A Periodical of Saudi Aramco

Spring 2018

dimensions INTERNATIONAL

POWERING THE FUTURE AT

Ras al-Khair

dimensions INTERNATIONAL

The Saudi Arabian Oil Company, also known as Saudi Aramco, was established by Royal Decree in November 1988 to succeed the original U.S. concessionary company, Aramco. The Aramco concession dates back to 1933.

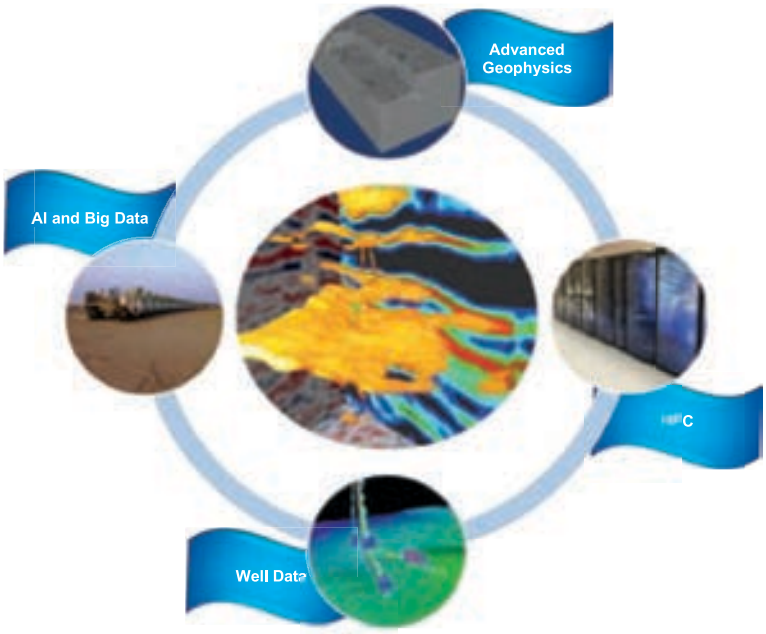
Saudi Aramco's Board of Directors is chaired by His Excellency Khalid A. Al-Falih, Minister of Energy, Industry and Mineral Resources, and former president and CEO of the company. The Board of Directors, as steward for the Government's interest in the company, steers Saudi Aramco's business affairs, provides management with guidance in determining the company's mission and long-term strategy, oversees senior management succession planning, establishes internal controls, and assesses company opportunities, risks, and strategies for risk mitigation. The Board includes senior Saudi Government officials, heads of leading Saudi research and academic institutions, senior figures in the international oil, gas, and finance industries, as well as senior members of Saudi Aramco management.

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

Nasser A. Al-Nafisee
Vice President, Corporate Affairs

Editor:
William E. Bradshaw
Email: *william.bradshaw.1@aramco.com.sa*



Contributing to this issue:
Eamonn J. Houston, Jamsheed M. Din, 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
Public Relations Department,
Saudi Aramco Box 5000
Dhahran 31311
Saudi Arabia

ISSN 1319-0520

Printed on recycled paper
www.saudiaramco.com

About the cover:
A digital rendering of the King Salman International Complex for Maritime Industries and Services shows the dramatic scale of the new Ras Al-Khair shipyard when completed.

أرامكو السعودية
saudi aramco

POWERING THE FUTURE AT

Ras al-Khair

BY EAMONN J. HOUSTON | PHOTOS BY YARA ZIYAD

King Salman International Complex for Maritime Industries and Services

Saudi Arabia has charted a new course of economic diversification away from an overdependence on oil and gas in its Vision 2030 road map. Industrial enablers will be key to Saudi Arabia's success in this endeavor and in heavy industrial terms, they don't come much bigger than the maritime industry.

Saudi Aramco has joined forces with three maritime industry leaders to form the joint venture International Maritime Industries (IMI) — a name that is poised to flex a lot of industry muscle, and will not only transform the face of rig and shipbuilding in the region, but also globally.

This is a story of an economic transformation, the Ras al-Khair based maritime yard, and how the first ever rigs and ships will be constructed and launched in the Kingdom.

THE BEGINNING

In December 2016, on an approximately 12-square kilometer site on the northeast Gulf coast of Saudi Arabia, The Custodian of the Two Holy Mosques King Salman ibn 'Abd Al-'Aziz Al Sa'ud laid the cornerstone for the King Salman International Complex for Maritime Industries and Services.

In October 2017, dredging began at the maritime complex, signaling the start of construction of the anchor tenant, International Maritime Industries (IMI), unlocking one of the master keys for economic potential as outlined in the Kingdom's Vision 2030 plan.

A NEW ECONOMIC TRAJECTORY

The mega-project heralds the positioning of the Kingdom on a new economic trajectory. The projected macroeconomic impact by 2030 is huge, and the numbers are impressive and support HE Minister of Energy, Industry and Mineral Resources Khalid A. Al-Falih's statement in December 2016 that the maritime complex would offer a broader palette of development for Saudi Arabia and open the doors for strategic industries to operate and flourish.

It is anticipated that by 2030, 80,000 jobs will have been created, with 30,000 of those direct jobs in the maritime complex. There will be an import substitution of a staggering $12 billion and a gross national product (GDP) impact of $17 billion. In short, it's good news for the Kingdom.

Digital renderings show how the Ras al-Khair shipyard will look when completed. Both rigs and ships will be constructed, and the shipyard will boast the biggest dry dock and longest quayside in the region. The state-of-the-art complex will be globally competitive in rig and shipbuilding.

The IMI board of directors met late last year to appoint people to key roles. Front (from left) are Nabeel A. Al-Jama', Saudi Aramco VP of Human Resources; Ali A. Alharbi, Bahri CFO; Abdallah I. Al Saadan, chairman of the board and Saudi Aramco senior VP of Finance, Strategy and Development; Christopher McDonald, Lamprell plc CEO; and Tae-young Si, Dubai HHI general manager/head. Back row (from left) are Hani Mohammed, IMI CFO; Abdul Hameed A. Al-Rushaid, Saudi Aramco executive director of Drilling and Workover; Abdulhakim A. Al-Gouhi, Saudi Aramco VP of Industrial Services; Tony Wright, Lamprell plc CFO; Ziad T. Al-Murshed, Saudi Aramco executive director of New Business Development; and Fathi K. Al-Saleem, IMI CEO.

THE STRENGTH OF FOUR INDUSTRY LEADERS

IMI is a joint venture (JV) between Saudi Aramco, Dubai-based rig building giant Lamprell plc, the Saudi national shipping company Bahri, and Hyundai Heavy Industries (HHI) in South Korea — the world's largest shipbuilder and owner of the world's largest shipyard in Ulsan.

IMI has at its center four pillars — the strength of the four partners and how their expertise drives efficiency; supply chain localization through strategic sourcing; stakeholder life cycle partnering; and leading-edge technology. These strengths are unique to IMI and enable it to be well positioned to meet and exceed customer expectations.

LOCALIZATION OF THE SUPPLY CHAIN

When completed in 2022, IMI will be the largest fully integrated maritime yard in the Middle East and North Africa region, and one of the largest maritime yards in the world. It will offer to market new build as well as maintenance, repair and overhaul services for jackup rigs, commercial vessels, and offshore support vessels. This scope of product offering will spur the localization of the supply chain, creating small- and medium-sized enterprise activity.

IMI will deploy the latest technological innovations to deliver a competitive advantage, including Big Data analytics, virtual reality, additive manufacturing, process automation, and a diverse range of robotics and software integration. Its location at Ras al-Khair is geographically strategic, within easy reach of customers to the east and the west and close to international trade routes.

Its annual shipbuilding capacity will be three very large crude carriers, and starting in 2021, IMI will have the capacity to build and launch a minimum of four rigs per year. The annual maintenance, repair, and overhaul (MRO) capacity is 15 rigs, 137 vessels, and 116 offshore support vessels.

LONG-TERM OPPORTUNITY

For Saudi Aramco, IMI offers a strategic long-term opportunity — for the first time in the company's history its offshore requirements can be met in-Kingdom by a company in which it is the majority shareholder.

At its base in the Al Turki building in al-Khobar, IMI is a hive of activity with Saudis, Koreans, Europeans, and other nationalities piecing together a solid structure for the ambitious project. It is here that the technical, marketing, and human resources teams meet to work toward the first rigs and ships to be built in the Kingdom. There's a huge sense of pride and duty about the task ahead.

And young Saudis are playing their part and gaining in-

valuable exposure and contributing to the success of a project that holds the weight of history.

IMI CEO, Saudi Aramco's Fathi K. Al-Saleem, sits at the helm of the JV and recalls the genesis of the project.

> "IMI is positioned to be a global competitor and a regional hub for maritime industries and services." — **FATHI K. AL-SALEEM,** IMI CEO

"Around four years ago," he says, "we undertook an initiative to identify the opportunities that lend themselves to be obvious for Saudi Aramco to take in terms of strategically integrating its footprint in the Kingdom and helping to diversify the economy and create jobs."

The initiative that followed was the development of a competitive Saudi energy cluster, which involved a detailed mapping of Saudi Aramco's activities and the identification of those that appeared to be high priority, big value, and the maritime business presented itself as one obvious opportunity that ticked all of these boxes.

"All of that is based on the huge offshore oil and gas activities for Saudi Aramco, and at the same time, the requirements for shipping, either crude or commercial materials that would require rigs and ships," says Al-Saleem.

"And then there is our proximity to the international shipping routes. If you put all of this together with the strategic geographic location and the huge offshore oil and gas activities, you can clearly see the benefits and the opportunities — not only for Saudi Aramco, but also for the whole of the Gulf region."

The next level of analysis involved identifying how IMI could be made a reality and the enablers required to bring this industry anchor together had to be determined.

And so began a complex process with multiple dimensions. Government infrastructure incentives needed to be put in place similar to the arrangements put in place for maritime yards in South Korea and Japan.

Financing was pursued from the Saudi Industrial Development Fund, and the identification of human resources requirements and challenges came next.

"Last, but by no means least," Al-Saleem says, "we had to work with someone who can actually manage industrial cities, and for us that was obviously the Royal Commission. You cannot manage a sustainable industry when you just have a maritime yard. You really need to have the supply chain and ecosystem encompassing the yard to support production.

"All of the enablers are now in place and we look forward to commencing operations."

Mechanical engineer Abdulaziz Al Hejji (left) and workstream leader Ali K. Al Ajmi at work at IMI's al-Khobar base.

COMPETITIVE ADVANTAGE

Critical to the success of the IMI JV was persuading the right partners, with the proper know-how and technical expertise, to make this yard a world-class proposition with a distinct competitive advantage.

HHI are the well-established champions of shipbuilding, while Lamprell plc has distinguished itself as a top-class builder and maintainer of offshore jackup rigs. Bahri is Saudi Arabia's champion of shipping, overseeing a huge fleet. Saudi Aramco brings an impressive range of expertise in terms of project management, HR, engineering, and business development. The company has overseen many of the Kingdom's signature catalytic energy projects and its contributions are central to developing a vibrant local economy that both trains and employs young Saudis in line with the Kingdom's Vision 2030.

The combined power of the four partners was becoming a player to adopt such a strategy.

"The traditional approach is for maritime yards to competitively bid for one or two builds, unlike the continuous relationship on offer at IMI," he said.

The technical profile of the IMI's maritime yard is impressive in industrial terms.

Yi Seong Kang, HHI's chief operating officer of New Ship Build, says the technical muscle will ensure IMI's competitive edge.

"The combined 2,150-ton lifting capacity of the Goliath crane will be one of the biggest in the world. It means that we can build vessels with a high level of efficiency."

HHI also boasts the largest after service network in the world, and IMI will have full access to this network.

For the region, IMI is unique in scale and levels of integration. It will feature the largest dry dock area, one of the largest ship lifts globally at 25,000 metric tons, the longest quayside of 9,000 meters, and the largest total combined area of approximately 12 million square meters.

> "IMI is an anchor for localizing a new industry with an integrated supply chain that brings thousands of high-quality jobs for young Saudis."
>
> **— FATHI K. AL-SALEEM,** IMI CEO

reality and IMI began taking shape.

Al-Saleem points to the technical excellence of IMI.

"From the technical side, the maritime yard is unique in the world as a result of the diversity of products and services we offer. This ranges from offering new builds for jackup rigs and ships to offshore support vessels.

"We also provide MRO services for all of these products. There is not a maritime yard in the region that has this diversity. On another dimension, this maritime yard is designed not only to cater to the requirements of the Kingdom in terms of maritime services and products, but also to the whole region."

TECHNICAL HUB

The goal for IMI is, of course, to become a regional hub and a global competitor. The plan is to leverage the long-term relationship between the JV and its primary customers — namely Saudi Aramco and Bahri.

The strength of these relationships will help to create a strategic supply chain around Ras al-Khair, laying the foundations for a solid platform between strategic suppliers on one side and strategic partners and customers on the other.

"This level of leverage will help IMI be positioned to offer a life cycle, cost-effective product as the long-term collaboration will improve our ability to design projects and redesign and achieve excellence within the life cycle," Al-Saleem says.

George Gourlay, chief operating officer of Rig New Build and Rig and Ship MRO, said: "IMI will be the first maritime

SUPPLY CHAIN

Procurement and Supply Chain Management leader Abdullah Al Muhanna was one of the first people on the ground at IMI, tasked with dealing with the maritime project's strategic supply needs.

This is a critical function within IMI and crucial to the creation of local content.

"It's about building the supply chain ecosystem and the vision is to use procurement and supply chain excellence to make IMI a world-class provider of maritime products and services," he said.

The strategy is to minimize supply chain and logistical risks, improve margins, and enhance the quality and availability of local supply chains.

The different product and services mix requires different supply chain strategies — responsive and agile for maintenance repair and overhaul, and integrated, planned, and market focused for new building.

The development of a local supply chain ecosystem around the yard will be critical going forward. Local content is a priority, and identifying opportunities for localization is an ongoing process.

BUILDING TRAINING CAPABILITIES

As a new industry, maritime requires specific skill sets and the way to bridge any gap is through a comprehensive human resources and training strategy. This is one of the biggest challenges for IMI, but one that is being methodically approached.

Julian Panter is charged with establishing the human resources and training function, and staffing.

A lot of work has revolved around essentials such as policy manuals, the compensation and benefits structure, organization structure, and employment agreements. The short-term intent is to have these elements in place.

"There is a long-term intent, which is to really focus on

Saudization and how we can place Saudis into this new industry for the Kingdom and the region," says Panter.

"We look at how we are supporting Vision 2030 through the hiring, development, and retention of Saudi nationals, and in collaboration with the National Maritime Academy, we are developing training plans initially for Saudi high school graduates to grow and develop skills for the trades involved in the maritime industry."

SAUDI TALENT

Waleed Al-Othman, Training and Development leader, also underscores the opportunities for young Saudi talent.

Below: Julian Panter; lower: Abdullah Al Muhanna

Top: George Gourlay; *above:* Yi Seong Kang

"Our target workforce number will be approximately 30,000 employees — direct and indirect — in the complex.

According to Al-Othman, IMI has set about maximizing the opportunities contained within Saudi Aramco's In-Kingdom Total Value Add program.

"We are looking at localizing everything that we do."

IMI's scope for education is large. The National Maritime Academy has been set up, and features two training streams — an industrial focused stream, and a more maritime specific stream that focuses on port authority training, navigation, deckhand training, officers, and marine engineering.

TRAINING CENTERS

The skill sets needed to build and maintain ships will also be a central focus. Saudi Aramco has recently established a Local Workforce Development Department (LWDD) tasked to establish specialized training centers based at the National Industrial Training Institute and Maharat.

The training center closely cooperates with the Technical and Vocational Training Corporation (TVTC), Saudi Aramco, and the College of Excellence.

A training center in Jubail has been availed by the government, and in 2019 a permanent training center will be constructed in Ras al-Khair.

NATIONAL MARITIME ACADEMY

IMI is now the first client of the National Maritime Academy, a nonprofit organization.

Training will be across the full range of skills demanded by the maritime industry.

The concept behind the academy is to provide professional training to skilled Saudi talents with approximately 40 trades offered, including welding, metal fabrication, electrics, and mechanics.

For the maritime yard, there are 150 different job titles — each with a combination of skills, which calls for carefully designed training courses.

The first intake for the two-year program is 700 trainees and there will be 1,000 additional places made available annually. Salaries and medical insurance for trainees will be provided, as well as accommodation for those living outside of a certain geographical area.

Diplomas awarded will be recognized nationally by the TVTC and the College of Excellence, and successful graduates are guaranteed a job.

All of this is being built on IMI's collective knowledge and it is hoped that this deep mine of experience will result in quicker and better outcomes.

The training model will be unique in that it will combine the best practices of the four JV partners, as well as the industry.

Sa'ad Al-Shahrani is the managing director of the academy and says it is being developed as a best-fit training provider for IMI and the local maritime industry as a whole.

"The whole aspect is about the localizing of jobs, so this could not happen without a training entity for this maritime project. The National Maritime Academy was aligned with the big initiative — the Maritime Yard Joint Venture.

"Saudi Aramco has taken the lead in creating this academy, as it did with so many other academies in the past aimed at creating new opportunities for the local Saudi population.

"This is part of Saudi Aramco's focus on social responsibility and making sure that all of the enabling elements for the Maritime Yard Joint Venture success are present," says Al-Shahrani.

Saudi Aramco, along with TVTC, took the lead in establishing the academy by signing a Memorandum of Understanding in late 2016.

The process of getting the center ready is now underway. The academy will not only serve the JV, but will also serve all maritime-related industry within Saudi Arabia. To be specific, the marine operations and the port operations, which by themselves are very large markets. There are tens of thousands of opportunities for young Saudis to be employed in this sector.

Al-Shahrani adds, "For the training itself, we're looking to partner with top-tier international training providers meeting high expectations of the international JV itself and the local maritime sector. The training provider will also offer the best-in-class training practices to train the Saudis to meet their job requirements and make sure that they are up to the right levels, standards, and up to the challenges demanded by this new company."

The training provider will have all of the required international and industry mandated qualifications in shipbuilding and marine operations to make Saudi Arabia a hub for such specialized training.

"Attraction and retention is a worldwide challenge in

Left to right: Waleed Al-Othman; Sa'ad Al-Shahrani; Peter Snowden; Fathi K. Al-Saleem

When the King Salman International Complex for Maritime Industries and Services becomes fully operational, it will play a pivotal role in the Kingdom's forward economic voyage.

this business, and I think that between the employer itself, which is the JV, and the National Maritime Academy, and the collaborations that they have and the benefits they will be offering to the young Saudis, the state-of-the-art education that they will be benefiting from in this academy, and the bright progression future they have upon graduation, will ensure that we get the proper selection of candidates," Al-Shahrani says.

SAFETY FIRST

Peter Snowden is charged with framing IMI's safety template.

"Building on the excellent track records and safety certifications of the four partners, IMI is in a position to have a similar safety performance, procedures and training," said Snowden.

As well as stakeholder partnering and continuous learning, IMI will deploy cutting-edge virtual reality (VR) technology.

"There are many benefits to the use of VR within our industry. The depth of learning is demonstrably better through 'doing,' rather than watching. IMI HSE is investing in VR, as that will bring the benefits of massive reductions in risk to people and assets, reduced costs, and language agnostic training. It is clear that VR is going to be central to the training of the future."

A PROJECT TO BE PROUD OF

For Al-Saleem, the coming together of such a complex industrial jigsaw is a source of pride. When fully operational, the maritime complex will play a pivotal role in the Kingdom's forward economic voyage.

"The whole demography of the industrial landscape within Saudi is going to be transformed. The fact that we have managed to build an anchor project for the Kingdom and to say that we do not just produce oil and gas, but also build rigs and ships, too, and have a regional maritime hub, is an accomplishment we can all be proud of.

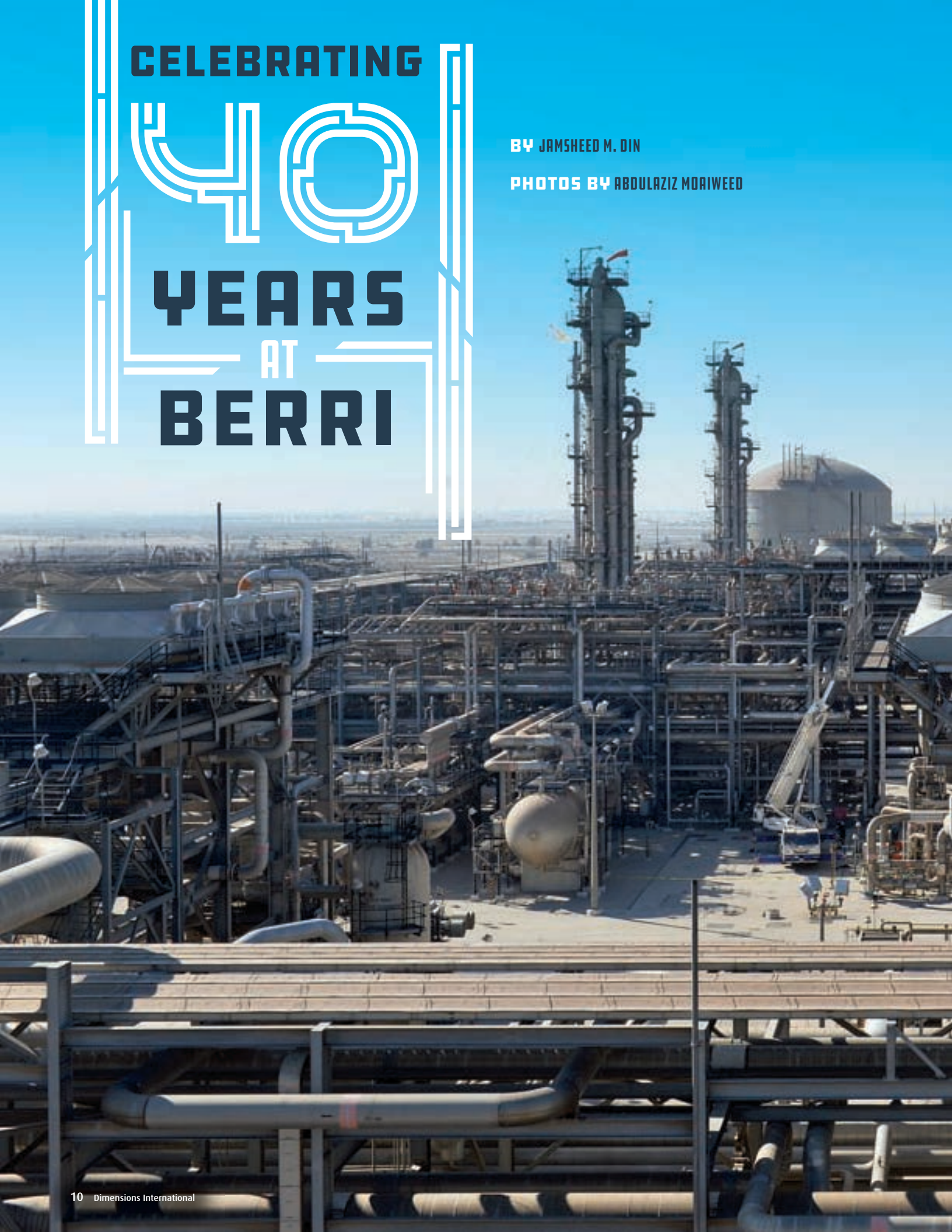
"The sense of pride is also coming from seeing young Saudis inspired and working hard to make this happen.

"The day we launch the first Saudi made rig and ship will be a major historical milestone for Saudi Arabia and Saudi Aramco."

CELEBRATING 40 YEARS AT BERRI

BY JAMSHEED M. DIN

PHOTOS BY ABDULAZIZ MOAIWEED



The year was 1977, and the effects of the royal inauguration by King Khalid ibn 'Abd Al-'Aziz Al Sa'ud would be felt across the nation, and indeed the world. Industrially, the Kingdom had come of age.

As it celebrates four decades of service, BGP is far from a spent force. The facility is as important as ever. It stands as a symbol of the Saudi Aramco story — at the service of the Kingdom and its people. It's a narrative that continues to this day, and as with Saudi Aramco, the BGP story is far from over.

A MASTER PLAN

In 1975 the Saudi government undertook the decision to construct the Master Gas System (MGS) — at the time, one of the most ambitious and largest engineering and construction projects ever undertaken by any nation.

It was a time of unprecedented growth for both the company and the Kingdom. The Saudi workforce was evolving with qualified engineers and technicians now available to enter the work arena.

The Kingdom was making sweeping economic plans that would transform the domestic industrial landscape. The MGS would see Saudi Arabia's natural gas resources power a new domestic economic era by supplying fuel and feedstock to the new industrial cities in Jubail and Yanbu'.

The MGS would resemble an electricity grid, offering a ready supply of varying forms of gas to domestic customers, and via export, globally.

For years, the associated gas that was found in crude oil was not recovered — mainly due to technological and economic factors. But the global market took a shift. Rising

energy costs, coupled with energy and conservation concerns, made the requirements for gathering and processing associated gas both practical and profitable.

With the shift in the new economic environment, the Saudi government turned to Aramco. The MGS would be the backbone of a new era in the Kingdom and Aramco had the know-how, the people, and the trust of the government to execute the ambitious program.

The result for BGP was an unforeseen date with destiny. With the new MGS plans announced and now in the care of Aramco, it became clear to the company that with a little modification, BGP could not only be incorporated into the overall MGS, but could serve as the forerunner and first facility in the system.

"Berri Gas Plant, in many ways, is the foundation stone of the new industrial age that occurred in the Kingdom in the late 70s," noted BGP manager Khalid A. Al Harthi.

Every ambitious project needs a pulsating start, and then momentum that sustains it to completion and beyond. For the MGS, it would need not look any further than BGP.

"It was the kick-start, the first facility in the Master Gas System and then others followed, but it was Berri that got the ball rolling," said Al Harthi.

Berri Gas Plant has undergone a number of expansions since its inauguration in 1977. It was King Khalid ibn 'Abd Al-'Aziz Al Sa'ud who officially opened the facility (above left) in the presence of then Aramco president and CEO Frank Jungers. The plant was the first facility in the Master Gas System to come online.

After the successful startup at Berri, other components of the MGS were completed in rapid succession with commissioning of the Shedgum Gas Plant, and the Ju'aymah Fractionation Plant and Liquefied Petroleum Gas (LPG) loading and exporting pier in 1980. A year later saw the operational startup of the East-West Pipeline and the 'Uthmaniyah Gas Plant, followed in 1982 by the commissioning of the Yanbu' Fractionation Plant and LPG export facilities. The MGS was up and running.

THE BERRI TIMELINE

Glowing in the dark, the lights that don the mega-structures within Jubail Industry City serve as a reminder of the lightning development of Saudi Arabia. Along with other industries in the city and across the Kingdom, they enjoy a ready supply of varying gas products drawn directly from the Kingdom's vast MGS. Meanwhile, across Jubail, at the nearby King Fahd Industrial Port, tons of sulfur are being prepared for export to nations across the world.

There is a common thread that weaves through all of the above — BGP.

In 1977, the plant kicked into action with a processing capacity of 620 million standard cubic feet per day (scfd) of sales gas. The facility contained three gas sweetening units, two sulfur recovery trains, and a utility plant processing associated gas from the Abu Ali field.

Expansion would become a byword for BGP and only three years later, the first additions to the plant began. Ethane

Khalid A. Al Harthi

Abdullah H. Ghailani

Sulfur is prepared at Berri Gas Plant to be sent to King Fahd Industrial Port in Jubail for export.

gas was an important product in the MGS inventory and to mitigate any possible outage in supply, the company commissioned an ethane storage facility at Berri.

Another commercial milestone was reached in 1984 with the construction of the sulfur handling and export facilities at the King Fahd Industrial Port. The new addition would be the first sulfur facility of its kind in the Kingdom.

"This was very significant," said Abdullah H. Ghailani, senior supervisor of Maintenance at BGP. "It was a new business for the company. The sulfur pelletizing units were in place and the plant could now prepare sulfur for export."

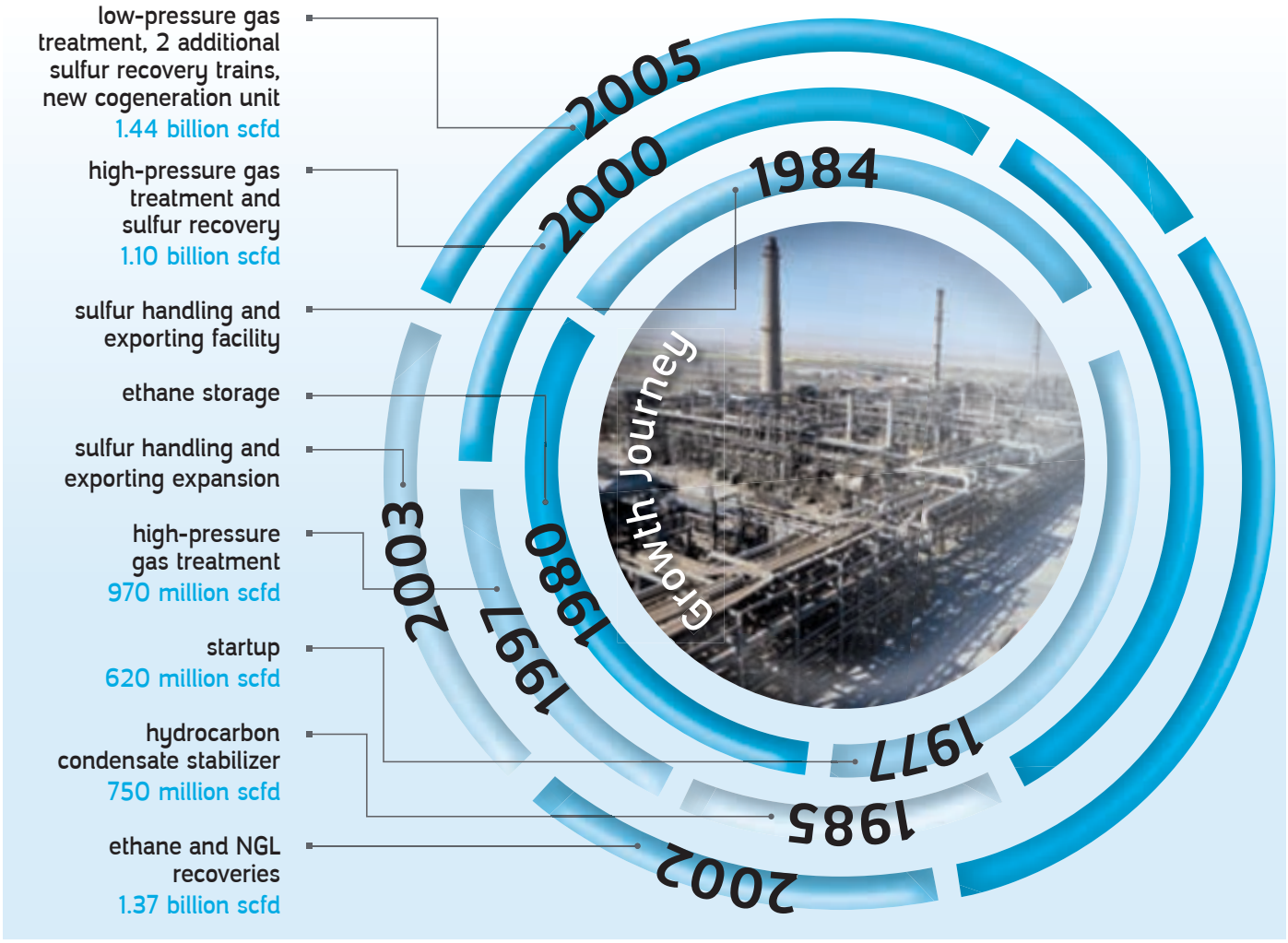
Sulfur, recovered from the gas, is used heavily in fertilization products and is in much demand globally — BGP was having the desired economic effect.

With Jubail Industrial City continually expanding, the demand for ethane and sales gas from nearby BGP increased. "Whenever the Kingdom plans for a new product we have to provide the feedstock to the plants," noted Ghailani.

In 1997, another major expansion at the plant saw the introduction of the high-pressure gas treatment facility, increasing capacity to 970 million scfd. The new expansion was a necessity to process high-pressure associated gas from the Safaniyah and Marjan offshore fields. Previously, BGP was only capable of processing low-pressure associated gas, mainly coming from Abqaiq.

And demand continued to increase. The year 2000 saw the commissioning of another sulfur recovery train and an additional high-pressure gas treatment unit, pushing the

Opposite: In the control room at the facility, Mossab A. Al-Ghanmi (standing) and Hassan F. Almughaliq view detailed aspects of the gas operations.


low-pressure gas treatment, 2 additional sulfur recovery trains, new cogeneration unit
1.44 billion scfd
high-pressure gas treatment and sulfur recovery
1.10 billion scfd
sulfur handling and exporting facility
ethane storage
sulfur handling and exporting expansion
high-pressure gas treatment
970 million scfd
startup
620 million scfd
hydrocarbon condensate stabilizer
750 million scfd
ethane and NGL recoveries
1.37 billion scfd
2005
2000
1984
1980
1997
2003
1977
1985
2002
Growth Journey

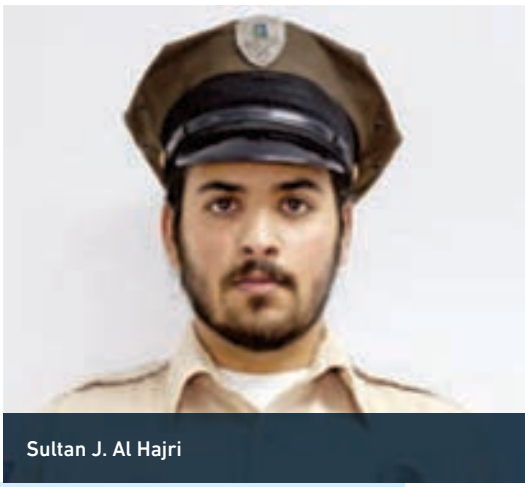
Mohammed Al Tahini

Saeed Al Qahtani

Jaber S. Al Hajri

Mohammed A. Al Tahini

Abdullah Al Qahtani



Sultan J. Al Hajri

GENERATION TO GENERATION:

FOR SOME ARAMCONS, WORKING AT BERRI GAS PLANT IS A FAMILY TRADITION AND HONOR

Mohammed A. Al Tahini is all smiles as he discusses his recently acquired role at Berri Gas Plant (BGP). The 28-year-old engineer has only been with the company since August 2017 — but the family connection goes back much further.

His grandfather, also named Mohammed, joined the company in 1953 as a technician, and worked at BGP between 1985 and 1994 where he served as a shift superintendent before retiring.

"He was thrilled when I told him I was joining Berri Gas Plant," said the younger Al Tahini. "He told me, 'I have done my part, now it's your turn.'"

Al Tahini is enjoying his new career at BGP. "Berri is world-class — there are a lot of brilliant people here. This is due to a combination of good education and experience. I would like to follow in my grandfather's footsteps and be successful at Berri."

Abdullah Al Qahtani, a 24-year-old instrument technician at BGP, is a graduate of Saudi Aramco's Industrial Training Center. It was his uncle, Saeed Al Qahtani, a 35-year veteran at BGP, who gave him encouragement to join the organization.

The elder Al Qahtani retired from the company in 2013, after having been in charge of sulfur export at the plant. For Abdullah, it's a source of pride that his uncle bore such a responsibility.

"My uncle is still well-known at Berri, and that is something that gives me great pride. I hope I can follow in his footsteps and be successful here too," said Abdullah. "The atmosphere is positive here and we receive a lot of training, especially in new technologies."

Despite his young age, Abdullah has already found himself working on a recent major processes control upgrade project at the plant.

"We are working hand-in-hand with more experienced employees," he says. "This makes us passionate about our work and allows us to be good role models."

When Jaber S. Al Hajri comes to work at BGP each morning, another member of his family is heading home in the opposite direction. His son Sultan works the night shift in Industrial Security at BGP, and together the father and son encapsulate the family spirit that permeates through the plant.

Jaber is a supervising computer aided design and drafting operator and knows BGP like the back of his hand. Having joined the facility in 1987, he is the gatekeeper for the drawings and original plans of the plant — including all subsequent expansions. In effect, if any work needs to be done on a section of the plant it's Jaber who must supply the blueprints.

"It feels special to have my son also working here in Berri Gas Plant," he said. "We have a lot of support from management here. I have been here for 30 years and Berri is in my blood — and now it's in the blood of my family too!"

overall capacity at the plant to 1.10 billion scfd.

Since its startup, BGP had sent C2+ (ethane plus NGL) to Ju'aymah for processing, but in 2002 that was to change with the installation of the ethane and NGL recovery units, sending capacity to 1.37 billion scfd.

"This increased plant capacity and recovery of high value product," said Ghailani. "By processing the ethane in Berri, it allowed for the deep recovery of ethane to meet the ever-increasing demand of ethane for the Kingdom's petrochemical industries."

In 2005, the addition of the low-pressure gas treatment unit and two further sulfur recovery trains sent production to 1.44 billion scfd. The plant's evolution had seen its production levels more than double since its inauguration. And to continue efficiency, the plant built its own cogeneration unit, also in 2005. This unit, producing 300 megawatts (*MW*), generates enough electricity to independently power the plant. To appreciate the power output, 300 *MW* is approximately the amount required to power 200,000 average-sized homes.

BGP's sheer diversity of operations is unrivaled domestically, and it was no surprise that its expertise would be tapped for another major project on the opposite side of the Kingdom.

The Midyan gas facility processes gas from the Midyan field in the northwest of Saudi Arabia, supporting industry in the area. In many ways it mirrors the origins of Berri — thereby, the company entrusted its development to BGP.

"Although it's across the Kingdom, BGP is responsible for Midyan — this is very unique," said Mossab A. Al Ghanmi, Processor supervisor at BGP. "Midyan is considered as a unit within BGP. Its objectives are to support growing energy demand and support local development.

"All the training for the employees is done here at BGP, in fact, we even monitor the facility from here. It's a hugely important project and we are proud to have been entrusted to handle it."

HUMAN RESOURCES HUB

It's a badge of honor for Berri. Serving as a training and human resources hub helping to produce qualified engineers and technicians in addition to many senior company leaders, the facility has become synonymous with employee development.

There's no doubt that the complexity and diversity of the operations at BGP are a main factor in this. For young engineers, BGP is the place to cut your teeth.

"There is a legacy in Berri for developing people," said Al Harthi. "It has been like that since the beginning — it seems it is part of Berri's DNA."

BGP has received engineers and technicians from Khursaniyah, Wasit and Fadhili gas plants, who spent extended time at the facility learning the ropes from experienced hands.

In fact, knowledge transfer was an early concept at the plant. "We have a well-established operator training program that has been in place for some time. It is important as we have senior technicians and operators who have been here for more than 20 years and transferring their experience to the next generation is crucial," says Al Harthi.

"The pride you feel is carrying the torch that was lit by the early pioneers at the plant. The history and legacy here is amazing. From the work done to help kick-start the Master Gas System to the incredible efforts put into developing and training employees. We are celebrating 40 years, and one thing is for sure, just like a true patriot, Berri Gas Plant will keep powering forward — for another 40 years."

Knowledge transfer and training of employees is one of many success stories at Berri Gas Plant. Here, senior maintenance engineer Abdulkareem O. Turkistani explains the workings of a pump component to machinist technician Abdulrahman K. Al-Omari.

GeoDRIVE

Integrated geophysical solution for subsurface model building

PHOTOS BY
LAMEES N. ALOBOUDI

SAUDI ARAMCO SCIENTISTS IN EXPEC ARC SET A NEW STANDARD FOR SUBSURFACE MAPPING AND CHARACTERIZATION

The Geophysics Technology Division (GPT) at the Exploration and Petroleum Engineering Center – Advanced Research Center (EXPEC ARC) achieved a major breakthrough by unlocking ultra-resolution subsurface mapping and characterization. Saudi Aramco's integrated geophysical solution for dynamic real-time image and velocity estimation (GeoDRIVE) successfully produced a 3-D image of the subsurface geologic layers at a record resolution of 7.5 meters.

"Achieving this resolution level is imperative for meeting our exploration and development targets," said Ibraheem M. Assa'adan, vice president of Exploration for Saudi Aramco. "The launch of this in-house developed, advanced tool is timely and represents a significant addition to our subsurface imaging capabilities."

"The limits of geophysical techniques have historically been behind the engineering needs at reservoir level," said Ali A. Al-Meshari, manager of EXPEC ARC. "The smallest distinguishable features in geophysical methods are of the size of tens of meters, whereas optimal drilling and producing operations require accurate measurements within a few feet.

"We successfully imaged the target reservoir at a resolution that was previously deemed out of reach."

SUBSURFACE IMAGING USING SEISMIC AT SAUDI ARAMCO

Saudi Aramco's exploration and development targets have historically been very large with simple structures. For such targets, quick and simple geophysical methods were sufficient to provide an overall picture of the geologic settings at the subsurface. However, recent targets have become increasingly more complex in challenging environments such as low-relief structures, stratigraphic traps, subsalt, and fractured reservoirs. In such environ-

Ali Al-Momin speaks about the importance of incorporating multidisciplinary data, extreme performance computing, advanced techniques, and user-friendliness with GeoDRIVE.

ments, accurately simulating the physical propagation of seismic waves through the subsurface is an essential step to extract subsurface models from seismic data.

While optimal in theory, there are several obstacles that prevent the use of advanced seismic imaging techniques in production workflows. Massive seismic data, typically in the order of petabytes (1e15 bytes), is simulated in 3-D models that have several billion cells.

Moreover, each imaging application requires several simulations for each portion of the data, resulting in tens of thousands to hundreds of thousands of simulations. The data volume, model size, and number of simulations render advanced imaging techniques very challenging and inefficient in utilizing computing resources — even when utilizing the world's largest supercomputers. As a result, most conventional applications are restricted to smaller areas with limited resolution, approximated physical properties, and simplified wave propagation physics.

The vast computational cost of accurate seismic simulations created a gap between theoretical advancements in the academic world and practical industrial applications. Subsequently, Exploration's continuous search for more ambitious objectives gave Saudi Aramco the perfect environment for accelerating the path of implementing academic frontiers in industry settings. This provided a unique opportunity to build an innovative solution that can satisfy Saudi Aramco's current needs as well as the future needs of researchers and professionals.

KAUST AND EXPEC ARC COLLABORATION

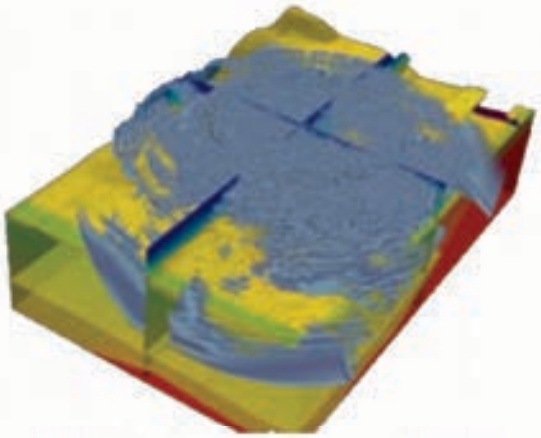
To tackle this multifaceted challenge and to enable and support next-generation depth imaging and model estimation algorithms, GPT worked in collaboration with the Extreme Computing Research Center and the King Abdullah University of Science and Technology (KAUST) Supercomputing Laboratory Core Lab teams to develop GeoDRIVE. This fully integrated seismic imaging platform is designed for massively parallel exascale supercomputers with optimized simulators and modular infrastructure.

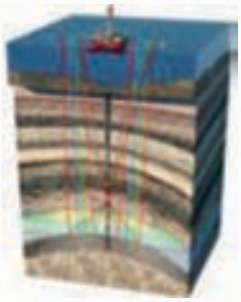
The first pre-release of GeoDRIVE was successfully applied on *Midyan* 3-D seismic data using the Shaheen II supercomputer at KAUST in collaboration with the Red Sea Department. The in-house, integrated platform efficiently utilized more than 100,000 cores to compute 54,000 seismic simulations. This enormous computing power was made possible thanks to the KAUST Cray supercomputer

"Achieving this resolution level is imperative for meeting our exploration and development targets. The launch of this in-house developed, advanced tool is timely and represents a significant addition to our subsurface imaging capabilities." — IBRAHEEM M. ASSA'ADAN, VICE PRESIDENT OF EXPLORATION

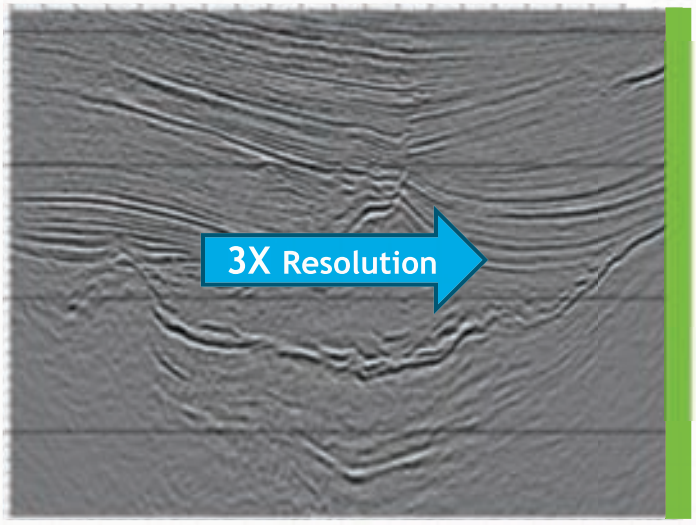
GeoDRIVE:

A versatile solution for advanced seismic applications





GeoDRIVE applications spans from conventional surface seismic data imaging to acoustic sonic imaging and vertical seismic profile imaging.



Ultra-resolution imaging

GeoDRIVE's high performance computing design and implementation allowed us to increase wave equation imaging resolution by 3X.

Shaheen II, which is the 18th ranked most powerful computer system in the world.

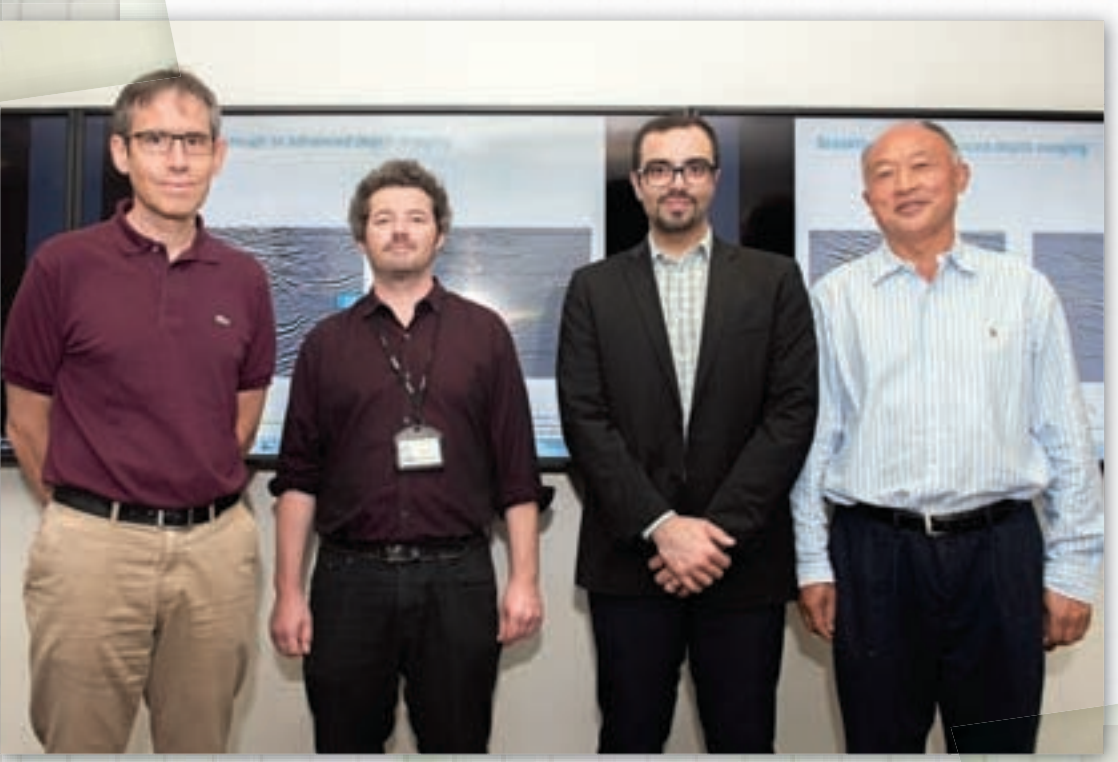
Throughout this collaboration, KAUST mobilized its resources to provide EXPEC ARC with seamless access to Shaheen II, as well as specialized personnel for system program support and optimization to ensure the runs went smoothly and efficiently. KAUST's high-performance computing expertise and Saudi Aramco's geophysical expertise were effectively integrated in this case where the whole became much larger than the sum of the parts.

"This is a long-awaited moment in the history of Saudi Aramco/KAUST collaborations," noted David Keyes, director of KAUST's Extreme Computing Research Center. "It represents more than an academic collaboration — a real production run was performed at a record high frequency. Our collaboration puts to use software developed in the Ph.D. theses of KAUST computer science graduates who were Saudi Aramco sponsored — one of whom now supports Saudi Aramco from Intel's own research center on the efficient use of Intel's multicore processors on every node of Shaheen II."

THE FUTURE OF SUBSURFACE CHARACTERIZATION

The objective of geophysical methods is to enable geoscientists to interactively and efficiently build high-resolution and high-fidelity Earth models. To achieve this objective, GPT strives to bring the next evolution of geophysical solutions and go beyond providing seismic images. The ultimate goal is to estimate a dynamic Earth model of the whole Kingdom that provides the essential information about the reservoir in real-time. Such fundamental change will require a complete overhaul of the way subsurface characterization in conducted in our industry.

The GeoDRIVE application to full waveform sonic data unlocks unprecedented imaging of reflectors over several thousand feet along the well's trajectory and up to 200 feet away from the wellbores.



Members of the GeoDRIVE development team are in full agreement that the future leading Upstream solutions need to incorporate multidisciplinary data integration, extreme performance computing, advance techniques, and user-friendliness — all under one umbrella.

Thierry Tonellot, Vincent Etienne, Ali Al-Momin, and Yi Luo

AN ARAMCO FIRST IN DETROIT

Company shines at North American International Auto Show debut

Aramco put its commitment to being part of the solution to transportation challenges on display at the North American International Auto Show in Detroit in January.

While this year was the first time for the company to participate in the event, Aramco brought a resonating message and presence to the fore to hundreds of thousands of visitors over the course of the world-renowned event.

Aramco's activities were highlighted at the company's exhibit, with tours providing an overview of our technology and lab activities. Also, our flagship technology focus — gasoline compression ignition — was a special feature at the show.

The internal combustion engine is here to stay, so efforts to cut global emissions must focus on increasing the fuel efficiency. That was one of the central messages delivered by the team from Aramco's Detroit Research Center exhibiting at the city's annual North American International Auto Show earlier this month.

Saudi Aramco was a premier sponsor of the event, which attracted more than 5,000 media attendees, 40,000 industry professionals, and 700,000 consumers.

Engine efficiency and new technology

The Saudi Aramco team, led by chief technology officer Ahmad O. Al-Khowaiter, emphasized how internal combustion engines have harnessed unparalleled energy density of hydrocarbons, transforming the world and powering economies to ever-greater heights. And with

Ahmad O. Al-Khowaiter, shown here being interviewed by CNBC, noted that being at the Detroit auto show was an opportunity to share advancements our researchers are making in vehicle technologies to reduce emissions, improve fuel efficiency, and increase engine performance.

Visitors to the North American International Auto Show in Detroit examine an opposed-piston GCI engine concept — a collaboration between Aramco and Achates Power — that reinforces the viability of the technology and its efficiency at an estimated 37 miles per gallon.

hydrocarbons (whether fossil or renewable based) meeting 99% of the world's transport needs, Saudi Aramco outlined the importance of the company's work into greater engine efficiency and new technical advances enabling the onboard capture and storage of carbon.

"Being at the Detroit auto show is an opportunity to share the significant advances our researchers are making in vehicle technologies that reduce emissions, improve fuel efficiency, and increase engine performance," said Al-Khowaiter. "As a leading energy company, we have a role to play in bringing our expertise to the table and supporting automakers in responding to worldwide calls for reductions in greenhouse gases and pollutants that impact the environment."

Showcasing our work

Aramco's activities were highlighted at the company's exhibit on the main show floor adjacent to Kia and Chrysler/Fiat/Dodge/Jeep/Ram, as well as a booth in the innovation-oriented Automobili-D exhibit space.

Pre-event tours of the company's Detroit Research Center attracted eight major global automakers who were given an overview of Aramco's technology and lab capabilities, as well as a separate tour organized for top-tier media outlets.

Other Aramco centers involved in transport technology that were highlighted during the show include the Research and Development Center (R&DC) in Dhahran; the Clean Combustion Research Center at the King Abdullah University of Science and Technology through the FUELCOM collaboration; the Aramco Fuel Research Center-Paris; and the Beijing Research Center.

"Our work in transport technologies is global in scale with teams, facilities, and partners around the world working together within regional infrastructures to find new approaches to the challenges that are common to us all," said Ammar A. Al-Nahwi, head of R&DC.

Technology for the full range of emissions challenges

Aramco's flagship technology focus — gasoline compression ignition (GCI) — was a special feature at the show. As part of their work to build the most advanced GCI engines anywhere, Aramco researchers are leveraging the physical and chemical properties of gasoline and gasoline-like fuels along with innovative combustion approaches to substantially lower emissions.

In Detroit, a Ford F-150 displayed at the Aramco booth showed a collaboration with Achates Power on an opposed-piston GCI engine concept — reinforcing the viability of the technology and its efficiency at an estimated 37 miles per gallon.

On display at the North American International Auto Show in Detroit is the opposed-piston gasoline compression ignition engine — Saudi Aramco's flagship technology focus.

Also in the spotlight was Aramco's mobile carbon capture program. In this research area, a novel exhaust system captures and stores the carbon dioxide (CO_2) onboard the vehicle for later offloading and use in industrial and commercial activities. A particular area of interest for Aramco is heavy-duty trucks, which represent some of the heaviest polluters in the transport sector. At the show, Aramco reaffirmed our goal to further advance mobile carbon capture to demonstrate a 50% reduction in CO_2 emissions by year-end.

Octane-on-demand, another highlighted Aramco technology, drew attention at the show for the power and performance it can offer through a two-fuel system — a high-octane fuel for conditions that require it and low-octane for normal driving conditions.

"We are looking at transport challenges from a wide variety of perspectives and technology solutions — from the fuels we refine and the engines that consume our fuels, all the way through to tailpipe emissions and beyond," said Amer A. Amer, chief fuels technologist at R&DC.

Sustainability a key focus

The North American International Auto Show — one of the largest auto shows in the world — was also an important venue for discussions surrounding the many technology advances taking place in the automotive industry.

"As a top global refiner, Aramco brings a unique view to optimizing fuels with engines, including the internal combustion engine, which currently makes up 99% of all power sources for vehicles," said Al-Khowaiter. "In the short- to mid-term, this is where we as a company can make a significant impact as part of our commitment to sustainable mobility."

The world's automotive capital

Detroit is home to all major U.S. automakers, as well as the R&D centers of most automakers worldwide, engine makers, and technology providers.

"Our presence at the Detroit auto show was notable and sent a strong signal to the industry that we are here to collaborate and make a meaningful difference in fuels and engine technology," said David Cleary, director of Aramco's Detroit Research Center.

Amer A. Amer meets with visitors at the Detroit auto show. Amer shared how the company is looking at transport challenges from a variety of perspectives — "from the fuels we refine and the engines that consume our fuels, all the way through to tailpipe emissions and beyond."

abbrev.

Saudi Aramco news in brief

Top: **Members of the first-place winning team from EXPEC ARC, include Diego Rovetta, Daniele Colombo, and Ernesto Sandoval-Curiel (not pictured is Federico Miorelli).** ***Bottom:*** **The team of second-place contributors includes Pavel Golikov, Robert Smith, Andrey Bakulin, Mustafa Al-Ali, Ilya Silvestrov, and Kevin Erickson.**

EXPEC ARC wins top innovation awards at International Conference on Engineering Geophysics

AL-AIN, UAE — The EXPEC ARC Advanced Research Center (EXPEC ARC) recently won first and second place in the 2017 Innovation Award competition at the International Conference on Engineering Geophysics (ICEG) in Al-Ain, UAE.

Sponsored by the Society of Exploration Geophysicists, the ICEG event represents the biggest and most prestigious society in exploration geophysics of the oil and gas industry.

The first-place innovation award was delivered to the group of innovative technologies known in Saudi Aramco as pQC and aQC, which provide the automatic solution of distorting the near surface for enhancing subsurface seismic imaging. This is performed by automatically deriving the necessary time shift corrections, velocities, and amplitude compensations.

The methodologies were developed in EXPEC ARC's Geophysics Technology Division and are the object of several patent and trademark filings.

The second-place innovation award was granted to Saudi Aramco for developing a novel fiber optic seismic system for onshore acquisition, which is capable of simultaneous near surface characterization and deep reflection imaging of oil and gas targets.

This new technology, which addresses both near surface and data quality challenges by burying sensors in the subsurface, was invented by EXPEC ARC's Geophysics Technology Division.

Saudi Aramco plays a strong part at Clean Fuels Symposium in Beijing

BEIJING, CHINA — Saudi Aramco was the sponsor of the Clean Fuels for Future High Efficiency Engines Symposium in Beijing, China. Part of the annual Society of Automotive Engineers International Powertrain, Fuels and Lubricants meeting, the symposium focused on peer relations for automotive original equipment manufacturers, trade associations, national laboratories, and automotive solution companies.

The four-day event attracted more

Amer A. Amer, Transport Technology chief technologist for Saudi Aramco's Research and Development Center, speaks on "Enabling Sustainable Mobility Solutions" during the Clean Fuels for Future High Efficiency Engines Symposium in Beijing, China.

Ali Dogru is pictured at the induction ceremony in Washington, D.C., with NAE chairman Gordon R. England, on the left, and NAE president C.D. Mote Jr.

than 500 industry professionals from across Asia, Europe, and the Americas, with a total of 245 technical papers presented.

Saudi Aramco's attendance at an event such as this is key to the development role the company plays as a leading global exporter of energy and our research into innovative clean and efficient combustion systems for the transport sector. The company's joint collaborations with several major automakers are designed to demonstrate the internal combustion engine's potential for considerable efficiency improvements and our efforts to accelerate the development of cost-effective, viable technologies that also address the challenge of climate change.

Saudi Aramco celebrates first employee inducted into U.S. National Academy of Engineering

WASHINGTON, D.C. — Ali Dogru, Saudi Aramco Fellow, has been formally inducted into the U.S. National Academy of Engineering (NAE).

Dogru is the first Saudi Aramco employee to be elected into this prestigious organization — considered one of the highest professional distinctions accorded to an engineer.

The induction ceremony took place in Washington, D.C., during the NAE's annual meeting at the National Academy of Sciences.

NAE officials recognized Dogru's lifetime achievements in the field, particularly highlighting his leadership in the development of high-performance computing in hydrocarbon reservoir simulation.

Dogru specializes in computational modeling technology and is an architect of Saudi Aramco's two legacy reservoir simulators. He is currently leading the EXPEC Advanced Research Center's TeraPOWERS Technology in the development of the company's first basin and reservoir simulator.

Throughout his distinguished career, Dogru has had many technical papers published and earned a number of U.S. patents for Saudi Aramco. Additionally, he has won several prestigious awards and honorary memberships.

Aramco Trading inaugurates its first international office in Singapore

SINGAPORE — Abdulaziz M. Al-Judaimi, Saudi Aramco's senior vice president of Downstream, officiated the inauguration ceremony of Saudi Aramco Trading Singapore (SATS).

Al-Judaimi was joined by Ahmed A. Al-Subaey, vice president of Marketing, Sales and Supply Planning; Ibrahim A. Al-Buainain, president and CEO of Aramco Trading; Mohammed K. Al-Mulhim, Aramco Trading vice president of supply and trading; and Nader A. Al-Arfaj, managing director of SATS.

"The expansion of Aramco Trading in Singapore is part of Aramco's strategy to optimize value across the whole oil and

From left, are Mohammed K. Al-Mulhim, Ahmed A. Al-Subaey, Abdulaziz M. Al-Judaimi, Ibrahim A. Al-Buainain, and Nader A. Al-Arfaj.

products chain, servicing our markets and customers, as well as support Saudi Aramco's expanding refining operations and petrochemical output," said Al-Judaimi.

"The opening of Aramco Trading's first office outside of Saudi Arabia is a testament to the tremendous growth opportunities we see in Asia and reinforces our commitment to this region," said Al-Subaey.

Officially launched in January 2012, Aramco Trading is the global integrated platform for Saudi Aramco's downstream assets, as well as for our international partners. Aramco Trading is a key player in the region, supplying to Europe, the Middle East, Africa, the Americas, Asia, and the Indian subcontinent.

Chief engineer delivers keynote at Harvard Business School

CAMBRIDGE, MASSACHUSETTS, USA — Nabilah M. Al-Tunisi, Saudi Aramco's chief engineer, set her focus on the future, sharing news of the company's direction at the Arab Conference at Harvard 2017. Al-Tunisi's keynote address, "Preparing for Tomorrow," attracted prominent politicians, business professionals, and civic leaders, as well as students from colleges across the region.

The event is the largest Arab conference in the U.S. held on the campus of the oldest university in the U.S.

"Energy is central to all that we do," Al-Tunisi said, adding that Saudi Aramco is preparing for tomorrow in ways that are both significant and progressive, and at the same time, the many recent achievements in Saudi Arabia are contributing to an exciting future.

Amin Nasser and Yousef A. Al-Benyan look on as a Memorandum of Understanding is signed by Saudi Aramco senior vice president of Downstream Abdulaziz A. Al-Judaimi and SABIC general manager of Polymers, Uwaidh Al-Harthi, during a signing ceremony. *Photo by Moayed Al Qattan.*

Nabilah M. Al-Tunisi offers a look at the future of energy during her keynote at the Arab Conference at Harvard 2017.

She highlighted Saudi Aramco's investments in startups and the encouragement and mentorship the company offers to entrepreneurs with unique ideas.

Saudi Aramco and SABIC sign MoU to develop crude oil to chemicals complex

DHAHRAN, SAUDI ARABIA — Saudi Aramco and SABIC recently signed a Memorandum of Understanding (MoU) to develop a fully integrated crude oil to chemicals complex (COTC) in the Kingdom of Saudi Arabia. The MoU governs the execution of the front-end engineering design before a final investment decision is made.

The complex is expected to process 400,000 barrels per day of crude oil, which would produce approximately 9 million tons of chemicals and base oils annually. The complex is expected to start operations in 2025.

The announcement marks a historic alliance between the two largest Saudi

Top: Dan Georgi (center) at the Houston Research Center with Basil A. Abul-Hamayel (left), president and CEO of Aramco Services Company, and Ashraf Tahini (right), director of the Houston Research Center. *Bottom:* Alberto F. Marsala (center) receives congratulations from Ali Al. Al-Meshari, EXPEC ARC manager (left) and Ali A. Al-Yousef, chief technologist of the Reservoir Engineering Technology Division.

global entities — in addition to solidifying the Kingdom's position as a global leader in chemicals — by substantially increasing production and further maximizing value across the entire hydrocarbons chain through integration. The complex would be constructed based on an innovative configuration that achieves COTC conversion that is unprecedented in the industry.

The complex is expected to create an estimated 30,000 direct and indirect jobs, further stimulating the Kingdom's economic diversification. By 2030, the COTC complex is expected to have a 1.5% impact on the Kingdom's gross domestic product, with investments being shared equally by both companies.

Consistent with the Kingdom's Vision 2030 economic transformation program, this project would support the creation of a world-leading downstream sector in Saudi Arabia.

EXPEC ARC employees recognized by SPWLA

DHAHRAN, SAUDI ARABIA — Two EXPEC Advanced Research Center (EXPEC ARC) researchers were recently selected by the Society of Petrophysicists and Well Log Analysts (SPWLA) to receive prestigious awards for their career achievements.

Daniele "Dan" Georgi of the Reservoir Engineering Technology Team at the Houston Research Center was awarded the Medal of Honor for Career Service, while Alberto F. Marsala of the EXPEC ARC Reservoir Engineering Technology Division at Dhahran was recognized with the Meritorious Technical Achievement Award.

Georgi has been with Aramco Services Company for the past four years in EXPEC ARC's Houston Research Center, where he has made a major impact through his contributions in building a research team to address issues associated with finding and producing unconventional source rock reservoirs.

Marsala was recognized for his technical achievements in pioneering the novel techniques of formation evaluation on drill cuttings early in his career. He was able to bridge the gap between logging-while-drilling and direct petrophysical characterization on rock samples. Marsala developed a series of revolutionary methodologies that allow real-time direct petrophysical measurements on rock cuttings while drilling.

The awards for such high-profile achievements were presented by the board of directors of SPWLA at a ceremony during this year's SPWLA Annual Symposium in Oklahoma City, Oklahoma, U.S.

Saudi Aramco

dimensions INTERNATIONAL

Public Relations Department
C-11B, Room AN-1080
North Admin Building #175
Dhahran 31311, Saudi Arabia

worldview

Niagara Falls, New York

Ghaida M. Ayidh took this photo of the American side of Niagara Falls in New York during a visit to the majestic falls in the spring of 2016. She used her Canon 550D camera to take the photo.

Ayidh works with the Planning and Performance Management Division of International Operations in the East Administration Building and has been with Saudi Aramco since 2013.