

# dimensions



## INTERNATIONAL



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**plug** A journey from  
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In 2017, Saudi Aramco's Exploration and Petroleum Engineering Center — Advanced Research Center (EXPEC ARC) established the Women at EXPEC ARC Network to focus on the development of women in the department, enabling them to push past boundaries and excel in their careers as engineers, scientists, researchers, and administrators.



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Saudi Aramco's *Dimensions International* is published periodically for the affiliates, customers and employees of the Saudi Arabian Oil Company (Saudi Aramco).

**Amin Nasser**

President and Chief Executive Officer

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Vice President, Corporate Affairs

**Fahad K. Dhubaib**

General Manager, Public Affairs

Editor:

**William E. Bradshaw**

Email: [william.bradshaw.1@aramco.com.sa](mailto:william.bradshaw.1@aramco.com.sa)

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*Contributing to this issue:*  
Adil A. Al-Sadiq, Mallee Al-Howaidi,  
and Jeffrey A. McCoshen

*Design:*  
Graphic Engine Design Studio,  
Austin, Texas, U.S.A.

*Printing:*  
Sarawat Designers and Printers,  
Jiddah, Saudi Arabia

*All editorial correspondence  
should be addressed to:*  
The Editor,  
Saudi Aramco Dimensions International  
Corporate Communication Support Department,  
Saudi Aramco Box 5000  
Dhahran 31311  
Saudi Arabia  
ISSN 1319-0520  
Copyright © 2018 Aramco Services Company

 Printed on recycled paper  
[www.saudiaramco.com](http://www.saudiaramco.com)

#### About the cover:

Samples of date seeds in different stages, which have been used to produce ARC Plug as per EXPEC ARC's defined specifications, to be used as a loss circulation material.

أرامكو السعودية  
saudi aramco





# GEO TRAIN: Charging Future INTO THE of exploration at Saudi Aramco

BY ADIL A. AL-SADIQ

PHOTOS BY ABDULAZIZ M. AL-MOAIWEED

AND HASAN ALMUBARAK

Saudi Aramco's preeminent position in Upstream has always been a hallmark of the company. Its continued progress over the decades did not emerge from a vacuum. It was the result of facing challenges head-on with determination, persistence, and creative and innovative thinking. And it was Saudi Aramco, through a unique training program, which helped equip and train professionals for the considerable tasks that would await them.

**A**s drilling and exploration operations require personnel with knowledge-based efficiency and capability, the company has been strongly committed to educating, qualifying, and training its employees. Today's training programs at Saudi Aramco did not appear out of the thin air and weren't based simply on an isolated decision, but go back to the company's early days of oil exploration operations when Jabal School — the company's first school — was established. The school represented the nucleus of the major training and development programs as we know them today in Saudi Aramco.

Educational programs in the company have developed and varied in quantity and quality. Thousands of employees were

Geologist Fatima Mohsen and Ali Alwaheed listen to Richard Collier from the University of Leeds as he describes a rock formation during a geological field trip to Midyan, in the north of the Kingdom as part of the In-Kingdom Master's Degree program, which is operated by the University of Leeds (U.K.).

qualified for scholarships to acquire bachelor's or postgraduate degrees in various scientific disciplines — especially engineering, geology, and geophysics.

This gives the Exploration organization a unique place in this giant company as its wide and complex operations represent the backbone for discovering, recovering, refining, and marketing oil. And because of this, the organization places great importance on education and training. Exploration employees are its true wealth and the main source to continue performing its operations in a vibrant and effective manner.

## WHERE ARE WE GOING IN THE FUTURE?

This simple and deep question served as a base for a fundamental change in Exploration. In 2011, former Exploration vice president Ibraheem M. Assa'adan (then general manager) challenged all of the organization's officials to reconsider and review employees' training by creating a 10-year



development plan to help avoid the loss of the wealth of information as a result of employee retirement.

The experience gained during those long years is a treasure that the Exploration organization wanted to preserve and use to ensure a smooth transition to help guarantee new employ-

ees sustainable success.

The Upstream sector in Saudi Aramco is known for its constant efforts to hire the largest number of graduates from the College Preparatory Program and the students of the College Degree Program for Non-Employees (CDPNE). In 2005,

Exploration started recruiting 40 to 60 male and female trainees to study geology and geophysics at a time when Exploration operations started to undergo remarkable expansion across the Kingdom.

Assa'adan stressed the importance of early identification of differ-

In 2011, Ibraheem M. Assa'adan challenged Exploration officials to create a 10-year development plan to help avoid the loss of information that arises because of retirement. Part of the response to that challenge has been the creation of programs such as the Geoscience Train program.





Above: Geologist Abdulkarim Alanazi investigates a rock formation in Qassim. Right: Some of the first geologists in the Kingdom included, from left, Tom Barger, Walt Hoag, Max Steineke, and Jerry Harriss, shown here during an exploration visit to the Eastern Province in 1937. Opposite: A rock sample taken during the geological field trip in the Qassim area.



ent capabilities and skills of trainees: “As it will impact their career,” and because of “the need for alignment between their interests and job requirements.

“We must identify the gaps that prevent us from an efficient transition to the future. We want to identify the best skilled and qualified mentors. That is why we are handling new graduates who are filled with energy and are eager to start work quickly,” said Assa’adan.

“All of our training programs serve the employees’ best interests,” said Misfir A. AzZahrani, acting executive director of Exploration.

“As there are increases in their educational output, we are obligated to search for different training methods. Since they received training in university classes, we are offering them on-the-job training as well. We are facing the challenge of alignment between the employee’s training and job,” said AzZahrani.

The most important question is: How can the development of these young employees be expedited, giving them an opportunity to work directly under supervision and training, to ensure the quality of the output, while engaging in management through their work?

The answer lies in the importance of providing new employees a quick training program that facilitates on-the-job learning for young employees and allows expertise and knowledge transfer from older generations to the new generation to maintain the same level of high performance of professionalism. Through this program, young employees become qualified to perform their jobs with efficiency and enthusiasm while satisfying their career ambitions.

In addition to that, the large number of employees who will leave the company due to natural attrition will leave a gap that must be filled by developing a program that includes the Exploration’s two primary disciplines — geophysics and geology.

## GEOSCIENCE TRAIN IS THE BEGINNING

The Exploration sector developed the idea of the “Geoscience Train” program after a number of meetings and brainstorming sessions led by many geologists and geophysicists, including those working in the Exploration’s Human Resources (HR) Group.

The “Geoscience Train” program focuses on building the participant’s strengths in geology and geophysics through a mix of educational courses and field applications. It also selects mentors from different specialties and backgrounds to align ideas with expertise and close the scientific gap between the new and seasoned employees. This enables the new generation of geologists and geophysicists to deliver new and innovative solutions to address challenges facing Exploration. Throughout the program, participants benefit from their understanding of geology through class lectures, group projects, and field trips before they are assigned to work in the organization’s divisions.

## FOUR PHASES

The Geoscience Train route was divided into four phases through which new employees undergo extensive training. Each phase includes intensive study to meet the new graduates’ needs in geology, geophysics, and other related fields.

In the first phase, the program will focus on geophysical methods and include a mix of training courses presented by world-class experts and practical applications to reinforce the basic concepts and principles of geophysics.

In the second phase, the program will focus on petroleum systems, including petroleum geological principles and tools, as well as major oil and gas exploration technologies. This is accomplished through a series of lectures and practical projects under direct supervision of mentors to enable the program participants to gain the necessary skills as soon as possible.

The third phase includes applying tools and techniques to fully understand the process and operations of oil and gas reservoir exploration, and identifying causes of success and potential risks that might cause failure of the exploration process.

The fourth and final phase of the Geoscience Train program focuses on building 3-D models for oil and gas fields and reservoirs, and evaluating oil and gas reserves by using well logs and geophysical and petrophysical information.

The idea of the program is to accelerate the development of skills required to meet the growing needs of the exploration operations and the development of oil and gas fields. The trainee can accomplish the tasks assigned skillfully after completing the program, which lasts for 18 months from the time the employee joins the organization.

The program offers a golden opportunity for both trainees and the Exploration organization to make the proper decisions to steer the workforce in the right direction at the right time. After completing the Geoscience Train program, the Exploration’s HR team begins the process of identifying the individual’s majors and the right division for graduates based on three factors: work needs, employee skills assessed by the instructors, and the specialty they selected. During this process, priority is given to selecting the specialty that

is appropriate to the graduates’ talents and abilities. This process is conducted in detail as follows:

1. Identifying the needs of work: Reviewing each division’s work requirements and the number of professionals it needs for each specialty.
2. Mentors’ evaluation of the graduates’ skills: During each phase, mentors categorize the participants who enrolled

A group of geologists examines rock characteristics in relation to porosity during a geological trip.





in the program according to their performance in the tasks assigned to them and their accomplishment during their enrollment during the four phases. This helps identify their strengths and the appropriate specialty for each.

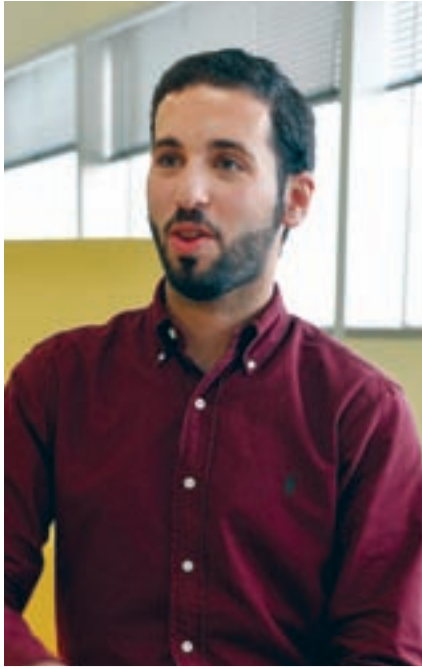
3. Candidate preference: Each graduate chooses the specialty he or she prefers by answering the following questions:

- What are their professional interests based on the experience provided by the program?

- Which department do they want to join?
- Would they like to perform a short-term task before joining the targeted department?

The Geoscience Train program was launched in November 2013 under the supervision of HR leader Eman Al-Yami, members of the Exploration organization's HR team, and an advisory group of specialists. The primary objective is to directly follow up this program to learn about the details of the implementation phase and allow for the timely intervention to adjust the program as needed. So far, eight batches, consisting





Left from top to bottom: Majid Al-Ghamdi; Hassan Al-Momen; and Jana Alabdullatif. Below: Participants in GEO Train's Batch 10 on a geological trip to Hail make their way down a hillside as part of their field studies.

of 156 employees, have graduated since the program was launched. There are plans to extend the program in the coming years to include all CDPNE students, as well as candidates for recruitment from the Kingdom's university graduates.

### GRADUATES' REMARKS

The graduates' remarks bear witness to the success of the program and achievement of its desired objectives. For example, Deema Al-Beesh (a graduate of Batch 5) says she has been able to identify all scientific and technical specialties in geophysics and geology. She said that she benefited from the quality and quantity of information provided by

the program, and she was able to choose the appropriate academic specialization that fulfills her professional and career aspirations.

"The Geoscience Train program has played a genuine role in developing my knowledge and sharpening my skills," said Al-Beesh. "I have been able to accomplish different tasks in the company. I also met a number of specialists in several disciplines, understood the nature of the work they perform, how to access them in times of need, and I was able to identify the specialization I want to study in the future — namely petrophysics."

"The program has allowed me and my colleagues to accumulate a wealth





“Since they received training in university classes, we are offering them on-the-job training as well. We are facing the challenge of alignment between the employees’ training and job.”

– MISFIR A. AZZAHrani

of information about the Exploration organization, its departments, divisions, and units. It helped us to understand and apply professional communication techniques to all employees inside and outside the organization,” said Majid Al-Ghamdi (a graduate of Batch 7). “The Geoscience Train program actually enlightened and transferred me from the

knowledge level to the work level.”

Hassan Al-Momen (a graduate of Batch 7), emphasized the importance of delivering presentations before the vice president of Exploration, department managers, and division heads as these officials can ask questions of the employees directly, and allow the employee to demonstrate their skills and talk about their experience in the program.

“When I graduated from university, I had wide theoretical and cognitive knowledge about everything related to geophysics. However, I had little knowledge about the practical geophysics in Saudi Aramco, which we will practice professionally.”

Geophysicist Jana Alabdullatif echoed Al-Momen’s comments, noting that working in the field is of critical importance. “I didn’t know anything about seismic tests, techniques, equipment, or the machines that are deployed within Saudi Aramco,” she said. “Choosing geophysics as a major seemed exciting and very gainful. Every day brought new challenges that helped me define my future career where the potential options were even broader than I ever imagined.”

## THE FUTURE OF CAREER DEVELOPMENT IN EXPLORATION

Currently, three groups graduate each year, allowing Exploration to have approximately 60 employees able to choose their appropriate specialization.

This is not the end. Exploration is pursuing a recruit-to-retire integrated development program.

This is to ensure continuation of the professional development of the employee during his or her entire career in Saudi Aramco in a way that is suitable to their specialty and work requirements.

For example, during the five years following the Geoscience Train program, Exploration will seek to enable 75% of the employees to obtain a master’s degree, along with continuing the scholarship program for postgraduate studies. In an agreement with the University of Leeds, a leading U.K. university, Exploration nominated 30 employees in 2017 to pursue a master’s degree in the Kingdom while they are still on-the-job.

Ten years after the completion of the Geoscience Train program, the organization will strive to ensure that the employee is qualified to be a world-class professional in his or her area of specialty, and have the ability to lead and train new employees. 🌐





Photos by  
**Brigido O. Alcayde**

As an element in promoting diversity and inclusion, Saudi Aramco's Exploration and Petroleum Engineering Center – Advanced Research Center (EXPEC ARC) established the Women at EXPEC ARC Network (WEN) in 2017 to focus on the development of women within the department. WEN complements women empowerment by enabling them to push past boundaries and excel in their careers as engineers, scientists, researchers, and administrators.

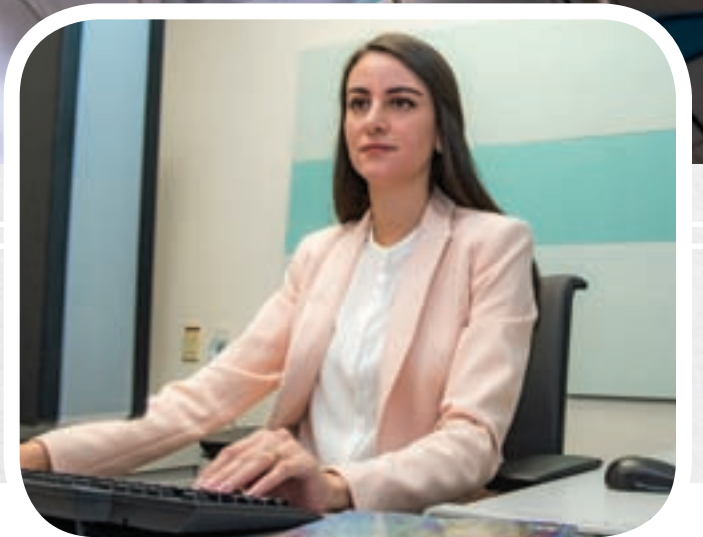
In collaboration with the Women Development and Diversity Division (WD&DD), activities were developed and tailored to EXPEC ARC's unique fabric and aligned with the WD&DD corporate program, resulting in a more adaptive and inclusive atmosphere at EXPEC ARC.

WD&DD leadership courses such as "Together at Work," "Leading with Inclusion," "Women in Business," and the "Women in Leadership Program" have been completed by many WEN members. Eleven mentors were assigned from EXPEC ARC to join the Mentorship Program sponsored by WD&DD. An introductory session about the Mentorship Program took place last year where WEN champions and EXPEC ARC selected mentors were introduced to the program by WD&DD representatives.

WEN also assigned 12 mentees (six women and six men) from EXPEC ARC to join the Mentorship Program. Women are also supported in attending local and international



Development, opportunity, and encouragement are key ingredients to the success of the Women at EXPEC ARC Network, or WEN, at Saudi Aramco. Working hand-in-hand with the Women Development and Diversity Division, EXPEC ARC has opened new doors to employees such as Nour O. Baqader. "At EXPEC ARC, we feel encouraged to be the best we can and unleash our talent, ensuring we have the opportunities to do so," says Baqader, one of a number of WEN participants.



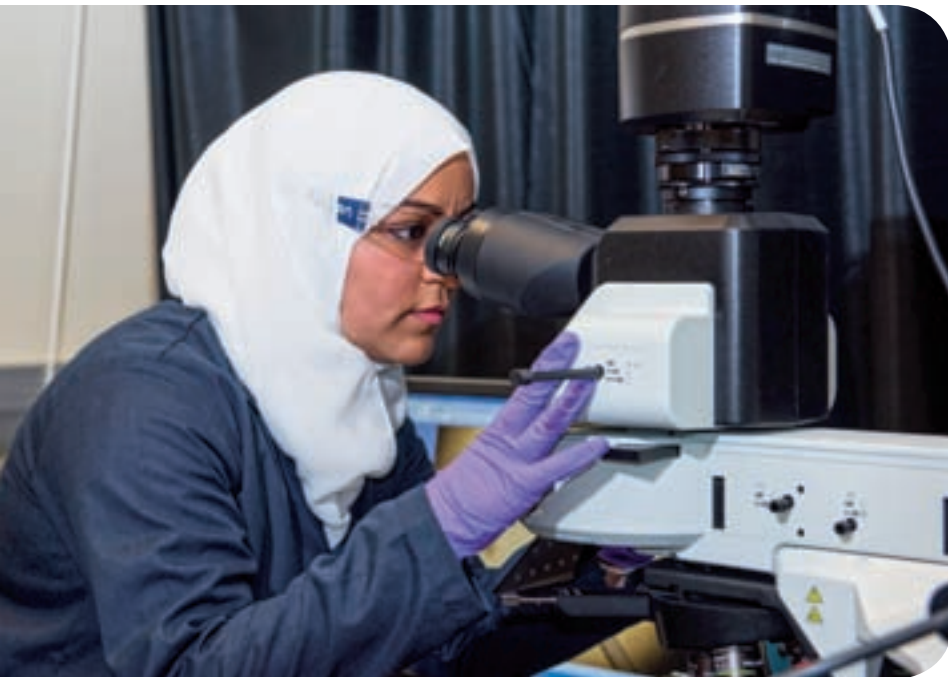
*Left:* Salma M. Alsinan, shown here working with EXPEC ARC colleague Philippe G. Nivlet, said the Women at EXPEC ARC Network has brought many benefits to women like herself. A member of the Young Researchers committee, Alsinan said, "Through this program, we are pushing the boundaries and creating opportunities for women at EXPEC ARC." *Right:* For Suha N. Kayum, the Women at EXPEC ARC Network has many benefits, with the ability to meet and collaborate with other women in the department chief among them. "Women have been nominated to champion activities in several groups within EXPEC ARC," she said.

courses that facilitate their advanced degree application requirements. The one-week King Abdullah University of Science and Technology Winter Enrichment Program in January addressed the Human Machine Future and was attended by 30 EXPEC ARC employees — 11 of whom were women.

### **Engaging in the industry in many ways**

To help women in EXPEC ARC develop technical and leadership skills, WEN encourages female researchers to

participate in the industry by attending conferences and playing an instrumental role there, as speakers, mentors, technical reviewers, organizing committee members, etc. EXPEC ARC has sent female researchers to several events in reputable conferences focused on women development. Examples include the Women in Energy conference at the Abu Dhabi International Petroleum Exhibition and Conference, Society of Exploration Geophysicists Women Network Mentor Program, and the Leadership Excellence for Women Awards.



The opportunities provided by the Women at EXPEC ARC Network have been multifold. With strong support by management, researchers such as Afnan Mashat (seen here working in the laboratory) have seen their careers grow. "I have been given a lot of opportunities that I would not have without management support," said Mashat.

Six speakers have been selected as potential keynote speakers for upcoming "Women Who Inspire" sessions.

### **An opportunity for recognition**

Recognition plays a major role in the success of any program. Internally, the EXPEC ARC Special Achievement Recognition of eXcellence (SPARX) awards were presented to five women in 2017. Shamael Al-Shuhail was recognized for scoring the highest in the Production Engineering Flagship course; Zainab A. Al-Saihati completed the Drillstring Design course with an excellent score and active role in the class; Jumanah A. Al-Kubaisy was recognized for her active role in the EXPEC ARC driving safety

program; and Nora A. Omairi and Mashail M. Naqi were both recognized for their outstanding administrative support.

Omairi and Naqi, along with Lauren Stout, were also named finalists in individual categories of the 2017 EXPEC ARC Annual Awards where WEN members were among many teams named as finalists and winners. Among the 12 categories, three female employees were winners — Sarah F. Saif of Reservoir Engineering Technology won the Outstanding Young Professional category; Feng Liang of Production Technology won the Effective Publication award; and the Best Support Staff award went to Nourah M. Alarifi of Geology Technology.

Women contribute their expertise to developing technologies that are nominated for international awards throughout the year. In terms of individual recognition in 2017, Abeer M. Olayan won the Oil & Gas Middle East "Woman of the Year" award, and Sarah F. Saif was awarded the Young ADIPEC Engineer Award.

EXPEC ARC women are also active in the department's Young Researchers Program (YRP). The YRP objectives are to develop self-motivated and innovative researchers who lead in their area of specialty and support EXPEC ARC's vision, mission, and strategic goals. Currently, about 20% of the participants are WEN members.

The young professionals are paired with qualified senior researchers within EXPEC ARC through graduation from the program, at which time they are expected to possess a subject matter expertise and lead technology teams in a multidisciplinary technical project.

To inspire women in EXPEC ARC to reach their full potential, WEN has launched an event of multiple sessions throughout the year titled "Women Who Inspire." The event hosts female leaders from different business lines in Saudi Aramco and outside the company as keynote speakers to share their stories and experiences with WEN members and EXPEC ARC employees.



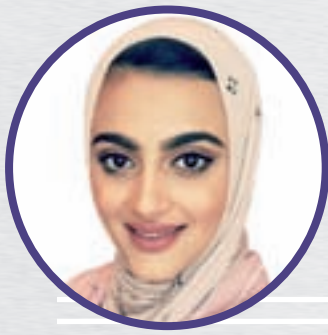
At EXPEC ARC, we feel encouraged to be the best we can and unleash our talent, ensuring we have the opportunities to do so. I have the tools and support to develop my expertise, share my capabilities and creativity with colleagues and international audiences, and to show talent to upper management.

— NOUR O. BAQADER

WEN has empowered women by creating a channel for us to meet other women in our department, collaborate with women from different divisions to organize programs and activities, and collectively have a voice. Women have been nominated to champion activities in several groups within EXPEC ARC.

— SUHA N. KAYUM





Working in EXPEC ARC gave me strength, courage, and confidence. I am always able to express my development desires and discuss them with my mentor freely to achieve my goals with creativity. I had the opportunity to attend and participate in several conferences inside and outside the Kingdom. EXPEC ARC is a healthy working environment where management encourages teamwork, supports ideas, and promotes collaboration.

— JAWAHER M. ALMORIHIL

At EXPEC ARC, the environment of the department has always been inclusive and diverse. I have witnessed and worked with very strong-minded women in EXPEC ARC with very clear career goals. EXPEC ARC managed again to develop a new promising philosophy through WEN, and I look forward to contributing to EXPEC ARC's success at large.

— BASMAH S. BAKHREBAH



Five female employees were nominated in different categories for the Leadership Excellence for Women Awards (LEWAS) in which Abrar A. Alabbad was shortlisted as a Rising Star. The department also won the Corporate Champion category for EXPEC ARC's numerous initiatives that ensure a level playing field for women in R&D. In conjunction with the awards program, eight WEN members participated in the 2017 LEWAS workshop and symposium.

In 2016, Nouf M. Al-Jabri placed third in the Berlin Falling Walls competition and was the first person recognized from the Middle East. To recognize her remarkable achievements, she was honored in 2017 with the Medal of Creativity in Science by HRH Prince Khalid Bin Faisal, governor of Makkah Province.

### Better field assignments

In an effort to create a more level playing field for women, field assignments have become a reality for women in Saudi Aramco. EXPEC ARC, capitalizing on the opportunities provided by Upstream and Petroleum Engineering and Development in this regard, has been supportive in encouraging female engineers to go to the field for visits, witnessing jobs, and on-development assignments. Fourteen WEN members have enrolled in these programs.

### Inspiration to the next generation

WEN members are also keen on transferring their knowledge of technology innovation in the oil and gas industry and their career experiences to high school students to raise awareness and share with them information about petroleum engineering and geoscience disciplines.

Earlier in 2017, WEN organized a school visit to promote safety awareness for elementary school students. The event took place during a career day organized by the school, at which WEN members promoted both safety topics as well as petroleum engineering and geoscience as a career to the female students. The campaign included presentations and an EXPEC ARC booth gift in the school lobby for the full day. The presentation engaged students in sharing safety messages with their classmates, as well as in a safety-related game.

EXPEC ARC's young female professionals have also been participating in department level activities — especially those that involve higher management presence to sharpen their strategic thinking skills. Women are assuming different roles in the governing bodies meetings of EXPEC ARC, including the Technology Council, the Steering Committee, and the International Advisory Council. 🌐



WEN provides a unique opportunity for us to voice our concerns and actually make a change. Through this program, we are pushing the boundaries and creating opportunities for women at EXPEC ARC to develop their technical, soft, and leadership skills. I was actively nominated for technical workshops, courses, and awards.

— SALMA M. ALSINAN

I have been given a lot of opportunities that I would not have without management support. I have delivered technical presentations at different levels with senior management and have attended several international conferences since I joined the company. All these experiences have helped brighten my career.


— AFNAN A. MASHAT



# WELL CONTROL SCHOOL

BY MALLEE AL-HOWAIDI

DRILLING AND  
WORKOVER  
TRANSFORMS  
WAREHOUSE  
INTO STATE-  
OF-THE-ART  
FACILITY



Drilling engineer Munther A. Al Osilan experiences firsthand some of the new Well Control School's state-of-the-art equipment as he takes a seat in the facility's cyberchair simulation while instructor Haythem M. Elkamash offers some guidance.



**A new state-of-the-art facility recently launched by the Drilling and Workover (D&WO) Training Division has doubled the number of participants the organization can bring in to meet Saudi Aramco's demand, all while enhancing the learning experience and exceeding international standards in well control training.**





Classrooms and high-tech equipment at the new Well Control School in Dhahran have provided an expanded platform upon which to better train company employees.

The D&WO Well Control School, which features advanced well control simulation technology, a beacon in training, and development and certifications of critical operations field personnel, was inaugurated during the company's Executive Management Safety Review in Dhahran.

During the review, Quality Assurance adviser Dania Ghazi presented an overview of the facility and its features, which was followed by a technical tour of the facility guided by engineering supervisor Suliman M. Azzouni. The tour highlighted features such as the facility's onshore and offshore simulator halls, high-tech simulators, and visualization wall.

The launch was also highlighted during a quarterly Management Information Systems meeting where Abdul Hameed A. Al-Rushaid, D&WO vice president, welcomed a number of the company's top management to view firsthand the facility's remarkable cyberchair simulation. This included

a demonstration of the chair's features and capabilities that allow participants to gain additional confidence in applying safety measures across D&WO well control operations.

### AMBITIOUS BEGINNINGS

D&WO, with assistance from many Saudi Aramco organizations, first tackled the well control school project two years ago. Planned, developed, and implemented over a number of phases, the project transformed a warehouse upgrade into a state-of-the-art well control school.

A number of phases were covered over that time, including utilities connectivity, IT services, fire protection systems, furnishing, and finally, setting up the drilling simulators' equipment. By splitting up the project into multiple parallel phases, the completion time for the project was reduced by more than six months.

The in-house developed design supported the launch date, and the awarding of a contract for construction toward the end of 2016, with successful completion achieved by March 2018.



The recently inaugurated school provides the latest in technology, training, and certification to better prepare employees for how to best handle a wide variety of scenarios that can occur in the field.



## TRAINING, ACCREDITATION, AND QUALITY

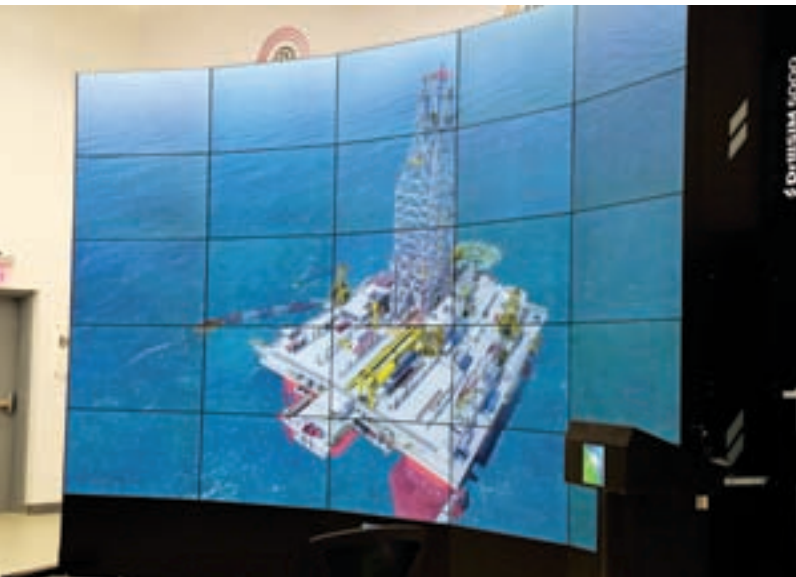
Adding to its international quality measures, the D&WO Training Division that oversees this new facility is accredited by the Accrediting Council for Continuing Education and Training (ACCET). Organizations accredited by ACCET receive their certificate for their attention to detail and strategic organizational commitment to quality training.

D&WO Training rigorously seeks to keep its programs current, relevant, and educationally sound by maintaining ACCET and keeping other accreditations current such as the International Association of Drilling Contractors (IADC).

D&WO's in-house well control training has evolved since 2007 when D&WO Training received IADC accreditation to conduct well control courses, certification, and recertification — all in-house. It not only maintained the international standard of well control training and certification, but also exceeded many aspects, including:

- Increased hands-on training and simulation time performance by at least 36% more than IADC and the International Well Control Forum (IWCF) well control training providers.
- 10% higher certification passing scores.
- An additional assessment of Saudi Aramco well control policies and procedures.





A large visualization wall allows an immersive experience for those taking courses and earning certifications at the Well Control School in Dhahran.

These enhancements contributed to improvement in participants’ performance in well control certification exams and in raising awareness and compliance to Saudi Aramco safety measures.

Also, the return on investment extends to producing operational case studies from real-life scenarios, which is a research and development catalyst for well control specialist and drilling engineers, and a community of professionals networking and exchanging ideas, challenges, and tested solutions.

### A GREATER INTAKE FOR TRAINING

Up until the beginning of 2018, the well control courses and certifications were delivered at the D&WO Training Center. Today, the new school adjacent to the center spreads two state-of-the-art classrooms — with space for 24 participants — in a facility that holds four different types of well control simulators and its one-of-a-kind visualization wall.

With this new facility, D&WO is doubling its annual intake, accommodating D&WO certification and training demand with a full-time, all year-long running facility. Over the past five years, D&WO has succeeded in certifying more than 2,500 employees to handle all well control situations. It has also assessed more than 500 experienced new-hire foremen before field deployment as an additional quality safety measure to ensure that valid well control certificates meet Saudi Aramco’s additional quality and safety standards.

### WELL CONTROL SKILLS AND OFFERED COURSES

Well control training plays a critical role in the development of a competent crew. Being able to respond quickly and successfully to alerts and incidents saves time, money, the environment, and most importantly, the lives of people. Well control certification is the first line of defense Saudi Aramco has against well control situations.

By ensuring that professionals in the field have the proper certifications, D&WO Training helps protect the Kingdom

and Saudi Aramco from any potential well control situations. Judging a professional’s reaction during a well control scenario is priceless. Having a well control certification gives Saudi Aramco the extra assurance, control, and confidence to run safe operations.

Well control training standards are set by the IWCF, and the training courses are run through IADC in the form of the Wellsharp Program. Organizations willing to conduct courses in-house must acquire accreditation from IADC and certify their instructional personnel in well control to be able to deliver the material. This is what D&WO Training acquired in 2007 and maintains to this day.

The well control school offers five well control courses ranging from introductory to advanced levels for drilling engineers and field personnel all the way up to the supervisory level. It also offers a stuck pipe prevention course.

Each course is assessed with a combination of exams, in addition to a practical assessment where participants must demonstrate the practical and technical skills required to complete the well kill operation. A number of essential leadership and problem solving skills are embedded in these courses, boosting decision making processes required for critical operations.

### THE SIMULATORS

The new facility houses four types of simulators used to primarily train drilling engineers and foremen. They include:

- The DS 20 drilling simulator for single participants.
- The DS 500, with additional simulation capabilities.
- The DS 5000, which offers a reality sense of field operations.
- The DS 5000 with cyberchair and visual wall. With an 18-square-meter screen, the unit known as CyberSIM offers graphical insight that combines training on conventional and cyber rig operations. The latest, which is the most advanced simulator in the facility, is attached

to the largest visualization wall installed on a DS 5000 and one the first models of its kind in the world.

The simulators are used to improve efficacy at the rig site when doing day-to-day operations such as tripping. These powerful simulators can save rig time by giving D&WO trainees the valuable practice they need to go from normal drillers to effective ones.

### THE FUTURE OUTLOOK

The Well Control School has implemented operational plans of training and certifying D&WO employees for the entire year ahead. Additionally, it has started providing opportunities to D&WO field management to simulate and test real operations in a safe and realistic environment through the use of these simulators before commencing drilling. Test data is plugged into the system to run scenarios, and the machine then analyzes and runs expected results in audio, video, and data formats, allowing for calculated decision making.

To boost the value of this school, Pinnacle (the D&WO drilling specialist program) plans within a couple of years to graduate its first batch of well control specialists, among other specialties serving D&WO and representing the organization technically and academically on local, regional, and

international levels while producing valuable research input in the area of well control.

The Well Control School also plans to produce a quarterly publication highlighting the latest in well control R&D and other related topics, applications, and case studies. The publication will serve as a means to communicate professional and specialized knowledge with similar industry learning hubs.

D&WO management's culture of transparent communications has always supported decisions of its well control committee in establishing policies and procedures related to well control and safety in line with international industry standards.

A committee assigned by D&WO management has a mission to develop Saudi Aramco's well control policy, equipment standards, training, and certification requirements. It interfaces with other operators, drilling contractors, and industry organizations (such as IADC, the American Petroleum Institute, the Society of Petroleum Engineers, and the Drilling Engineering Association, among others) to exchange information ensuring that industry best practices are continually improved and that these improvements are incorporated into Saudi Aramco's D&WO operations.

The support extends widely as witnessed in training, development, and certification efforts represented in the recently launched well control school. 🌐

The facility, which was recently inaugurated in Dhahran, has allowed Drilling and Workover to double the number of participants the organization can bring in to train at any one time, thereby meeting Saudi Aramco's demand while also enhancing the learning experience and exceeding international standards in well control training.





# ARC plug

A journey from  
inspiration to  
commercialization

A lab scientist shows a **sample** of the ground date **seeds**, which has been used to **produce** ARC Plug as **per EXPEC ARC's** defined **specifications**.

PHOTOS BY: MOHAMMED A. ALSHAIKH AND BRIGIDO ALCAYDE

**The journey of Saudi Aramco’s Exploration and Petroleum Engineering Center – Advanced Research Center’s (EXPEC ARC) date seed-based loss circulation material, ARC Plug, spans a full cycle of several phases from a simple idea all the way to commercialization. The journey from inspiration, to research, scale up, field testing, and onward to a commercial product addresses the challenge of losing drilling fluids and mud in drilling operations, and is filled with people and local partnerships who brought this idea to life.**

**T**his new technology is an example of EXPEC ARC researchers’ commitment to come up with innovative solutions that will capitalize on our local products and replace imported materials. The ARC Plug story is not only proof of the viability of this new product, but also shows how two industries can be brought together — the date industry with oil and gas — to result in a win-win situation. The technology delivers on both the business mandate for EXPEC ARC — to develop technologies that meet upstream strategic goals and address the operation’s current and future challenges — and the Kingdom’s vision of localization.

“ARC Plug supports the Kingdom’s 2030 Vision by augmenting the iktva program objectives, increasing national technical expertise, and creating jobs,” said Mohammed Y. Al Qahtani, senior vice president of Upstream. “In addition to achieving Upstream objectives, this technology boosts our economy through localization and chemical exportation.”

## THE INSPIRATION

The story began in September 2015 when Md. Amanullah, senior researcher and leader of EXPEC ARC’s Drilling Fluids Focus Area, was spending a quiet weekend at his home in Dhahran tending to his backyard garden where he cultivates many native plants, including a large date palm. While harvesting



*Above: Collecting local dates is a time-honored practice. Cleaning and removal of old leaves generates a huge volume of pruning waste, which in turn can be used by Saudi Aramco in the drilling process. Right: The hidden date seeds — Saudi Arabia has a sustainable source of locally available raw material for the complete localization of product development.*

and enjoying a few of his dates, he was inspired by the idea that the leftover seeds could be a possible alternative to the nut shells that were commonly used to manufacture drilling fluid products.

This gardening pastime triggered the researcher's inherent curiosity to examine the use of various waste components of the date palm tree — pruning waste, leaflets, fruits caps, and deceased date trees.





He eagerly took this idea, along with a few samples, to his lab the next morning for testing.

## EARLY TESTING

Once at the EXPEC ARC lab, the testing went better than Amanullah could have expected, as the date seeds revealed properties that met, and even exceeded, the imported nut shells. He then researched for additional local sources to expand his preliminary tests, which led him to the Date Research Institute in al-Hasa. The institute was very receptive, and it arranged for a visit by Amanullah's team, during which it gathered various date seeds from different types of trees and regions to replicate and broaden the testing phase.

The team discovered that all varieties of date seeds fell into a tight range of mechanical properties — all of which were suitable for manufacturing a new product. Based on such early work, a patent was filed to protect the idea for future development as a potential business.

A local factory worker checks the quality of the recently collected dates. From this point, the dates will be properly cleaned and washed to produce high quality ARC Plug products.

## GETTING BUY-IN

While explaining the project to a young researcher, Amanullah asked, “What are the top two products that Saudi Arabia produces, consumes, and exports?”

The young researcher replied, “Crude oil and dates?”

Amanullah continued: “What if we take the waste materials of the date industry and inject that into oil wells to solve long-lasting drilling problems?”

The rest of the story is history.

Amanullah emphasized that such a new date seed-based technology can simultaneously provide:

- A solution to the disposal problem of the date palm industry.
- Localized products for the oil and gas industry.
- And can also act as a powerful catalyst for the growth of local industries and enterprises to provide a sustainable source of supply of locally developed products.





EXPEC ARC scientist Mohammad Arfaj checks the quality of the ground date seeds, one of the many steps in the ARC Plug process that facilitates the use of date palm refuse to help extract crude oil from the ground. *Left:* Mohammad Arfaj and Md. Amanullah evaluate the quality of the ARC Plug admix based on the particle distribution pattern in the sample mass.

“It was absolutely a dream to link both industries together and use something we throw away every day, such as date seeds, to help solve different oil drilling challenges such as drilling fluids losses into drilled formations,” said Mohammad Arfaj, who worked with Amanullah to take the technology from the laboratory and conduct tests in real drilling wells.

The first test conducted showed remarkable performance and determined that the compound effectively seals rock formations in oil



## “What if we take the waste materials of the date industry and inject that into oil wells to solve long-lasting drilling problems?”

— MD. AMANULLAH

and gas wells while drilling, and was therefore the start of the official journey of ARC Plug development.

“EXPEC ARC has a solid track record of working closely with proponents to understand our field challenges and delivering efficient, high-impact technical solutions,” said Nasir K. Al Naimi, vice president of Petroleum Engineering and Development. “ARC Plug is an exemplary success story illustrating the creative force that is propelling EXPEC ARC into a leading and renowned international center for research and development.”

### TO THE FIELD

After reviewing the technology, the team identified local strategic partners to process and produce date seeds in bulk

according to the required particle sizes and specifications. After that, the new product needed to see the light and go outside the laboratory and factory to the real world — the oil field.

Arfaj worked closely with competent drilling engineers and drilling fluids specialists to identify potential candidate wells whose conditions were applicable for ARC Plug. After selecting three candidate wells, strong communications with the proponent continued to ensure safe operations. Then came the moment of pumping this “valuable” material downhole instead of throwing it away.

Amanullah demonstrates the suspension capability of ARC Plug in a drilling mud. No settlement of particles after six hours of static aging demonstrates a good suspension property.



In the first field trial, the rig team drilled a few thousand feet deep when partial drilling fluids losses were encountered. Immediately, ARC Plug was mixed in the active drilling fluids system. It quickly started doing its job and successfully reduced the scope of the drilling fluids loss problem. Moreover, the product was tested in the other two wells while drilling different formations in different conditions. It met all the set success criteria and proved the applicability of this novel product as an alternative to the imported counterparts.

With the product tested and verified as a proven solution, it was then time to turn the hard earned lab work into a reliable and readily available solution for drilling.

## THE BUSINESS VALUE PROPOSITION

The next question arose from Mahmoud Abughaban, who recently presented EXPEC ARC’s commercialization strategy for the department’s Upstream stakeholders. “What is the business need identification?” he asked as the first question beginning the strategy. With ARC Plug, the answer was straightforward.

“Currently, we are importing 100% of our supply from companies that produce it overseas — and at a premium cost,” he said in answer to his own question. With the new patent created from Amanullah’s research and a confirmed

Turki T. Al-Subaie, a senior lab technician, tests the sealing efficiency of ARC Plug products.

supply of date seeds that currently are in need of disposal, it was now possible to begin manufacturing this routinely used product. Furthermore, this is a technology that is well-aligned with one of drilling’s biggest challenges — lost circulation.

In collaboration with the Technology Strategy and Planning Department, a rigorous economic analysis was performed to confirm the economics based on cost of materials, and a proposed manufacturing method was performed. The analysis confirmed that an in-Kingdom strategic partner will enable Saudi Aramco to manufacture ARC Plug at a reduced price (compared to nut shells) while at the same time providing a boost to the local economy.

These samples, as well as the documented results noted by Arfaj during the field trials, were used to catalog the product officially with a Saudi Aramco SAP number to establish the product officially in the system.

After being qualified for routine use, it was now necessary to establish a formal business contract with a strategic partner to be able to produce field quantities. Multiple companies were analyzed before selecting both the most appropriate and capable for licensing the intellectual property required to produce, sell, and use ARC Plug technology.

## RECOGNITION AND AWARDS

“Throughout the journey, from a backyard garden inspiration through all the phases of R&D, the Drilling and Workover (D&WO) organization provided continuous collaborative





A display of whole date seeds, and several grades of ARC Plug products manufactured for laboratory evaluation.

support. Now we will benefit from the product in routine use of ARC Plug technology starting the first quarter 2019,” said Abdul Hameed A. Al Rushaid, D&WO vice president. “The new date palm-based products, designed to replace expensive imported products as an effective alternative, could significantly reduce drilling costs.”

The multiple successes of ARC Plug have resulted in international recognition as a practical and effective technology

Md. Amanullah evaluates the quality of various grades of date seed-based ARC Plug products.



solution. The Saudi Aramco Board of Engineers recognized the team for its innovative product development using date palm industry wastes. Then, the technology won the 2017 Technical Innovation of the Year by the Oil & Gas and Refining & Petrochemical Middle East judges. The invention also drew significant national and international attention from professional and business communities due to its economical, technical, and social impact in several national newspapers, as well as international oil and gas industry publications.

Saudi Aramco has come a long way in upstream chemical research and the evolution from simple evaluation to fully fledged chemical development, with hundreds of ideas and patents transformed into products that were then commercialized. During this transition, the developed chemicals have been either a replacement of currently used chemicals at lower cost, or a creation of new innovative solutions and synthesis — all of which capitalize on the Kingdom’s local resources.

“Every technology project has a story of inspiration and challenge by those who blaze the new trail. Such successful contributions by EXPEC ARC to the company, the Kingdom, and the world — along with the recognition they bring — is a tremendous complement to our efforts and business strategy,” said Ali A. Al-Meshari, EXPEC ARC manager. “And now with ARC Plug, our experts have added yet another technology to the company’s vast portfolio.” ☺

# abbrev.

Saudi Aramco news in brief



**Sunil L. Kokal, center, an EXPEC Advanced Research Center principal professional, proudly displays the SPE Improved Oil Recovery Pioneer award he recently received. Also pictured are Ali A. Al-Meshari, EXPEC ARC manager, left, and Ali Al-Yousef, Reservoir Engineering Technology Division chief technologist.**

## Sunil L. Kokal earns SPE honors in U.S.

**TULSA, OKLAHOMA, USA** — Sunil L. Kokal, an EXPEC Advanced Research Center (EXPEC ARC) principal professional, was recognized with the Society of Petroleum Engineers (SPE) Improved Oil Recovery (IOR) Pioneer award at the April SPE IOR Conference in Tulsa, Oklahoma. As one of the society's most prestigious international awards and top honors, it is given to select individuals who have made significant advancements over the years in IOR technology.

He is a Reservoir Engineering Technology Division focus area champion of IOR/enhanced oil recovery (EOR). Kokal has 35 years of research and professional

engineering experience in the oil and gas industry, primarily in IOR. He is a world expert and researcher in reservoir engineering, focusing on oil recovery. Kokal led the design and implementation

**Ziad T. Al-Murshed, Saudi Aramco executive director of New Business Development and CEO of the Saudi Aramco Development Company, and Clay C. Williams, chairman and CEO of National Oilwell Varco (NOV), sign a shareholder agreement to form a joint venture partnership in Ras al-Khair. Amin Nasser, Saudi Aramco president and CEO, watches along with other senior members of Saudi Aramco and NOV management as the agreement is signed. Photo by Musleh Khathami.**



of the first carbon dioxide EOR demonstration project in Saudi Arabia that won five international awards.

## Saudi Aramco, NOV team up to create world-class onshore rig facility in Ras al-Khair

**DHAHRAN, SAUDI ARABIA** — Saudi Aramco has signed a shareholder agreement with National Oilwell Varco Inc. (NOV) to form a joint venture (JV) partnership to establish an integrated world-class onshore rig and equipment manufacturing and aftermarket facility in Ras al-Khair, near the Jubail Industrial City on the Kingdom's East Coast.

It will serve as a major hub for high specification drilling rigs using cutting-edge technologies, with a capacity to manufacture 10 onshore rigs per year.

As per the shareholder agreement, Saudi Aramco will own 30% of the JV's shares, while NOV will own the remaining 70%.

Amin Nasser, Saudi Aramco's president and CEO, said the new JV is aligned with the Kingdom's efforts to accelerate economic diversification, as part of Saudi Vision 2030. Targeted at enabling the creation of new subsectors and attracting investments from our international partners, Vision 2030 and the company's



Organizers and officials of the Saudi Aramco Contractors Forum pose for a photo with Ahmad A. Al Sa'adi, senior vice president of Technical Services.

own iktva localization program are generating new streams of revenue for the Kingdom and creating thousands of new jobs for Saudis, Nasser said.

## Aramco hosts forum to promote iktva, attract more Asian contractors

**SEOUL, SOUTH KOREA** — Aramco Asia-Korea hosted the “Saudi Aramco Contractors Forum” in coordination with Saudi Aramco’s Project Management Office Department and Procurement and Supply Chain Management in Seoul.

The forum was designed to welcome Korean engineering, procurement, and construction companies’ participation in Saudi Aramco’s upcoming mega-projects and to enhance the company’s contractor lists, general bid slates, and in-Kingdom/out-of-Kingdom lump-sum turnkey master screening lists by expanding existing contractor registration areas and identifying new construction contractors from Korea and Asia.

More than 100 representatives of 27 engineering, procurement, and construction (EPC) companies from Korea, Japan, India, Australia, and Indonesia participated in the forum.

In a keynote address, Ahmad A. Al Sa’adi, senior vice president of Technical Services, said the forum is an integral part of Saudi Aramco’s process to

introduce business to our partners and EPC industries, and also to help foster a relationship between Saudi Aramco and the partners.

## Aramco Asia-Japan reaches out to more local suppliers

**TOKYO, JAPAN** — Aramco Asia-Japan’s (AAJ) Strategic Procurement and Logistics Department recently hosted the

first Suppliers Forum in Tokyo to place stronger emphasis on fostering closer ties with commercial suppliers.

Approximately 160 delegates from over 90 companies, as well as representatives from Japan’s Ministry of Economy, Trade and Industry, the Japan External Trade Organization, and all three Japanese mega-banks attended the event co-hosted by the Japan Cooperation Center for the Middle East.

The forum was held for the first time in Japan to target Japanese suppliers with objectives to expand and strengthen the supply base to AAJ, explain the suppliers’ qualification process, and introduce the localization program “iktva,” which is also a part of the joint “Saudi-Japan Vision 2030” between Saudi Arabia and Japan.

“This forum couldn’t have come at a better time, because Saudi Aramco has huge investment opportunities over the coming 10 years. And those will include a number of mega-projects where certain Japanese suppliers such as you are expected to play a major role,” said Omar M. Al-Amudi, representative director of AAJ. 🌐

Omar M. Al-Amudi, representative director of AAJ, delivers the opening remarks at the first Suppliers Forum in Tokyo.



## worldview



### *A Painted Sunset at Manila Bay, the Philippines*

Edgardo B. Faro took this photo standing on the pier at the Yacht Club in Manila Bay, the Philippines, in early 2018. While out on a walk with his family, he was able to capture this breathtaking image of the setting sun. Faro used his Canon 5D Mark 11 camera with a 24-70 F2.8 II lens.

He works in the Academic Programs Division of the Academic Programs & Partnerships Department. Faro has been with Saudi Aramco since 1996.