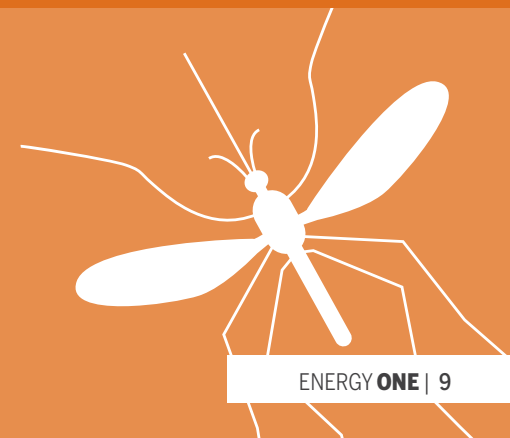
The researchers hope this will lead to the development of a sustainable diagnostic kit with magnetic nanoparticles that can be re-used in the future.

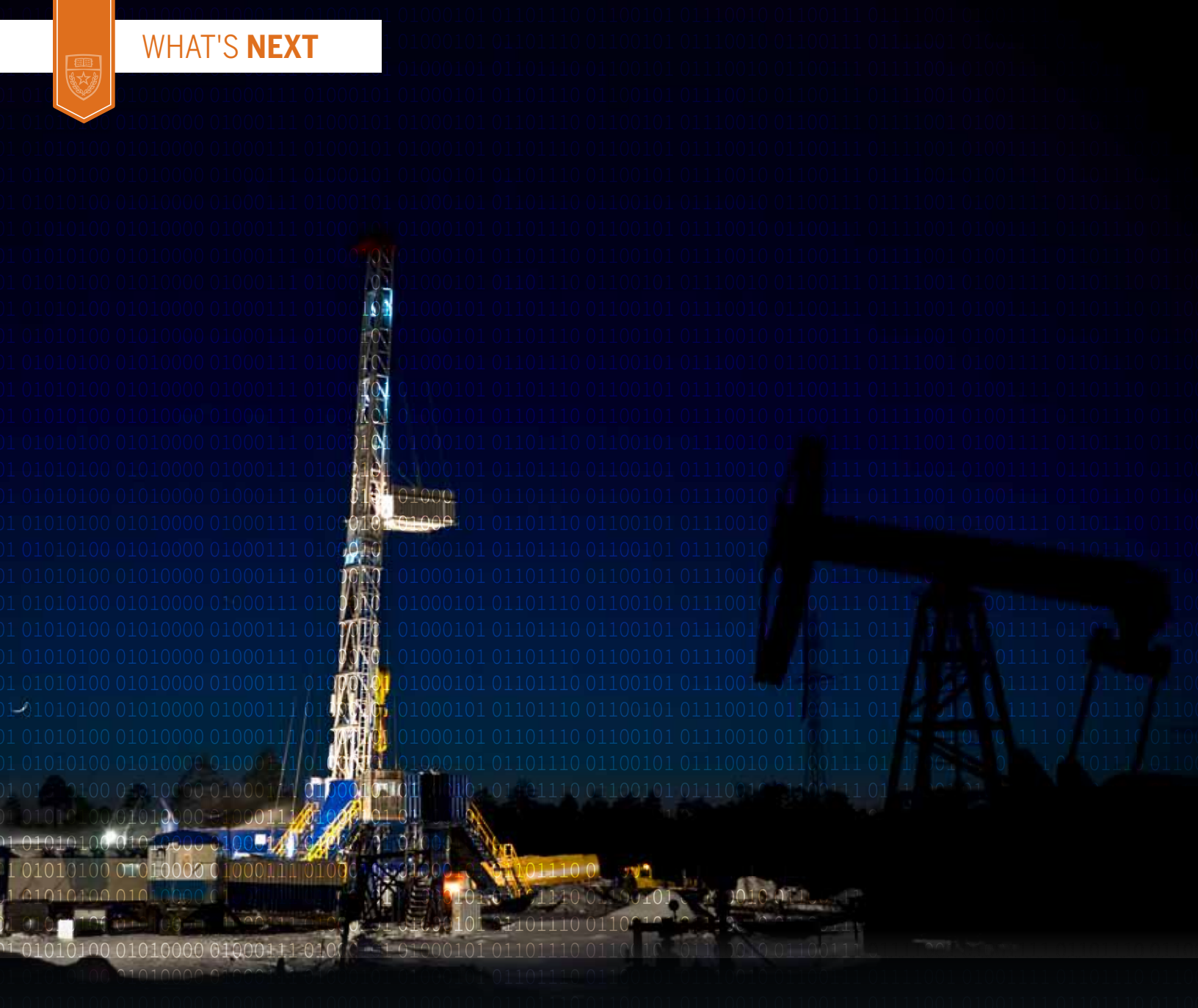
\$100,000

Grant awarded from the Bill & Melinda Gates Foundation for the Grand Challenges Explorations initiative

3.2 Billion

People at risk of malaria infection





DRILLING FOR DATA

Recognizing the oil and gas industry was entering a period of data disruption, Dr. Eric van Oort had the vision to launch a state-of-the-art real-time operations center (RTOC) at UT PGE in 2012. Now, the industry is looking at the enormous amount of data flowing in by the second from its rigs to optimize drilling performance.

Van Oort, who built industry's first large RTOC for Shell in its New Orleans office, knew creating a lab dedicated to big data and automation would pave the way for successfully training the next generation of drilling engineers and industry leaders.

Companies have made a calculated move to incorporate big data across several industries including healthcare and agriculture, positioning big data as an essential tool. According to The Wall Street Journal, a recent survey by NewVantage Partners found 70 percent of firms now say that big data is of critical importance to their organizations, a significant increase from 21 percent in 2012. With the low-price oil environment, the gold standard for drilling has become productivity.

"The future involves automation, so we are shaping it," said van Oort. "We will be monitoring wells, finding ways to minimize inefficiencies and creating a safer work environment."

In the spring of 2016, van Oort and his team partnered with an energy company to create a research program housed within his Rig Automation Performance Improvement in Drilling (RAPID) consortium. The program's goal is to provide undergraduate and graduate students experience and skills in analyzing data. In addition, it aims to give the industry partner meaningful recommendations on how to improve the drilling performance of its onshore unconventional wells.

Theresa Baumgartner (PhD PE '17) is one of two graduate students who has been working on the program since it launched, addressing industry's challenges.

"Operators collect huge amounts of data during their drilling operations, but they do not have the resources and capability to process it," said Baumgartner. "This is where we come in."

Baumgartner is serving as a mentor to the six undergraduates who are working on the project. She is training them on understanding huge data files and encourages them to drive the assignment to gain valuable leadership skills.

"The department does not offer a dedicated undergraduate course in automation, so we are trying to close the loop on their learning," said Baumgartner. "Students will need these skills in industry and I think it will help set them apart from students at other universities."

In addition to learning from the graduate students, the undergraduate students also gain expertise from the project's manager and UT PGE research scientist Pradeep Ashok. A PhD graduate from UT Austin's Department of Mechanical Engineering, Ashok worked for the rail industry to automate shift yards upon his graduation in 2007. He collected data and wrote control algorithms to help automate the process. While Ashok brings experience in automation to his current project, he says the problems in oil and gas are much more complex, but that is what intrigued him.

Will DuBois (BS PE '17), a petroleum engineering undergraduate student, worked on the project in the spring. He saw Ashok as a mentor, valuing his knowledge and familiarity with the field. DuBois was excited to get involved with the project as he didn't realize this type of work is being conducted in the department.

"When I think about big data, I think Silicon Valley, so it is exciting Dr. van Oort and his team are working on it right here at UT," said DuBois.

A unique aspect of the program, which is a priority for Ashok, is bringing together students from petroleum and mechanical engineering as well as computer science. Each area of expertise is critical to ensuring the work is

"The future involves automation, so we are shaping it," said van Oort. "We will be monitoring wells, finding ways to minimize inefficiencies and creating a safer work environment."

successful. Ashok's focus is teaching the computer engineers what they are looking for in the data, so they can excel in analyzing it and developing recommendations.

A significant challenge the students face with the data is manually combing through hundreds of pages of information that comes in through various formats. Their goal is to develop a software program that will standardize the data. This will save the researchers substantial time, enabling them to provide more suggestions for how industry can decrease rig down time.

DuBois enjoyed the problems he tackled during his research internship as he believes big data is here to stay and will help industry succeed.

"This situation reminds me of the movie 'Moneyball' – instead of going on their gut feelings, the Oakland Athletics' management took a deep look at player data and figured out how to do more with less," said DuBois. "I think industry can do this as well."

To learn more about the program and the RAPID consortium visit: drilling.utexas.edu



E&P 2.0 - Designed by HELGE HALDORSEN (PhD PE '83)



CURRENT POSITION: General Director of Statoil Mexico in Mexico City

HONORS: 2015 Society of Petroleum Engineers President, 2013 Rhodes Petroleum Industry Leadership award by the American Society of Mechanical Engineers

CREDENTIALS: In addition to holding various executive engineering roles around the world, Haldorsen was a second lieutenant in the Royal Norwegian Navy, a professor of industrial mathematics at the University of Oslo and a lecturer at Stanford University

1 **What innovations are you seeing in the industry right now that are most inspiring to you?**

With the downturn, E&P business as usual is not an option. The industry must adapt and improve all across the board - in a hurry. In this "lower for a lot longer" situation that the industry now finds itself in, everyone in the E&P village must pitch in, in innovative ways, to get the industry FIT@50 again.

I see inspiring E&P innovations in so many areas: the supply chain is trying to go from Yellow Cab to Uber using the Internet of Things. Drilling automation (putting a Watson or Deep Blue on the rig floor with big data and analytics operating the joy stick) may cut well cost materially. An "aggregation of marginal gains" approach to field developments can boost value-creation and yield cost

reduction via simplification, standardization and industrialization. Going forward, we will more and more be "manufacturing oil & gas"-laser-focused on the margin per barrel and on doing it in a safe and sustainable manner with a diminishing amount of CO₂ emitted per barrel produced.

2 **How can the industry create sustainable energy for the 21st century?**

Increasing competition between energy resources is expected as the world after COP21 wants more energy but less CO₂. If navigated wisely, oil and gas will be key parts of the solution and key components of the global energy mix for many decades to come. We all know that success is never final and that any industry must continuously adapt and renew itself!

As mentioned earlier, we must make E&P fit again at a much lower oil price. Let us call this new and improved version of our industry E&P 2.0. We need to innovate and be creative while we compete and collaborate to make the industry safer, quicker, cheaper, smarter and more sustainable with lower break-evens and more value creation. Finally, more than ever the E&P industry needs technology savvy STEM educated millennials to remove the "im" in E&P impossibilities today - and in the process make an app for that!

3 **How are you shaping the oil and gas reform in Mexico as the head of the Mexico Statoil operations?**

Statoil has been in Mexico a long time and we are very supportive of the reform. To this end, Norwegian politicians have shared their

experiences from 40 years of E&P on the Norwegian Continental Shelf, where there are more than 50 operators, with their Mexican counterparts. Statoil is taking a close look at all opportunities offered in Mexican bid rounds.

Mexico fully understands that to make the energy reform a success, they must offer globally competitive opportunities, terms and conditions and acceptable investor security. Graduating UT Austin students should view Mexico as an up-and-coming job opportunity theatre of operations. If you don't speak Spanish, take a class!

4 **What advice would you give to current petroleum engineering students?**

Congratulations on your choice of occupation! Energy fuels human progress, raises living standards and in this year alone will lift about 150 million people out of poverty. Oil and gas will be needed for many decades to come, so stay the course. Even in 2040, more than 40 percent of the global energy supply will come from oil and gas. In life, we all create our own luck and nothing creates luck like new useful and radical innovative ideas – particularly coming from you. Good ideas come from other disciplines and sciences and tribes. Surprise yourself with taking steps to become a more risk-taking, innovative, creative and passionate version of yourself – and luck will follow!

5 **How do you think big data and automation technologies will impact the future of the industry?**

I recently saw a picture of a driller in a driller's cabin in front of the usual data screens holding on to a joystick. The caption underneath the picture asks: What is wrong with this picture? The correct answer is: the driller!

In the future, the driller becomes the drilling process operator while a trained (on the first few wells drilled) computer is doing the drilling based on an endless feed of big data from sensors everywhere. I firmly believe that big digital data, automation, optimization and analytics that lead to corrective actions will be able to boost efficiencies and create added value in the field.

A NETWORK of KNOWLEDGE

Since 1955, the UT PGE Department has been graduating innovative PhD students. The program started with only a couple graduates a year and has now grown into more than 20 graduates annually. Almost 20 percent of PhD graduates land academic careers at prestigious universities, including Texas A&M University, the University of Calgary and Kuwait University. The professors at UT PGE are not only educating the next generation of future leaders on the Forty Acres, but across the world through the department's graduates. It is a network of knowledge that webs out around the globe with UT PGE being the hub.



Dr. Jerry Jenson, who is an '86 PhD graduate from the department, is a professor at the University of Calgary in the Chemical and Petroleum Engineering Department. He reveals the top five lessons he learned at UT PGE and now shares with his students inside his labs and classrooms.

1

Give graduate students room to explore their own ideas. Dr. Larry Lake gave me nearly a year to pursue an idea that ultimately failed. I learned a lot from that experience and appreciated the time to explore and read. I now try to give my students the same gift.

2

Try to be open about what you do not know; learning is a joint adventure. It was a shock to hear former UT PGE professor Bob McDonald tell me, if I were to be his student, he expected that I would teach him.

3

Avoid confusing complexity with sophistication. One reason my first-year efforts failed was that my method fell apart when noise was added to the measurements. Since then, I've tried to teach my students about robustness, the 80/20 rule (80 percent can be achieved with 20 percent of the effort) and the importance of simple models.

4

Take time to be a friend to your colleagues. One reason I found my study experience to be so enriching was the opportunity for discussion and banter with other students. I learn many things when I take a few minutes to chat with colleagues when we are passing in the hallway.

5

Try your best to acknowledge past contributions. UT PGE Professor Emeritus Bob Schechter particularly showed me that we stand on the shoulders of those who have gone before us. It takes time, but learning what others discovered and recognizing their contributions to my students' work helps them to be better engineers.



Lauding our LEADERS *and* LEGENDS

Every fall, hundreds of Longhorns from UT PGE and the oil and gas industry come together in Austin to recognize the department's most impressive alumni with the Distinguished Alumni Award.

For 85 years, the department's graduates have made a significant impact on the industry through leadership and entrepreneurship. This year's elite class joins a notable group including Jeffrey D. Hildebrand, Ernest Cockrell, Jr. and W.A. "Tex" Moncrief, Jr.

From a prominent CEO to a UT Board of Regents member to a "face of the future" according to Fortune magazine, all the 2016 honorees have individually and collectively influenced the energy and higher education landscapes with their bold ideas.

The seventh annual event will take place on Friday, Nov. 11 at a new location, the Four Seasons Hotel Austin, to accommodate the growing demand for the program.

UT PGE's Distinguished Alumni Program Committee, comprised of UT PGE alumni and faculty, is pleased to announce the prestigious 2016 Distinguished Alumni honorees:

JACK SMYTH **JOSEY** (BS PE '39)*

JOE M. **PARSLEY** (BS PE '51)*

SCOTT D. **SHEFFIELD** (BS PE '75)

ALEX M. **CRANBERG** (BS PE '77)

JOHN A. **WEINZIERL** (BS PE '90, MBA '98)

SUE **PARK** (BS PE '07)

(*Deceased)

For full bios on the honorees and more information on the ceremony, visit: bit.ly/16DAhonorees



FIELDING *Success*

Born into a family with three athletic brothers and parents who graduated from UT Austin, junior UT PGE student and baseball player Jake McKenzie was destined to become a Longhorn athlete. As the fourth generation in his family to walk the Forty Acres, he's carrying on his family's burnt orange legacy in a big way.

In high school, McKenzie was certain he wanted to attend UT Austin and pursue a STEM-related field. However, his petroleum engineering selection did not become official until a long car ride with his uncle who is in the oil and gas business.

"My uncle told me my skills and strengths matched those of a petroleum engineer," said McKenzie. "The aspect that sold me the most on the industry is the encouragement and space for new ideas to make processes better – I feel I could have a lot to contribute."

McKenzie graduated summa cum laude from W.T. White High School in Dallas and has continued his academic success in UT PGE. Despite three hour practices almost every day during baseball season and consistently traveling for games across the country, he was still named to the Big 12 Commissioner's Honor Roll and maintains a steady focus on academics and his future as a petroleum engineer.

Baseball has taught McKenzie a lot about succeeding in school and as a petroleum engineer.

"Teamwork is essential in any business, and by working with such a diverse group of people, I have also learned the importance of time management and leadership skills," said McKenzie.

Last spring, McKenzie was recognized for his leadership efforts receiving the Big 12 Conference Champions for Life award. The honor is given to athletes who display the lessons of teamwork, leadership, time management, discipline, perseverance and giving back to others through community service.

After wrapping up baseball season in May, McKenzie packed his bags for Gonzales, Texas, a small town east of San Antonio. EOG Resources hired him for a summer field internship position. During his internship he gained more knowledge of the industry, better preparing him to start his full-time career in the spring of 2018. He has also benefited from the mentorship and advice of UT PGE alumnus and former UT Austin baseball player Patrick Marsh (BS PE '14), who also works for EOG Resources.

"It is valuable to learn from someone like Patrick who had a similar collegiate experience," said McKenzie.

In the spring of 2017, McKenzie will be back on the field under the helm of new Longhorn baseball coach David Pierce. He hopes to continue as a utility player and have the opportunity to find his way back to the mound.

A BROAD LEARNING EXPERIENCE



Dubrovnik, Croatia

The Croatians have a phrase “tko ne riskira, ne profitira,” which translates in English to “nothing ventured, nothing gained.” This past summer 13 UT Austin students and a UT PGE faculty member embarked on the first UT PGE-sponsored study abroad program in Croatia. The program provides students with insights on international oil and gas operations and the ability to learn computer programming in order to solve complex energy problems.

More than 3,000 Longhorns study in 80 countries every year, and UT Austin ranks second in the nation for the most students studying abroad, according to the Institute of International Education’s latest annual report. The Cockrell School of Engineering has a dedicated international office, offering 14 summer faculty-led programs and 16 university exchange programs to students.

With UT PGE’s alumni working and living abroad population representing 60 countries, it is important for petroleum engineering students to participate in an international educational opportunity during their time on the Forty Acres.

“Students entering industry with global experience are at an advantage, as companies in this field often prefer a demonstrated ability to live abroad or communicate with overseas

partners and colleagues,” said Ellen Aoki, program coordinator of the International Engineering Education (IEE) office.

The four-week Maymester, which IEE will offer again in 2017, provides in-residence credit for PGE 310 (Formation and Solution of Geosystems Engineering Problems). The program targets freshmen and sophomores with the goal of fulfilling a major course requirement and providing students an educational network that could positively impact their future careers. The students spent a month in Croatia, leaving Texas in late May and returning at the end of June.

Recently promoted associate professor Maša Prodanović led the program in a country where she has developed many strong academic and industry contacts. Prodanović earned her

bachelor’s degree in applied mathematics at the University of Zagreb, located in the capital of Croatia.

“I owe much of my understanding of people and cultures, the important knowledge that goes beyond the facts and theory, to international education and travel,” said Prodanović. “I wanted to take students along to experience part of it and hopefully set them on a path of integrated life-long learning.”

THE WORLD IS A BOOK – THOSE WHO DO NOT TRAVEL ONLY READ A PAGE

The students spent two weeks in Zagreb, a bustling European city with a population of over 1 million within the metropolitan area. They took their class within the Department of the Faculty of Mining, Geology & Petroleum Engineering



Wall of Ston



Drilling Rig in the Adriatic Sea



Dr. Maša Prodanović

at the University of Zagreb. The summer class gives students a head start to prepare for their upcoming reservoir simulation classes.

"I learned about petroleum engineering outside of the U.S. and met some remarkable industry professionals, which helps me expand my network," said Mirka Mendez, a second year UT PGE student. "The course was fast-paced, but I enjoyed it because we were a small group so it was easier to ask questions or get help. It also gave me an opportunity to know my professor and TA better than I would have in a regular semester on campus."

The students had the opportunity to explore the city, but the majority of their time was spent devoted to academics. They were in class three hours a day, with additional office hours, homework and quizzes. Several Croatian graduate students also enrolled in the course, enabling UT Austin students to learn from people who have seen the world, more specifically industry, through a different lens.

"The Croatian students were incredibly driven and smart," said second year UT PGE student Laura Bohorquez. "I was surprised at how easy it was to become close friends with people who have a completely different background, lifestyle, language and sense of humor."

After completing the PGE 310 course in the fourth week in Zagreb, the group traveled to Pula, Croatia to visit offshore gas platforms Ivana A and Ivana K in the Adriatic Sea. The tour of the platforms gave students an important understanding of how offshore rigs operate. While in the rig's control room, the students saw the content covered in their class applied in a real-world format.

OH THE PLACES YOU WILL GO!

Two weeks were spent in Dubrovnik with excursions to Plitvice and Split. The fortress looking historical city is set along the crystal blue waters of the Adriatic Sea. With a small population of less than 50,000, the city has recently gained fame by serving as a set of the hit HBO drama series "Game of Thrones."

The students resided on-campus at the Inter-University Centre (IUC). The group participated in the Petroleum Engineering Summer School (PESS), a conference that brings together distinguished professors from all over the world to exchange knowledge. The interactive seminars provided key information to the students on technical, technological, environmental and economic issues in the petroleum and energy industries.

Even with a rigorous schedule and workload, the students found time to indulge in the local cuisine, swim at the local beaches and watch the Croatia futbol team play in the EuroCup.

"I highly recommend this experience to other students," said second year UT PGE student Andrew Faulk, calling it a "once in a lifetime opportunity." From the close interaction with Dr. Prodanović, company connections and excursions, "I believe this experience will help me in the long-term within industry."



UT PGE Staff & Students

STUDY ABROAD
Excursion Highlights



PULA, CROATIA
"Out to Sea"

The group took a two-hour boat ride to receive a first-hand tour of offshore gas platforms Ivana A and Ivana K in the Adriatic Sea. The workers of INA hosted the group.



DUBROVNIK, CROATIA
"Winter is Coming"

The "Game of Thrones" television show uses Dubrovnik's historical King's Landing as a setting. A group of students and staff went on a themed walking tour to see different scenes from the show.



STON, CROATIA
"The City of Walls"

An excursion with PESS took the students to the city walls of Ston. The city's walls are the second longest in the world, with only the Great Wall of China having greater length.

The DOMAIN of DISCOVERY

The University of Texas at Austin is a flagship university for innovative energy research. For 85 years UT PGE faculty have been developing tools that revolutionize the oil and gas industry, including the radial drill collar and the mini permeameter. With the department's reputation as the No. 1 petroleum engineering graduate program in the country, many students majoring in STEM at prestigious universities across the country desire to come to the Forty Acres to learn first-hand from some of the world's best petroleum engineering experts.

The Summer Undergraduate Research Internship (SURI) program, now in its eighth year, provides this research opportunity to a select group of almost 20 undergraduate students who are vetted through a stringent application process. Thanks to the support of our dedicated alumni and corporate partners, the students work in the UT PGE labs with faculty and graduate students on critical energy topics. The goal of the program is to offer a strong research experience to students, particularly those who are interested in pursuing a PhD in petroleum engineering.

The students are assigned a specific project at the beginning of the 10 week program and then provide their results at a final poster session

to faculty and program supporters. In addition, the students take a field trip to a major oil and gas company each year to see what it is like to conduct research in industry.

In the past, the program has mainly consisted of non-UT students. Due to the industry downturn leading to low summer internship availability, the department supplemented additional positions within the program. The purpose is to ensure UT PGE students gain valuable skills in the lab, which will help them succeed as students and engineers in industry.

During the program, UT PGE senior Lauren Wucinski worked with associate professor Matt Balhoff on microbial enhanced oil recovery (EOR). She was injecting microbes into a core so they could eat away at the oil and water interfacial tension, which reduces residual oil saturation.

"There is still so much to discover in petroleum engineering," said Wucinski. "We are looking for the next thing to revolutionize the industry."

Prior to the program, graduate school was not even a blip on Wucinski's radar, but now she is considering continuing on her educational journey after working directly with graduate students on a daily basis. She didn't realize how much research would fit her personality

type, but as someone who describes herself as "super detail-oriented" and "always checking everything twice" the research avenue matches her strengths.

Karl Schmidt, a senior in physics at the University of Southern California, tested a new algorithm on characterizing mixtures of fluids developed by assistant professor Ryoosuke Okuno. He was comparing the old and new methods to see how thermodynamic parameters affect the topology of the Gibbs free energy.

"I'm helping to further refine the understanding of what the oil and gas is doing underground," said Schmidt. "If we know the properties and behaviors we can extract it more efficiently."

Schmidt is hoping to take his physics degree and apply it to an engineering field in graduate school. He has found petroleum engineering research rewarding and that it has taken him out of his comfort zone.

"We are doing completely groundbreaking research - we are working on ideas that have never been explored or even considered," said Schmidt. Wucinski added, "The program promotes coming up with new ideas. It might work, it might not but it is all about the drive to try."

Excellence & Accolades

Prodanović Promoted to Associate Professor

Dr. Maša Prodanović has been promoted to associate professor effective Sept. 1, 2016. An NSF CAREER Award recipient, Prodanović's research specializes in multiphase flow and image-based porous media characterization especially applied to heterogeneous media, level set method, ferrohydrodynamics, sediment mechanics/fracturing and unconventional resources.

Chiranth Hegde Wins Best Student Paper at AADE Conference

UT PGE master's student Chiranth Hegde won the Sandy Purdy Award at the 2016 American Association of Drilling Engineers (AADE) Fluids Technical Conference and Exhibition held April 12-13, 2016 in Houston at the Hilton North hotel. The award, named after the founder of AADE, is given to the top student paper at the conference. This marks the first time a UT Austin student took home the award.

Researchers Receive SPE Regional Awards

Assistant professor Zoya Heidari and associate professor Quoc Nguyen received 2016 SPE Southwest North American Region Awards for their significant contributions to the oil and gas industry. Heidari received the Formation Evaluation award and Nguyen won the Reservoir Description and Dynamics award. The Center for Petroleum and Geosystems Engineering's (CPGE) senior research scientist Richard Schultz won the Completions Optimization and Technology Award for the Gulf Coast Region.

Mukul Sharma Named Texas Exes Top 10

For the fifth year, Texas Exes put out a list of the Top 10 UT Austin professors, selected by Longhorn alumni. Professor Mukul Sharma is a 2016 recipient of the honor. The faculty who were recognized this year all had a "zeal for knowledge and devotion to their students" according to the Alcalde, a Texas Exes publication.

Three Professors SPE International Award Winners

Three UT PGE faculty members have been selected as recipients of the 2016 International Society of Petroleum Engineers (SPE) awards. Professor Jon Olson, who is a leader in hydraulic fracturing research, and professor Eric van Oort, who has established a global reputation for his ideas on revolutionizing the drilling process using the latest technology, have been awarded the SPE Distinguished Member award. Established in 1983, the Distinguished Member award recognizes SPE members who achieve distinction deemed worthy of special recognition. Distinguished Membership is limited to one percent of SPE professional members.

Professor Kishore Mohanty has been awarded the SPE Distinguished Achievement Award for Petroleum Engineering Faculty. It recognizes superiority in classroom teaching, excellence in research, significant contributions to the petroleum engineering profession and/or special effectiveness in advising and guiding students.

Graduate Student Honored with Best Poster at SPE Forum

UT PGE graduate student Nkem Egboga won the 2016 SPE Gulf Coast Reservoir Technology Forum poster contest held May 19, 2016 in The

Woodlands at the Anadarko Conference Center. The Reservoir Technology Forum is an annual event designed to disseminate knowledge and technology needed to achieve the many objectives of reservoir management, including understanding risk, increasing production and reserves, and maximizing recovery.

UT PGE Student Appointed to the United Nations Young Leaders Initiative

After receiving 18,000 applications from 186 countries, sophomore Karan Jerath is one of 17 students from around the globe selected for the United Nations Young Leaders Initiative. The program recognizes exceptional young people who are leaders in the effort to end poverty, combat climate change and reduce inequalities. Spear-headed by the Office of the UN Secretary-General's Envoy on Youth, the UN Young Leaders Initiative identifies talented students and young professionals who are driving change.

During his term, the Young Leaders will work with the Envoy on Youth and the United Nations to help galvanize other young people around achieving the Sustainable Development Goals.

Brooks and Grieve Receive Staff Awards

UT PGE's financial analyst Allison Brooks received the Cockrell School of Engineering's 2016 Staff Excellence Award. Communications coordinator Katharine Grieve is a recipient of the 2016 President's Outstanding Staff Award. Both awards recognize staff members who foster collaboration and communication and perform at an exceptional level.



To read more about the accolades visit: pge.utexas.edu/news



The WATSON Effect

In 2011 IBM's Artificial Intelligence (AI) platform, Watson, went up against the all-time most winning JEOPARDY! champion Ken Jennings. Within a few categories, Watson's depth and breadth of knowledge surpassed the human brain providing Watson with the win. At that moment, Watson demonstrated to the world the powerful role AI will play in the 21st century. Watson hung up his game-show career, but has been incredibly busy over the past five years gaining vast amounts of insights on many fields, including oil and gas.

Industries took notice of the power of big data analysis to find solutions to a broad range of their pressing challenges. With massive amounts of information pouring in from sensors by the second, companies must process, analyze and find meaning in this data to fuel innovation and create opportunities. Recent UT PGE graduate Katy Hanson (BS PE '16) is at the forefront of this ever-evolving field.

This summer, Hanson worked side-by-side with the world's most recognized technology platform. She had a full-time internship at IBM's

corporate research laboratory in New York, prior to returning to Austin to attend graduate school in petroleum engineering this fall.

IBM Watson is a technology platform that uses natural language processing and machine learning to reveal insights from large amounts of unstructured data. The Watson team began programming the system for the oil and gas domain, which requires deep industry knowledge. Hanson had the unique experience of teaching Watson some of the important petroleum engineering information she acquired during her time as an undergraduate student at UT PGE.

"In the current oil and gas industry environment, Watson will be a huge asset," said Hanson. "Having Watson pour through huge amounts of data will help companies save time, money and lower their exploration risk by helping them make better decisions about acquiring new leases or undiscovered areas."

Watson has an uncanny ability to learn through repetition. Whether that is humans like Hanson repeatedly telling Watson what to

look for in long geological assessment reports to improve efficiencies or feeding Watson historical data to help Watson find indicators of exploration potential.

"Watson can take massive amounts of data, generally taking an engineer hours upon hours to go through, and use it to help people make a decision about something almost instantly," said Hanson. "It is revolutionizing the speed and accuracy of our decision-making."

While the main goal is for Hanson to teach Watson, Hanson learned a lot from the AI platform as well. She received a first-hand glimpse of where the industry is headed and potential opportunities that combine AI technology and petroleum engineering.

"By working with Watson, I now feel confident to work in the UT PGE drilling lab during graduate school as Watson helped me to see the important role automation will play in the industry," said Hanson. "It is giving me ideas about where we can go from here - it is exciting that in a downturn you can see the value of significant changes coming to industry."

A NON-TRADITIONAL ROUTE

With oil prices hovering around \$45 a barrel in May 2016, UT PGE graduates came up with creative avenues for finding jobs while remaining connected to the oil and gas industry. Many students secured positions with broader consulting or technology companies that have energy clients, including Matt Inman (BS PE '16).

Born and raised in The Woodlands, Texas, Inman grew up around oil and gas professionals including his father who worked in the downstream sector. However, it was not until a meeting with a UT PGE staff member in high school that Inman knew majoring in petroleum engineering was the right choice.

"I went to a Society of Petroleum Engineers (SPE) recruiting fair freshman year of high school and met UT PGE academic advising coordinator Arletta Tompkins," said Inman. "Her speech at the event inspired me to take the petroleum engineering route."

Inman, a petroleum engineering honors student, learned many valuable skills while at UT PGE. Those lessons have instilled a confidence in him to achieve a successful career.

"I worked hard at developing problem solving strategies and sharing knowledge in a collaborative space," said Inman. "If I did this degree in a vacuum I would have never survived."

As Inman entered his senior year and the low price environment continued, he knew it would be a challenge to obtain a job as an engineer in the oil and gas industry. In the fall, Inman

decided to expand his job horizons beyond UT Austin's engineering EXPO. He stopped by the final hour of the McCombs School of Business undergraduate career fair. He believed his analytical thinking skills could be attractive to companies at the fair. Inman was right. He secured a position with Capco Energy Solutions, formerly SunGard Consulting Services.

In the summer of 2016, Inman began working as a business analyst in the technology wing of the Houston based company. Capco Energy Solutions provides consulting services to energy companies throughout the U.S. Many of the company's clients are in the oil and gas sector.

Inman's role as a business analyst is to address the technology needs of his clients. If a client wants to implement a new software program, he sits down with the client to look at their current capabilities and goes through the design process with them. Once the program is developed by an in-house design team, Inman trains the clients on the new software to ensure it meets their needs.

"Working in the technology sector is opening new doors for me and it is great having the opportunity to find important solutions for oil and gas companies to make them more efficient," said Inman.

While Inman settles into his career, he reflects on what advice he would give to incoming UT PGE students.

"Don't sit back and wait for things to come to you - be proactive - that will be the best determination of your success."



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UT PGE TAILGATE - JOIN US!

UT PGE is hosting its seventh-annual tailgate, coinciding with the Distinguished Alumni Ceremony, in front of the CPE building on the UT Austin campus. This year's event will be held on **Saturday, Nov. 12**, three hours prior to the Longhorns taking on the West Virginia Mountaineers. Guests will enjoy a Texas-sized tailgate with food, drinks and giveaways, while mingling with students, alumni and professors.

RSVP: bit.ly/2016PGEtailgate