*High school students on the exhibit floor in 2016 look to the future during the Student Event: Energy Education Institute Program.*
All photos courtesy of OTC.

# OTC at 100: A Look Ahead to 2069

*Edited by Joseph A. Pratt*

The fiftieth anniversary of the Offshore Technology Conference (OTC) offers a reason to look forward and backward. The waves of technological advances that have shaped the growth of the modern offshore industry began in earnest in the late 1940s. Looking back to the years after World War II, we see offshore pioneers with a vision of building an industry in the uncharted waters of the Gulf of Mexico. In 1969, we see the creation of OTC and a technologically advanced offshore industry active around the globe. As we celebrate OTC's golden anniversary in 2019, it is interesting to speculate about the advances in technology in the next fifty years that might transform the offshore industry in ways we can barely imagine today.

In this concluding article, we give people associated with OTC a chance to contemplate the future of their organization. Our exercise in prophecy began with a questionnaire from the editors of *Houston History* to OTC officials and conference chairs, asking for their opinions about the future direction of offshore technology and of OTC and how they see OTC's journey from 2019 to its hundredth anniversary in 2069. Those who responded to our questionnaires include:

- **Wafik Beydoun**: *Current Chairman OTC, Total Kuwait Country Chair*
- **Susan Cunningham**: *Senior Adviser, Darcy Partners; Past OTC Board of Directors Chairperson*
- **Kim Faulk**: Chair, *AAPG Subcommittee to the OTC Program; Chair, OSIG, SUT US*

**Editor Joseph A. Pratt, Ph.D.**, is professor emeritus at the University of Houston. For more than fifty years he has studied and taught about the history of the oil and gas industry. He is also the founder and editor emeritus of *Houston History*.

What emerging technologies might become increasingly important in the next 50 years?

Joe Pratt (JP): This is a key question for understanding both the past and future of OTC. Technology is, after all, OTC's reason for being. In the formative years offshore, individual people and companies often brought forward innovations that then spread through the industry. In the last fifty years advances in older technologies and the creation of new ones have increasingly been the work of large numbers of experts working on the same basic technology in many different companies. Such cooperative efforts have pushed forward the process of incremental improvements in existing technologies and the emergence of new ones.

It is appropriate to begin our journey into the next half century with a quote from a science fiction writer, presented to us by Wafik Beydoun, current Chairman of OTC.


*Displaying the program guides from the first and fiftieth OTCs, Wafik Beydoun, OTC Board of Directors Chairman, speaks at the opening ceremony commemorating the fiftieth OTC in 2018.*

Wafik Beydoun (WB): When Arthur C. Clarke (famous British science fiction writer) was asked a similar question in the mid-60s he warned: "Only if what I tell you appears absolutely unbelievable, have we any chance of visualizing the future as it really will happen." Amazingly, many of his predictions back then turned out, 50 years later, to be true!

For the past 50 years, technology has progressed at an amazing pace, sometimes disruptively. In the late 1960s, state-of-the-art technologies included portable calculators, audio cassettes, and high-end computers with a power less than our smart phones today. Who would have imagined that in the 1970s we would be entering the Digital Era, propelling technological changes at an *exponential* rate? The digital transformation is becoming so prevalent in all industries and technologies that it infiltrates our lives and environment in symbiotic and personal ways. Almost everything appears to be riding in the same vehicle, fueled by digitization, and driving into the future with ever increasing speed. The rising tide of the digital revolution is lifting us all, whether we want it or not.

Fifty years from now, in say 2070, the world population could be close to 10 billion, a 33% increase from today, with a life expectancy of over 110 years. This will require an energy demand of 1 Zetta-Joules (+67% from today - Zetta is 10 to the power 21) and an electricity capacity of 45 trillion KWh (80% higher than today). $CO_2$ emissions resulting from

*Unmanned aerial vehicles were introducted as a catagory to OTC in 2018.*

energy consumption are expected to be close to zero from a base line of 33 billion tons today and 13 billion tons 50 years ago. These are big challenges ahead that technologies of the future will need to address, one way or the other.

We need to remain humble in visualizing technologies that far into the future. However, at the same time we need to be "unbelievable" by highlighting technologies that are still in the ideation mode, as compared to emerging technologies that are already prototyped/experimented today (such as using wind, tides/waves, solar, geothermal – likely to mature in 10-20 years). To avoid being too generic or trivial, we limit our crystal ball predictions to technologies of the future that would impact offshore operations. Our resulting final list includes the following:

- Robots with AI (and/or virtual assistants, avatars) wearable or inside us, will be as present in our lives/body and our working environments as smartphones are today; computer-based intelligence will exceed the human brain;
- E&P value chain will be driven by real-time AI simulations, experimentations, digital-twins, integrating all disciplines to maximize profitability and ensure safety and reliability in operations;
- Offshore installations (surface, subsea and subsurface) will have their components interconnected, providing real-time feedback and analytics to monitor/maintain existing assets, optimize complex networks, and deliver performance in production; intelligent nanofluids will be injected in wells, reservoirs, flowlines, pipelines to monitor fluid flow, optimize recovery, correct/repair subsurface incidents, and/or control inflow to the delivery point;
- Offshore exploration and production of hydrogen gas will mature, contributing to $H_2$ becoming a viable commercial fuel in the energy mix;
- Geoengineering technologies will fix deviations in climate change regionally or locally, regulating the balance in oceans, water cycle, soil, and in the atmosphere, while protecting wildlife.

*Attendees are enthralled by a product demonstration at the 2017 OTC exhibition.*

Despite all of these far-reaching technological changes in the next fifty years, exceptional and unique human attributes such as creativity and innovativeness will continue to be very highly sought and valued.

We need to point out that these rapid transformations are weakening our well-established institutions for education, work, and employment and undermining the very notion of humans' ability to adapt to this acceleration. Skeptics are already warning that unless technology can be controlled, it will marginalize humankind. How far are humans willing to morph with the digital world or conversely to seek, more than ever before, what differentiates us from that world? I remain confident of one thing: human's ability to learn, adapt, and cope with rapid-fire technological changes while innovating and prospering in the process.

In summary, the next fifty years of the Digital Era promise to be one of the most transformational periods in human history. Regarding offshore activities, technologies related to transforming various resources into energy would be designed to ensure that oceans—which are the largest ecosystems on Earth and remain key assets for maintaining our planet habitable—are more nurtured and protected. We are currently only seeing the tip of the iceberg of emerging technologies. In the next 50 years, these will develop to become incredibly smart and creative, beyond our wildest dreams.

Susan Cunningham (SC): Fifty years is a long time to think about! Fifty years ago some of the emerging technologies with the greatest impact included: (1) DRAM (affordable computer memory); (2) commercial satellites (instant relaying of pictures/communication); (3) BASIC programming language (democratization of computing); (4) LED's and electro luminescent panels (brighter/cheaper luminescence); and (5) direct distance dialing (connecting people instantly, not through an operator) and of course – the internet.

*Susan Cunningham, Past OTC Board of Directors Chairperson.*

Looking forward, we will have significantly increased recovery of oil and gas from reservoirs with biotechnologies; robotics will transform farming, food production, and many other areas; quantum computing will continue to increase computing speed with more complex modeling/simulations/predictions and enabling dramatic leaps in AI; a radical Digital Security solution will be found; resource mining offshore and off the planet will become common; and $CO_2$ will be captured from the air and turned into new products.

Our industry will continue its relentless day-by-day improvements to technologies and operations, resulting in amazing visualization subsurface and predictive capabilities in operations that will dramatically improve safety, reliability, cost and efficiency. These evolutionary improvements are more likely to increase value than any truly revolutionary new technology.

Is it likely that OTC will expand its coverage to include such energy-related offshore activities as offshore wind power or the harnessing of energy in waves? If so, in what ways?

JP: This question and the next one raise a similar question: What is the best use of OTC's resources in planning expansion—both geographically and in terms of offshore functions? Together, they present interesting insights about the dangers and opportunities of expansion.

WB: For the past several years, we have been noticing an increased interest in offshore renewables (e.g., wind and waves) at OTC events. Technology is now enabling alternative sources of energy from tides, waves, wind, and solar to become more visible and meaningful compared to hydrocarbons. OTC is adapting to this trend by experimenting with novel ways to share key advances in this area. For instance, OTC 2019 in Houston is dedicating several luncheons, breakfasts, and presentations on Offshore Renewables. Stay tuned.

*Kimberly Faulk, Chair, AAPG Subcommittee to OTC Program Committee; Chair OSIG, SUT US.*

Kim Faulk (KF): It is critically important for OTC to expand our coverage of all offshore- related energy activities, including renewables. Offshore technology is the focus of OTC, which should include all offshore energy-related technologies. For 50 years, OTC has had both a vision and a drive to continue to focus on innovative technologies. To remain a place where innovative minds in the offshore energy community gather and share ideas, it will need to develop better relationships and partnerships with the offshore renewables and scientific communities.

SC: OTC will need to expand its focus to remain relevant. Without changing the purpose of OTC (offshore technology), OTC could expand into technologies that enable the har-

nessing and transportation of energy and natural resources, including mining offshore as mentioned above, and, of course, grow with wind, wave and tidal energies. Offshore-related environmental technologies such as biotech clean-up of plastics could become important parts of OTC.

Alternatively, OTC might expand to include energy technologies in general. In this scenario OTC might need to change its name to the Energy Technology Conference and cover all energy-related technologies regardless of where the water is. This would be a fundamental strategic question for OTC to remain relevant going forward.

JP: These three points of view offer three different perspectives, but they agree that OTC expansion into technologies used in the quest for renewable energies offshore deserve serious consideration.

Do you think the global network of offshore conferences will continue to expand? If so, how might that impact Houston's role in the network?

WB: OTC's flagship conference, held annually in Houston, expanded technically and globally in the early 2010s with the Arctic Technology Conference, OTC Brasil, and OTC Asia. Organizing these regional events was driven by the idea of providing an opportunity for energy professionals located in these regions to meet, exchange ideas, and share opinions on offshore resources and environmental matters, with a focus on regional challenges. So far we have had several successful editions.

In the future, OTC Brasil and OTC Asia would benefit from attracting more professionals, companies, and institutions from neighboring countries in their regions. This would strengthen the regional offshore network by offering more relevant and valuable conferences while expanding the global offshore network through our flagship conference in Houston.

KF: The global network allows better information exchange and faster introduction of emerging technologies. The global network of offshore conferences will likely continue to grow, but at what rate? The expansion of these conferences started when the cost of oil was at its peak. Will a lower price environment allow continued expansion, or will it require that OTC contract back to its primary roots?

Whether the conferences continue to expand or not, Houston will need to work to remain relevant in an ever-broadening global world. As energy markets shift toward renewables, Houston will need to remain involved and prioritize the things that make Houston strong in the energy sector: innovation, technology, and safety.

SC: The global network of conferences could expand as new technologies in all offshore aspects grow. There is an incredible expansion of new technologies being developed beyond the incumbent professional society expertise that would benefit this diverse offshore possibility. OTC's core competence is understanding and executing quality, relevant technology conferences. Any expanded OTC conferences should be located where they are most relevant.

How might OTC expand its presence in technologies used to improve offshore environmental stewardship and improvement of safety?

SC: OTC could reach out to startups and other companies that are relevant to the industry in areas both inside and from outside the oil and gas industry. This might include companies in biotech, engineering, and chemistry. OTC may also need to include the relevant professional societies on the board and have strategic conversations with their leaders.

JP: Fossil fuel companies, as well as OTC, will almost certainly become more deeply involved in environmental stewardship in the next fifty years, either by choice or as a result of public and regulatory pressure.

Is carbon capture and sequestration (CCS) in offshore operations likely to become of greater concern for OTC and the offshore industry as a whole? If so, how might it be managed?

KF: The license to operate is a larger and larger question each year for energy and service companies. We are all concerned about safety, environmental stewardship, and cultural impacts of energy extraction. OTC's primary focus on safety over the years has made OTC a go-to place for best practice and discussions around offshore safety….Only recently have discussions focused on our license to operate from a cultural and environmental perspective started to happen at OTC. This shift in focus will occur naturally as younger generations join the energy sector as a whole, but we must create space for these technologies and discussions within the OTC program.

CCS should expand in offshore operations over the next fifty years. We are already seeing operators like TOTAL focus on carbon sequestration. AAPG is putting together a session for the 2019 conference focused on carbon capture and sequestration. We believe this will become a focus moving forward as


*Then U.S. Congressman John Culberson participates in a product demonstration in 2018.*

*Attendees and speakers on the OTC exhibit hall floor in 2016.*

environmental regulations and the science of climate change shift how we do business in the energy industry.

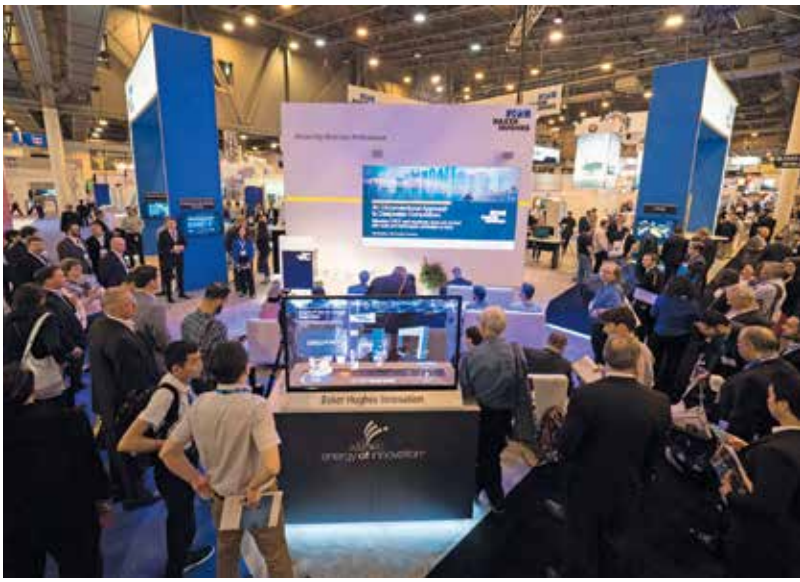
JP: Science and technology, two strengths of OTC, will drive public understanding and public policy on environmental standards; OTC can play an important role in helping define key environmental issues involving the oceans.

Is global warming likely to become a central issue in the offshore industry's work in the next half century? If so, how do you anticipate it will be addressed?

JP: Fifty years out, we will know much more about the severity of the impacts of climate change and the public policies that have—or have not—been put in place to mitigate them. OTC should continue to be a forum for discussions of all phases of the highly charged issues raised by climate change.

KF: Some disciplines like mine are already dealing with the impacts of climate change on the areas we study. Marine archaeological sites along coastlines are the first to be impacted by rising sea levels and stronger, less predictable storm events. I believe we will have to start addressing climate change in more serious ways in upcoming decades. The perils of ignoring climate's impacts on our pipelines, wells, port facilities, shipping, underwater cultural heritage sites, and sensitive biological communities are simply too great to ignore. Ignoring changing sea levels and storm impacts is not a question of believing in climate science, but rather a decision to ignore a tremendous risk.

To deal with increased flood potentials, serious rain events, and stronger, slower coastal storms, the offshore



*Attendees stop to listen to a Baker Hughes product demonstration at OTC 2017.*

industry will have to focus on providing better modeling, better risk analyses, better evacuation plans, and more robust facilities.

SC: Climate change is not relevant enough to the offshore industry to be a focus of the OTC, but it is a reasonable focus for the industry as a whole. As long as OTC is primarily concerned with offshore issues, I do not think that it should make CCS a significant part of its mission.

A lot of large companies involved in the OTC have their environmental/social sustainability/regulatory groups.


*Michael Neill speaks on risk and activity management at a Topical Breakfast, Tools for Process Safety in Offshore and Upstream Operations in 2016.*

CERA is big into this area. I would not try to compete here. This is primarily a political and regulatory issue; OTC should focus on technology.

One of the great aspects of the OTC is that it provides a relatively safe and politics free environment for objective conversation for technical professionals. OTC could build on that for conversation. Keeping to more technical topics would likely serve clients well. I would focus on environmental clean-up technologies for example. In particular, I would argue that a very relevant topic is the accumulation of plastics created by the oil, gas, and chemical industries in the oceans.

How can OTC build on the programs it has put in place to encourage greater participation by women and minorities?

KF: OTC has a reputation of being a good place to attend if you are a white male rising within the ranks of the energy sector. Too few women and minorities are visible within the OTC leadership at all levels. We need to broaden the membership of our technical subcommittees, session chairs, authors, exhibitors, and board members. The WISE event is the only event that currently provides a fully inclusive space within the OTC program, and it routinely pulls in women and minorities who attend no other sessions or events. The individuals who attend WISE are excited about growing within the energy sector and are hungry for a way to be involved in OTC.

As the industry evolves and younger staff members rise within their organizations, attitudes about race, gender, sexual orientation, and race or country of origin are going to shift. OTC needs to be at the forefront of these conversations and be working to ensure that no panel, session, or exhibit is populated solely with white men. We need to ensure that exhibits are not merely staffed with attractive models who then hand off the incoming client to the male technical staff. We need to ensure that an equal number of session chairs, authors, and technical leads are women. We need to ensure that we are making space for minority viewpoints during question and answer sessions, and that we are making sure we have recruited the best speakers – not just the easy one – to speak to the students and young professionals who attend OTC.

*Gabriela Arias, chemical engineer for Halliburton (left), and Angela Knight, global diversity leader, GE Oil & Gas, take part in the Networking Event, WISE: Women in the Industry Sharing Experiences at OTC 2015.*


*Students perform experiments and visit the exhibit hall booths in 2017 during the Energy Education Institute: High School Student STEM event.*

SC: If conversations about diversity could focus on issues more directly relevant to OTC, they would be more compelling to those who are not women or minorities. For example, a shift to more conversation about innovation, which requires thinking other than the norm, indicates that we need "other genders/ethnicities" as well as other demographics and technical functions to be part of it. If panel discussions were led in a purposeful way that illustrates an advanced understanding of the value of diversity to solving our challenges and problems, I suspect it would go a long way. Recognition that OTC's history is a bit checkered in this regard and admitting to it transparently would also help. Continuing to get senior technical leaders talking about this issue authentically would also go a long way. Authenticity is really important. Have people tell inspiring stories.

KF: Innovation is about diversity – diversity of thought, diversity of view, diversity of background, and diversity of solution. If OTC wants to remain at the innovative forefront of the offshore energy sector we must seek out diversity and make it the hallmark of OTC's next 50 years.


*University of Houston Energy participants at the 2015 OTC R&D University Showcase.*

JP: The key value of diversity has been the introduction of different ideas and perspectives. Innovativeness and creativity come in many packages. Greater diversity of perspectives, ideas, and training should be the goal.

How could OTC cooperate with other oil-related organizations to expand the initiatives to educate the broad public about offshore operations and technologies?

SC: The most obvious organizations are the advocacy groups, such as API, IOGP, and other national advocacy groups. I suggest that API and IOGP would be good groups with which to explore this concept. If this works, we could then consider expanding to others.

KF: OTC could work with organizations like the Society for Underwater Technology to run educational programs in schools around the world on offshore technologies and careers. If we want to inspire the next generation to join the offshore industry we need to start showing them what a drilling engineer, or chemical engineer, or naval architect, or marine archaeologist, or geologist, or metocean engineer, or petrophysicist, or safety coordinator really does.

JP: My experience as a member of the "Education Committee" of the Offshore Energy Center's excellent outreach program suggests that it would be a good partner for OTC. UH Energy also has reached out to help local schools enhance energy education.

What is OTC's most pressing priority to ensure its success for the next 50 years?

WB: I am very confident that technologies that help transform offshore resources into energy will remain assets for maintaining our planet habitable, in the short and long-term future. Therefore, OTC has all the reasons to succeed, as long as it "keeps its eyes on the stars, and its feet on the ground," paraphrasing a quote from Theodore Roosevelt. To achieve this it must remain pragmatic in the way it organizes events, and test new technical and geographical ideas based on perceived trends and opportunities.

KF: OTC must find a way to remain relevant in an increasingly global, interconnected world. We must find a way to contribute to conversations and provide solutions about renewable energy, climate change, and diversity. We must look to the incoming generation and those who have survived the latest downturn to provide new energy and vision for the next 50 years.

SC: Defining OTC's strategic purpose after some transparent conversations with professional societies, exhibitors, companies, and consultants should be a top priority. A 5-year plan should be included as needed. A change in the Board with the addition of members from other relevant professional societies might be needed. "Outsiders" from digital, bio, robotics, mining, other energy-related activities might make good contributions to the transformation of OTC. A clear focus on innovation produced amazing results in the past; refocusing as sharply as possible in the future on innovation, broadly defined, should do the same.

*High school students visit the exhibit floor during the student Energy Education Institute program in 2016.*

JP: We conclude with Susan Cunningham's remarks as she answers our request for thoughts on anything we omitted from the questionnaire.

SC: Since the "crew change" is happening as we speak, is there an effective way to explore "lessons learned" in an oil and gas career? We need better ways to pass on wisdom learned across generations. Discussing successes and failures from the past might help people to think more clearly about what the industry could be in the future. The forum could include people comfortable in the digital world who want to make a difference, as well as more environmentally conscious participants and others more comfortable in a diverse workforce. Get some millennials to talk about what they see as possible. Invite retirees from the offshore industry to recount their past.

I wish I could be around in 50 years to see how this all plays out. I am optimistic that mankind will figure it out. We are good at that. It will be messy and ugly in places, but we cannot even imagine the future in 50 years. The prospect of attending OTC's 100th anniversary and recalling how events evolved from 1969 to 2069 is exciting. ■