ECHO

WORLD'S CHAPTER OF THE MONTH

SPE Suez Canal University Student Chapter Magazine

Issue 5 | March 2013

FORMATION EVALUATION CHALLENGES IN DEEP WATER

THE GULF OF MEXICO - THE CAUSES OF A DISASTER

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2011 SPE International President

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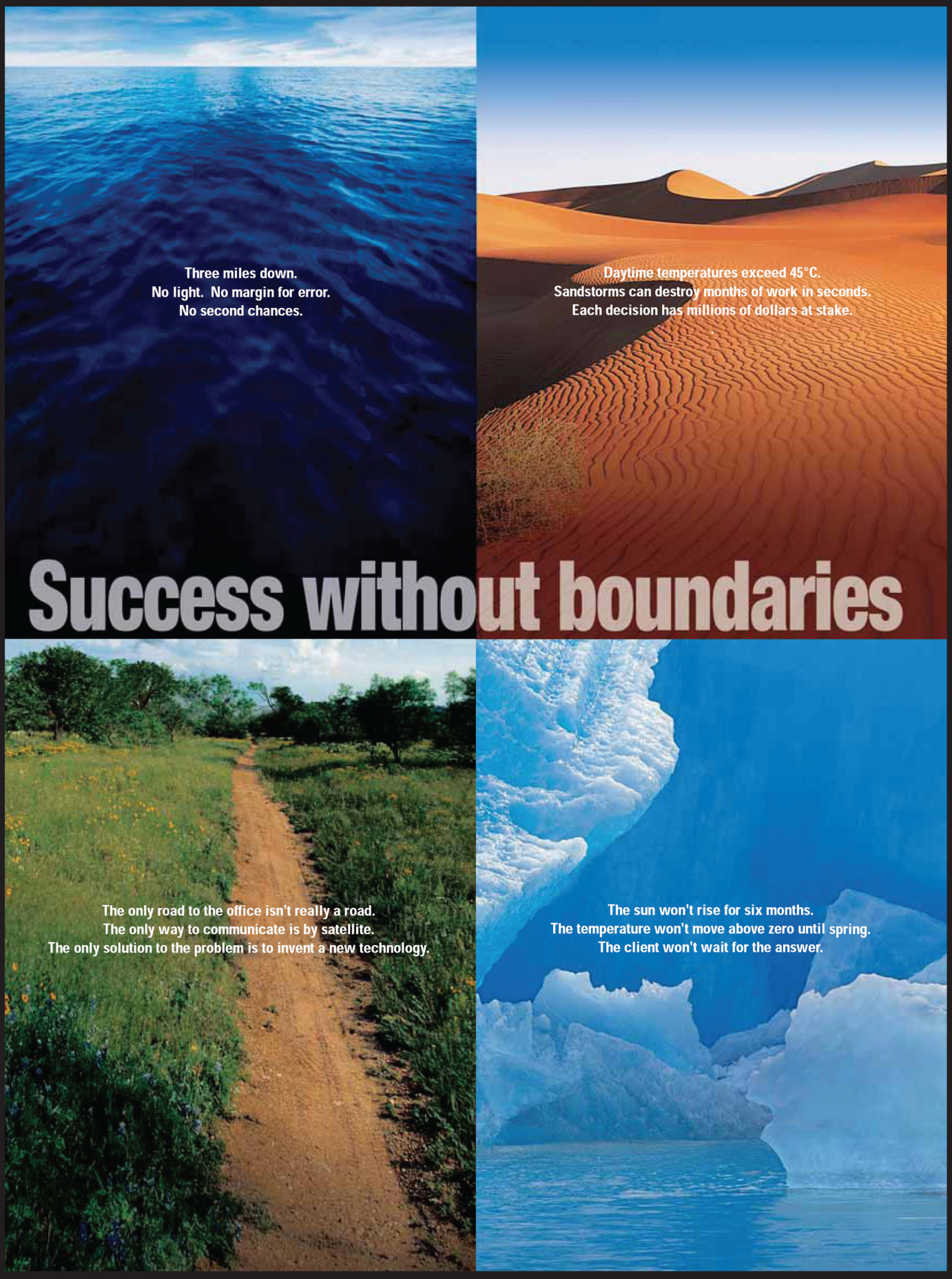
GTL - BEYOND THE FUTURE

PUBLISHED BY
Society of Petroleum Engineers
Suez Canal University Student Chapter



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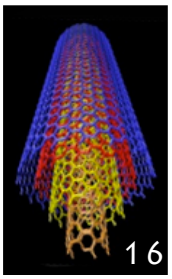

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The Future Begins Today

Mohamed Dmarany
Chapter President

This article comes as a conclusion for my lengthy and rewarding journey with student activities, as it's about to come to an end with my graduation. In the past four years, I realized that the only fundamental solution for a prosperous, bright future for Egypt is to develop and empower its youth. This is because of several social, political, economical, and technological factors that made youth the only sector capable of pushing the entire nation forward.

As Chris Grosser said, "Opportunities don't happen, you create them." So this matter won't be easy. We need to plan and work hard on a national scale to empower a potent generation and use new and unconventional methods to develop and motivate them. Looking at Turkey as an example, we find that it has become one of the world's sixteen most powerful economies in a decade. That was by virtue of setting clear strategies focused on developing youth by employing a modern education system, and allocating nearly 15% of its gross domestic product to scientific research. Another model is provided by Malaysia, which has been transformed from an agricultural, underdeveloped country plagued with unemployment to one of the top ten industrial countries in worldwide. Malaysia followed the Japanese experience through focusing on human—particularly youth—development in parallel with the industrial renaissance.

However—as proactive, young leaders—we cannot wait for such a top-down approach from the country leaders. We need to set our own model, and chart our own path. We must mobilize on our own by understanding our circles of influence and leveraging them. What we ought to do now is pushing our colleagues to participate in different student activities and non-governmental organizations, which will provide them with the skills and mindset that education doesn't offer, and unearth their buried talent and potential turning them, ultimately, into the capable leaders the future needs.

On the other hand, we must communicate our vision and dreams to the older generations to earn their support, persuading them with Franklin Roosevelt words, "We cannot always build the future for our youth, but we can build our youth for the future." We've all seen how older generations—especially in leadership roles—can hinder our plans when we fail to make them relate to our motives. It is crucial that they share our hopes and aspirations, and understand that they have a part to play.

We must also learn from the past initiatives that failed or succeeded in this matter. We have witnessed dozens of great ideas flop, and other—seemingly inferior—ones survive. My analysis is that for our initiative to succeed we essentially need to:

- Envision powerful dreams and targets that will inspire us to persist in front of hardships.
- Realize the value of what we do and set a clear plan to achieve it.
- Find new ways to motivate ourselves and the people around us.
- Believe in ourselves, then go ahead.

Exercising this conviction in our student chapter, we have always had a great contribution in the issue of developing youth in terms of technical knowledge and soft skills through conferences, internships, field trips, courses, workshops, and other events, all planned along the chapter's vision and strategic goals. And I am overwhelmed with joy and pride that our collective efforts were acknowledged as our chapter was named the SPE "Chapter of the Month" worldwide for March, 2013 out of more than 230 chapters. This honor we owe to each and every member in our team, our valuable partners, and our predecessors who laid the foundation for a truly exceptional chapter.

Now is our time to take charge of our future, put our dreams in front of our eyes, and work tirelessly to turn our generation into the leaders our country deserves.

"The future belongs to those who believe in the beauty of their dreams."
—Eleanor Roosevelt.

Islam Youssef
Editor in Chief

The Paradox of a Comfort Zone

First of all, I would like to welcome you to our fifth issue of ECHO, the official publication of the Society of Petroleum Engineers Suez Canal University Student Chapter (SPE SCU SC). For the fourth year working for SPE SCU SC, I would like to express my great honor and pleasure to be working with this team. I would also like to thank the editorial team for their remarkable effort.

You can notice that some people confine themselves to areas where they feel safer; they avoid breaking their daily routine just because they feel safe with it. They avoid taking an action that may change their whole life to the better because simply they are uncertain of its consequences. They get into an area of complacency and use a limited set of actions or behaviors to deliver the same level of performance although there might be alternatives that may deliver a better one. In other words, they put themselves in boxes and create boundaries around their minds. These actions, behaviors, attitudes, or mindsets are called comfort zones, which are the conditions you are familiar with and are not willing to change. But in fact, this state of safeness is not genuine, instead, it makes them eccentric that when they experience new challenges, they will stand arms folded.

So, we can conclude that one of the main reasons that give rise to comfort zones may be that people are afraid of change. And here is the point I want to stress on, is there a reason that makes you afraid of change? Let's consider it from another perspective; change in itself is an issue we experience every day, our bodies change as well as our minds, friends come and go, loved ones die and new ones are born, your values and beliefs change and your attitude in life alters in turn. Every day you experience a new change either consciously or unconsciously, so why are there troubles accepting change?

According to Brian Tracy, one of the most listened-to audio authors on personal and business success in the world today, one of the most functional solutions to get yourself out of your comfort zone is raising your self-concept or your idea of yourself. Set new goals, raise new challenges, and break all constraints. For example, set a new goal to increase your corporate profits by 20% this year. In a book called leaders by Warren Bennis, it was found that leaders have five qualities in common; one of them was that leaders are aware of the tendency to fall into a comfort zone and they force themselves out of comfort zones by setting bigger goals for themselves.

"Life begins at the end of your comfort zone." Neale Walsh. Suppose that there are two circles, one of them is much bigger than the other. Now, the small circle is your comfort zone, the place where you avoid risks and abide by the ordinary routine you are accustomed to. On the other side, the big circle is the place where the magic happens, where you could find the door that leads you to the ideal path. Indeed, the bigger circle will be the place you have to seek. So, pull every border apart to get out of your comfort zone, do things you never thought you could do and trust that even if it went awry, indeed you would gain new experience and the next time you will make it through. Set goals, go for them, and give yourself a pat on the back, because you are alive and since you are alive you can make good.

At long last, we, as the SPE SCU SC community, are trying day after day to deter ourselves and our colleagues from falling into the comfort zone since the academic life is a typical pattern of a comfort zone. There are students that feel contentment by attending lectures and studying the units or sections that the professor obliges them to study. From their standpoint, the academic life is lecture attendance and courses memorizing. And there comes our mission as SPE SCU SC community; we try as hard as we can to break the daily routine through field trips, training opportunities, extracurricular activities, opening doors for general sciences and languages, competitions, and many other activities that pull us from our comfort zone. We promise to continue in the same vein as we started and that we will Exceed Our Limits!

Mr. Alain Labastie

2011 SPE International President

By Mohamed Sherif Mahrous

Alain Labastie is Engineering Adviser, EOR Technologies, for Total and is based in Pau, France. He began his career in 1976 at Elf and has held numerous positions in reservoir engineering, primarily in R&D and technology development. His positions have included R&D Program Manager, Head of R&D Operations, and Head of Advanced Reservoir Techniques. Labastie also served in committees awarding public research funding for the French administration and the European Union.

Labastie served on the SPE Board as Director for the South, Central, and East Europe region and is a former Chairperson of the JPT Editorial Committee. He has been involved in numerous SPE committees, including the Distinguished Lecturers, ATCE, International Petroleum Technology Conference and Exhibition, Europec Technical, and Forum Series committees. Labastie also chaired the SPE France Section. He has also been an SPE representative for the Offshore Technology Conference. He earned an engineering degree from Ecole des Arts et Métiers and a petroleum engineering degree from Institut Français du Pétrole.

1. Mr. Alain Labastie, first of all, I would really like to welcome you in Egypt. Is this the first time you visit Egypt? And what impressions did you get during your visit?

No, this is not my first visit to Egypt; the first one actually took place while I was a student, roughly 38 years ago. I enjoy visiting Egypt, for the incredible number of points of interest and also for the hospitality of the Egyptians. Frankly, after the revolution you made in 2011, I was delighted to see that the situation is almost back to normal. The only thing I noted is the lack of tourists, which is troublesome to the economy; hopefully it will resolve soon.

2. After graduating as a mechanical engineer, what made you go for a degree in petroleum engineering?

I decided to go for a petroleum engineering degree as a young man due to the "romance" of the oil and gas industry, the ability to travel and meet people belonging to different cultures. The diversity of the careers offered by this industry is another factor as well. In these two domains, I must tell that what I have been doing has exceeded my initial expectations.

3. Being a two-degree holder, when should a petroleum engineering graduate think of having another degree? And what degrees do you recommend and find complementary to a bachelor degree in petroleum engineering?

I will not make any recommendation, as the choice is yours, and it all depends on your working preference; technical vs. business, operations vs. studies, etc…

In the near future, the E&P industry will need more than ever a diversity of the staff to face the incredibly diverse problems we will have to face.

4. For someone who has held key positions in R&D and EOR technologies for Total, is it real that we're witnessing the closing chapter of the "Oil Age"? And what do you say to our fellow colleagues who are anxious about their future careers?

In fact, I believe in the contrary that we are now entering the "golden age" of the oil & gas industry. Let me explain:
It is now well established that the hydrocarbon resources, even if finite, are enormous and sufficient for more than one century. However, resources are only resources; which means that a lot of work is needed to convert these resources into reserves and then production. Easy hydrocarbons have mostly gone. We will need three ingredients for future production: technology, investments, and staff. More difficult production will need more human brainpower!
It is very interesting to observe what is happening now in North America, the more mature oil and gas province. The development of unconventional hydrocarbons is literally reshaping the industry. For example, 300,000 jobs were created in USA for shale gas development. Moreover, in the US, both oil and gas production are on the rise, which was totally unpredictable as recently as five years ago. This was made possible by technology. Stories like this undoubtedly will happen in other places around the world.
I feel that you will have exciting times in this industry, but also a serious responsibility; providing the world with the energy needed. And remember, our civilization and lifestyle are based on an abundant supply of energy and this will not change in the next few decades.

5. Let's talk about SPE, can you tell us how did this all start? I mean how did you get involved in SPE?

I joined SPE as a young engineer and then I moved to Houston (at that time, SPE was not well known in Europe). I immediately enjoyed the opportunity to network with colleagues from other organizations and to have an "open window." After that I started volunteer activities for SPE, and never stopped.

6. I know that a lot of my fellow colleagues are very curious to know how you managed to be SPE president. Can you share your secret ingredients for success with us?

I was absolutely not considering this option five years ago, then I was nominated by colleagues, and finally elected. This is the consequence of a continuous involvement in SPE during 25 years and absolutely not a career plan. This is the beauty of SPE: you are recognized by peers, not by any form of management. This gives me the opportunity to remind you that SPE relies on volunteers for many activities. I encourage you to volunteer during your entire career; you will give a little of your time and get a lot of benefits; the more you give, the more you get!

7. As a president of SPE, can you tell us how you see SPE in the Middle East? And do you have any particular thoughts about Egypt's section?

SPE is a well-respected and prestigious organization in the Middle East. The main reasons are our fame for technical quality and our neutrality. For instance, most energy ministers in the region are SPE members, some of them are quite active. And, as SPE President, I have contact with authorities of most countries in a regular basis. Egypt does not make exception, I had a long meeting with your energy minister during my stay in Cairo, and our activities are well respected and encouraged.

8. After your meeting with SPE student chapters in Egypt, did you find any facets—whether good or bad—that are worth stopping at? And what's your overall assessment of these student chapters?

First, I would like to mention that I have been very pleased to see how enthusiastic the Egyptian students are. During the last two years, I have visited many student chapters around the world, and I can tell you that everywhere students basically think and act the same way, with only small differences tied to local culture: nothing significantly different in Egypt. The young generation is really forming a global community and SPE helps with fantastic opportunities of networking. This is excellent not only for our industry but for our world.

"I feel that you will have exciting times in this industry, but also a serious responsibility; providing the world with the energy needed. And remember, our civilization and lifestyle are based on an abundant supply of energy and this will not change in the next few decades."

9. Finally, are there any thoughts you would like to share with our readers especially students?

I would like to make a very important recommendation: during your professional life, you ought to be not only a good engineer, but also a good career manager. After a few years necessary to learn and establish a strong base in your domain of competence, you will have to decide what you want to do among the incredible number of possibilities offered by our industry. The HR people in your companies will help you, but don't trust them too much; decisions are yours! Your SPE membership will help, by giving you an open window to the outside world.

Ms. Regina Inani

MENA Recruiting Team Leader, Halliburton

By Islam Youssef & Mohamed Dmarany

1. Ms. Regina Inani, first of all we would like to know more about your professional life, how it started, what you were majoring in and whether you had extracurricular activities during your college life.

My major was English language and I picked this field because I was passionate about the utilization and importance of English language in today's business world. During college years, I focused on understanding the job market by attending as many summer internships as I could, as well as joining other activities administered by employers to teach students about life after graduation. I also volunteered in community development projects with the British Council and the USAID. After my graduation, I studied the HR foundation certificate at the AUC and later on I received my PHR (Professional in Human Resources) degree. My professional life started back in 2007 when I joined Halliburton as a fresh graduate. I worked in the benefits field, moved to administration, then worked in the HR generalist area before I moved into HRD (Human Resources Development) and then made my last move into recruiting which is my current field. I have had the opportunity to work in many countries and travel extensively with Halliburton. Among these countries are UAE, Libya, Algeria, Kuwait, Qatar, Nigeria and the US. The first-hand experience I gained from working in different conditions and with various cultures has helped me develop my perspective in life both personally and professionally.

2. Being a female and working in a tough industry like the oil industry is indeed something challenging. So, how do you manage to keep going in such an environment?

Actually I think I manage it pretty well! Working in a tough industry may be challenging but it just takes someone with the right attitude and the mindset to be able to manage this job regardless of whether this candidate is a man or a woman. If you have the right set of skills, the ambition and the positive 'can-do' attitude the sky is your limit, no matter how challenging the working conditions are.

3. How do you see the petroleum sector in Egypt in the near future with all the circumstances we are living?

This sector is very diverse and ever-changing. There may be some industry sectors that have a more stable state of affairs which is not the case with the oil and gas field. The operations in this field are affected by many factors like government passes, political state of the countries, availability of human talent, time necessary to deliver equipment and personnel on location, and the variety of the offered products and services. Given the above reasons, there is no one definite expectation of how this sector is developing on the long term. But on the short and medium term, it is definitely one of the most exciting sectors to work in due to its ever-changing nature and daily challenges both on the job and off the rig site.

4. Being the recruitment team leader in Halliburton makes you in a daily challenge to raise the bar of excellence. So, could you share with us some of the challenges that you as an individual and the company as a whole face? And how do you deal with them?

One of the primary challenges that I face all the time is finding the right talent for the job. In Halliburton, we have different profiles for each job that depends on the nature of the job and its working conditions. It is usually difficult even for the candidate themselves to know whether they are up to the challenge that the job requires. To deal with this issue, I sincerely urge every student to search for internship opportunities very eagerly so that they can get a feel of what it is like to be "out there" and getting the job done in the challenging conditions that we work under.

> **"I sincerely urge every student to search for internship opportunities very eagerly so that they can get a feel of what it is like to be 'out there' and getting the job done in the challenging conditions that we work under."**

5. It's well known that Halliburton is one of the companies that lead the way in the oil industry. And to be in the cutting edge you have to be unique, so where does the uniqueness lie in Halliburton?

The uniqueness in Halliburton is in its most important asset which is its people. This company really cares about its workforce and understands the different needs of every individual. The biggest driver behind this initiative is a deep understanding of the importance of a diverse workforce which Halliburton seeks by spreading the universal concept of "great minds don't always think alike." This way of thinking ensures that we embrace all cultures and differences to look together at common organizational goals and develop plans to accomplish them.

6. What are your plans for the future to improve the segment you are working in?

In Halliburton, we believe that our biggest asset is our people. The amount of knowledge and expertise the people bring into this organization is a treasure. Hence, the best aspect to focus on is diversity. Having a diverse workforce will help the organization to produce new ideas, find new concepts, and see the old problems with a new perspective.

7. In your experience, what is the feature that most fresh graduates lack?

The characteristic that may be scarce in fresh grads is knowing what they want. The problem is within the education system as we move from school to college with an eye on high grades instead of an eye on a career. So, I end up meeting grads with very high grades but unfortunately they don't know what they want to do with their career and what kind of a value they can add to their potential employer. This is why again I stress on the importance of internships, visiting job fairs and using every possible opportunity to interact with an employer in a professional working environment to enhance the skills needed to enter the professional world confidently.

8. As a recruiting team leader, what are the mistakes that most applicants slip in during interviews? And how can they avoid them?

Some candidates do not come prepared for the interview. I urge every caliber to take some time to read about the organization before going to an interview in it. It is of the utmost importance to formulate a solid understanding of a company's products, services and customers before going to an interview. This kind of knowledge really reflects on a candidate during an interview and creates a positive impression with the recruiter.

9. How do you see the student activities like the SPE? In your opinion, what do they add to student? And is it a point of strength for the fresh graduate to have some experience in one of them?

Yes, of course student activities add value to students! It is like a small company in which they join the board of directors. The way the student activities work really impresses me as there is a structured division of labor that splits the student groups into committees and each committee has a task force dedicated for a specific purpose with smart objectives and action plans. I would have to say that it is definitely a plus for any graduate to have a student activity experience on their CV.

10. Last but not least, what is your advice for us as the SPE Suez Canal University community, and as undergraduates? What should we most focus on to meet the market needs?

I would encourage you to focus on the interpersonal skills that are needed to join the professional workforce. You learn all the theories of the technical skills at college and then when you are hired you apply the theories and start developing technically. The interpersonal part of the profile is sometimes neglected and this is a huge drawback. Even if a candidate has great technical skills, it is important to surround these skills with good communication, effective negotiation, and ability to work in a diverse working environment.

Formation Evaluation Challenges in Deep Water

Meshary El-Ayed
Wireline Services
Schlumberger, Egypt

Introduction

Today, oil and gas exploration in water depths in excess of 300 m (1,000 ft) is considered to be deep water and there are 15 rigs in the Gulf of Mexico drilling in over 1,500 m (5,000 ft) of water. According to the US Department of Interior Service Deepwater Gulf of Mexico 2007 Report, there are over 4,200 active leases in deep water, with over 650 of these in water depths in excess of 2,200 m (7,500 ft). Consequently, there appears to be a surge in deep water drilling vessels under construction with capacities of up to 3600 m.

Deep water fields offer great potential, but the risks are correspondingly high. The complexities involved in exploring these reserves and producing them to surface are challenging and capital intensive.

Decisions based on global experience, reliable technologies, and a proven track record for successful innovation reduce the risks encountered in meeting deep water objectives.

In a conventional deep water field startup, the typical scenario starts with a wild cat well followed by wireline logging to resolve crucial information so that the uncertainties needed to make field development decision can be resolved. Then, another appraisal well might be drilled afterwards, and this might be the last chance before which the operator must commit to the future of the field. It is thus imperative that the wireline logging acquisition methods are planned to ensure that formation evaluation and reservoir characterization objectives are fully met in the challenging conditions present in deep water environments.

From a wireline formation evaluation standpoint, the deep water environment offers the following added challenges to standard wireline operations:

1. Complex job planning.
2. Conveyance challenges.
3. Formation evaluation in complex deep water environments.
4. Formation pressure testing and sampling for better reservoir fluid characterization in deep water environments.

In this article, we will focus on the first two challenges to the wireline operations.

I. Complex Job Planning

The high profile nature of deep water drilling operations requires logging jobs to be well planned. Detailed logging programs that cover tool strings and different scenarios as special operating conditions, failure contingencies and decision trees, real-time operations support, and risk prevention/mitigation practices are required to be discussed, documented, and agreed upon well ahead of operational execution time.

Tool modeling software predicts tool services behavior in preset conditions to help choose the correct parameters in the expected well conditions.

The tension simulation and risk assessment modules of tool planners provide the critical expected tensions in the well, while also providing a probability of getting stuck with the tool string and/or the cable.

The cable tension planning module of the Tool Planner allows for modeling of the expected tensions to be encountered given the well profile, depth, size, and well conditions.

II. Conveyance Challenges

1. Cables

High tension posts enormous challenges to the logging operations, particularly the wireline cable. Many cable failures happen due to the lack of understanding the effects of high tension. For example, coupling high logging tension with excessive cable torque (that is not dispersed) and/or cable cycling (also called "yo-yo") can lead to catastrophic results that will further jeopardize a high profile deep water logging operation.

The logging cable provides the electrical connection between the downhole tools and the surface processing equipment. Logging cables are constructed from a range of conductor, insulation, jacket, and armor materials. These cables are available in three distinct configurations: hepta-cable, mono-cable, and coaxial cable.

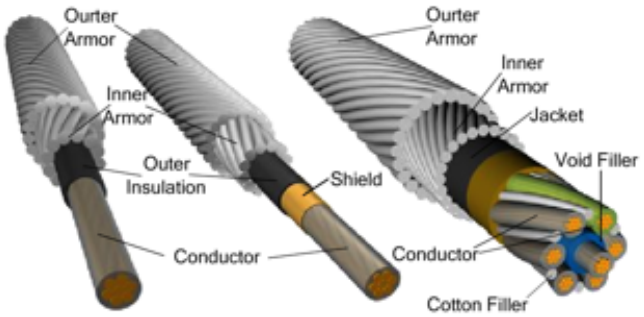


Fig.(1): Wireline Cable Structure

In conventional wireline applications, the cable is always kept under tension with operating techniques to maintain the correct degree of cable tension and mechanical stability. If severe or sudden compression forces are applied, the cable armor may distort or birdcage.

Deeper wells necessitate higher strength cables. Additional strength after a limit cannot be achieved by increasing the cable size as this will also increase the weight of the cable. Advanced techniques in wireline cable manufacturing have increased the cable strength by:

- High durability core and insulation material.
- High tensile strength wire in the armor package.

A high-tension operation is any operation where the Tool Planner or other indicators suggest that sustained surface logging cable tensions in excess of 8,000 lbf are to be expected. If such a job is expected, it shall be performed using a tension relief system, WDDC (Winch Dual Drum Capstan).

The principal reason is with today's deeper and higher deviation wells; more tension from the well is needed than that can be stored on a drum under a normal tension profile.

2. Capstan and Tension Relief

The capstan tension relief system is designed to ensure that the cable can be safely stored in the drum under the correct tension profile regardless of logging tension. The system is made up of two parts:

- The first is the capstan modified offshore unit, which provides the hydraulic power for both units and serves as the cable storage unit.
- The second part is the WDDC (Winch Dual Drum Capstan), which pulls the cable out of the hole, where the tension can be spooled back onto the storage unit under a normal tension profile.

The capstan drum is a friction drive device. The winch drums on capstans provide tension relief functions. The effects on multiple grooving, single cable layering, and applied torque from powered winch drum capstans are combined to absorb high line tension, which transforms into low tension as the cable exits the capstan to the cable storage unit.

3. **Electrical Controlled Release Device (ECRD)**

The Electrically Controlled Release Device (ECRD) is a releasable weak point for use with the LEH family of heads. The advantage over standard mechanical weak points is the ability to withstand high pulls and shocks, yet release with a slight pull after activation. This allows the engineer to run heavier tool strings to deeper depths. The 12,000 lbf rating of the ECRD-E offers increased chances of pulling free when logging tools become stuck. This translates into a major cost saving for the client who can reduce the number of fishing or Tough Logging Condition (TLC) jobs.

When stuck, the decision to free the cable from the toolstring can be made faster. There is no longer the necessity to pull and relax to the lower weak point rating estimate. The operator pulls to the maximum tension, holds, and if it does not come free he releases the ECRD-E and fishes for the tools using drillpipe. Long reach wells can now be logged safely, as overpull is no longer required to release the cable from the logging tools. This means the tension limits can be increased since they are determined by the cable strength and not the upper rating of the weak point.

Fig.(2): Comparison Showing Logging Head With Normal Mechanical Weak Point (Top) and Another Fitted With Ecrd Weakpoint (Below) and Will Include Ecri-E Bulkhead for Electronics Initiation of Release.

4. Logging While Fishing (LWF)

Logging While Fishing is a technique that employs traditional pipe conveyed logging principles together with a "cut and thread" fishing operation. In a situation where the logging tool is stuck before all logging/testing is completed, a cut and thread fishing job is initiated with special cable terminating adapters. Once the fish is engaged with the drill pipe, the cable is reconnected at surface with a double ended torpedo connection, and the wireline tool is electrically powered up again from surface. The job then commences in the same way as a TLC or pipe conveyed logging job by adding a Cable Side Entry Sub (CSES) adapter to move the pipe and wireline cable in unison in order to complete the critical logging remaining.

Conclusion

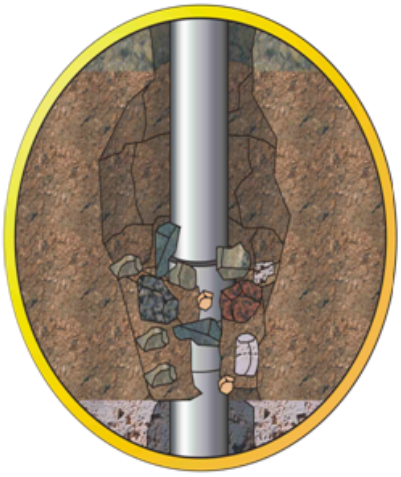
Deep water wireline formation evaluation poses numerous challenges in reservoir characterization. A successful wireline program necessitates a proper job planning, a relevant selection to the required conveyance tools and well prepared logging programs, pressure testing, and surveying instruments. The proper planning includes the selection of the convenient data interpretation method, the protection of the used tools, and the insurance of resuming the operation at any sudden problem while operating.

Fishing
The Art of Well Intervention

Hesham Helmy
Senior Field Engineer, Fishing & Re-entry Services
Weatherford International

Introduction

Traditional oil field services are classified into drilling, evaluation, completion, and production, but when it comes to fishing services, intervention will be the perfect term to describe fishing operations. A fishing job is performed during a drilling operation when a drill string gets parted during an evaluation operation, as a wireline tool may get stuck in the open hole, during the completion phase when a packer is prematurely set and needs to be milled and retrieved, or, finally, during production when an ESP gets stuck in its cable. This explains why fishing is an intervention service requiring extensive experience. As each fishing job is different than the other, the solution might differ from a service provider to another.



Unconsolidated Formation

Fishing is the removal of undesired objects or situations in the well bore. Fishing operations may be classified into planned jobs, like the work over ones, and unplanned (accidental) jobs, such as a sudden sticking in the drill string. From the well bore perspective, fishing jobs may be classified into cased hole fishing and open hole fishing, which requires additional experience with the variety of formations and well control issues.

Fishing Mechanisms

Fishing tools are old but durable and efficient enough to get the job done; some of the main fishing tools used today have been used on rigs since the 1950s. The main methods for catching any tubular element in the wellbore are: external catch, such as the overshot, which is the most popular external catching tool. It utilizes a basket and spiral grapples according to the fish outer diameter, and internal catch, such as the spear, which utilizes spear grapples according to the fish inner diameter. Fishing tools are evaluated according to their ability to be released from the fish, durability to withstand impact forces, torque transmission, and wireline accessibility.

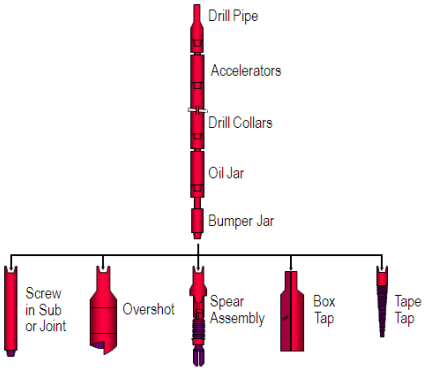
Open Hole Fishing

Open hole fishing is very challenging because of the wide range of formations, so local experience would be invaluable. Due to the uncertain nature of open hole environments and the infinite number of formation variables, pipe sticking becomes a big risk and the cost can be up to 25% of a drilling budget. The key to freeing the pipe successfully and economically is to know where and how the pipe got stuck, and observe the indications and behavior of it to identify the cause of the sticking in order to determine the best fishing method and avoid getting additional tools stuck in the hole. Most open hole problems are related to the formation and mud conditions. Stuck type identifying indications can be summarized in the ability to circulate, rotate, and trip in and out, in combination with the down hole conditions and well geometry.

Jarring Operations

Jarring has a substantial role in freeing stuck pipes. Nonetheless, if used incorrectly or at an inappropriate time, additional problems may happen, as in the case of packed off formation above a stabilizer. Jars work by delaying the tripping action until the fishing string has stretched, storing energy which is

released when the jar trips or fires. The jarring force is influenced by different factors as the length of jar stroke, hole friction, number of weight members above the jar (the hammer), the amount of stretch in the drill string, the amount of over pull exerted prior to the jar tripping or firing, and the upward movement speed of the hammer. Jar placement is very important to optimize the jarring operation; a computer program is used to precisely determine the placement of jar with the optimum number of weight members to provide the required impact forces and impulse values. Impulse refers to the force delivered to the fish multiplied by the period the force lasts. The longer the impact, the greater the



Fishing BHA

impulse and the further the fish can slide with each jarring blow. Therefore, when the impact force exceeds the sticking force at the fish, a larger impulse can move a fish farther for each jarring blow. The program output depends on the fishing string components, the fish, the applied pull loads at the jar, and other down hole factors such as the fluid and formation data. The program offers the ability to choose between high impulse and high impact configuration; for example, when stuck by a long hole slough or differentially stuck, it is common to fish using more impulse, but when fishing a packer where a slight movement will free the assembly, it is common to use more impact. The accelerator (known as intensifier or slinger) provides the stretch when the fishing string can't do so. It is placed just above the jar and drill collars, to prevent the loss of stretch due to drag on the string. A bumper sub is usually installed in the string just above the fishing tool. It enables releasing the fishing tool. Whenever needed, it will deliver the sharp downward blow required to release from the fish.

Milling, Washover & Tubular Cutting

Milling usually accompanies fishing operations to grind a fish using a junk mill or a rotary shoe and wash pipe configuration with diamond, or tungsten-carbide cutting edges. A mill is also used to dress the top of fish "TOF" to be caught by another fishing tool, ream out collapsed casing, ream tubular with scale, remove a section of casing for sidetracking or deviating a well, or to remove cement plugs.

Junk Mill

Internal Casing Cutters with tungsten-carbide dressed knives are widely used at offshore plug and abandonment (P&A) operations to cut the conductor and surface casing strings. External cutters are used with wash pipe configuration to cut stuck tubular as in the case of premature setting of cement around and inside tubing strings.

Fishing for Junk

Any undesirable object that is stuck or accidentally dropped in a well is known as junk. Junk may include bit cones, tong dies, broken slips, reamer parts or debris created by fishing, or milling operations or any other small debris that could impede drilling operations. Because of the variety of junk that can be in the hole, creativity will be paramount in planning a junk fishing operation involving the fewest trips and equipment. Junk fishing tools are widely used and might be found as standby tools on many rigs.

Economics of Fishing

It is significantly important to decide precisely when to terminate fishing and start re-drilling or sidetracking. Generally, fishing operations should be stopped when about half the cost of sidetracking has been reached. A formula is used to calculate the maximum time to spend fishing based on the replacement value of the fish, estimated cost of sidetracking, daily cost of fishing services, and daily rig operating cost.

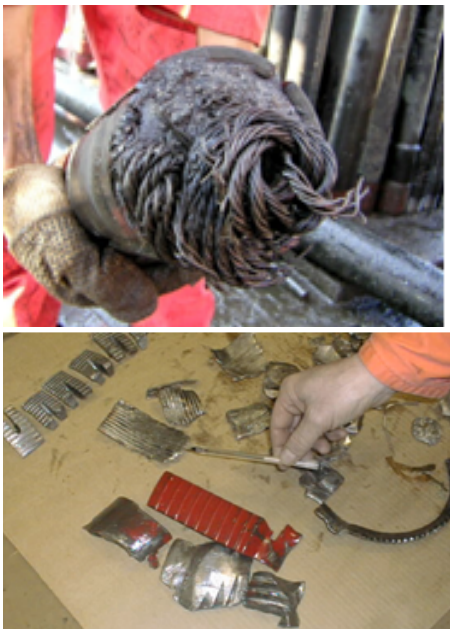
Fishing Technology Advancements

Fishing operations are facing challenges everyday with the technology's rattling progress; wells are getting more complicated with extended reach drilling and multilateral systems. Research and development centers are developing smart solutions as:

I. Integrating the fishing tools with MWD systems to have a better downhole communication and enhance the uncertainty management, as in the case of micro weight sensing, downhole milling, torque analysis, ECD, and downhole differential pressure.

II. Improving the catching range of overshot grapples from 1/16 inch to a much bigger catching range to reduce the missed fishing runs due to uncertainty of the fish outer diameter size, which may cost too much especially in deep water wells.

III. As fishing operations are considered non productive time (NPT), logging while fishing (LWF) techniques can be used to minimize the lost time by integrating logging tools in the fishing string for formation evaluation purposes.



Junk in Hole

What It Takes to Be a Fishing Tool Supervisor

Fishing is not a nine-to-five job. It requires people adaptable to unknown conditions and odd working hours since the next job location or the forthcoming challenges are indiscernible. Fishing tool supervisors are the oil field emergency specialists; they are responsible for providing sound advice and acting on a solution to correct the wellbore problem often without much information. Well records & data may be inaccurate and the fishing tool supervisor can't see what is happening downhole. Making the right decisions and picking the right equipment at the right time are essential. Fishing service companies put a lot into training fishing tool supervisors and providing them with a network of experts, but still the individual experience is very important. Fishing has an art component. Visualizing conditions that can't be seen requires a very keen sense of downhole conditions and experience over a broad range of situations.

The Gulf of Mexico
The Causes of a Disaster

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"I heard this awful hissing noise, and at the height of the hiss, a huge explosion. The explosion literally takes me to the other side of my shop. When I finally come around, I remember thinking to myself this is it, I am going to die right here. This is the end." But it wasn't the end of Michael Williams, chief electronics technician at the Deepwater Horizon rig. It was the end for eleven of his co-workers who were never found despite a three-day search. It was the beginning of the surge of a record breaking 4.9 million barrels of oil into the Gulf of Mexico for 87 consecutive days, which easily secured the "Gulf of Mexico oil spill" the first place, as the largest accidental marine oil spill in the history of the petroleum industry. This article briefly goes through the various causes of this catastrophic accident.

The Macondo Well Design

The well was initially designed by British Petroleum (BP), the majority owner of the prospect lease and the designated operator, to reach a Total Vertical Depth (TVD) of 20,200 feet. And after 17,168 feet were drilled and cased, and while drilling the final production section of the well, drilling fluid losses were encountered due to an unexpected subnormal pressure in the pay zone. This decrease in pore pressure narrowed the drilling margin (the difference between the fracture pressure and the pore pressure) to the limits that further drilling would be accompanied by either formation fracture and further losses, or kicks. As a result BP chose to terminate the well at a measured depth of 18,360 feet inside the pay zone, although the guidelines of BP itself specify that drilling should not be stopped in a hydrocarbon interval due to the increased probability of cement channeling or contamination due to washouts. And for the Deepwater Horizon work to be done in the Macondo well, the production casing string was to be lowered and cemented to complete the well.

The Cement Job

Because of the lost returns experienced while drilling the last section of the well, BP wanted to diminish the likelihood of any additional losses during the cement job of this section, and went after minimizing these losses by pumping the cement into the well at a relatively low rate of 4 barrels per minute (bpm). This low pumping rate wasn't sufficient to convert the float collar (float collar conversion is to make it allow the flow in only one direction, to prevent the cement or any other fluid from returning to the casing), as the float collar used was designed to convert at a pumping rate range of 5 to 7 bpm.

BP used the services of Halliburton to perform the cement job, and Halliburton's software (OptiCem) was used in the cement modeling. However, it was well established by the investigations conducted after the accident that the cement modeling, made by Halliburton, suffered from several defects and inaccurate assumptions. The most important of which are:

- The pore pressure assumed in the model for the hydrocarbon zone was 13.97 pounds per gallon (ppg) while the measured pore pressure value of this zone was 12.6 ppg. Also, the model used a bottom hole circulating temperature of 135 ^{o}F, instead of 140 ^{o}F that was found during cementing.
- The model also used also incorrect data in the centralizers, used to provide even distribution of cement around the casing. The nominal diameter inserted in the model was 8.622 inches, while centralizers of nominal diameter of 10.5 inches were the only size available at the rig and were the ones used. To make things even worse, the model was assumed using seven centralizers while only six centralizers were used. An order for additional centralizers was made, but the shipment failed to arrive in time.

The last straw that led to the failure of the cement job was that BP violated several of the American Petroleum Institute Recommended Practices (API RP) while cementing the production casing. Some of these violations are:

- API RP clearly states that a minimum volume of one bottom up (the volume needed to push the mud at the bottom of the wellbore to the surface) must be circulated before pumping the cement. However, BP pumped less than this recommended volume. This resulted in contamination of the cement slurry.
- BP chose not to the run casing to the bottom leaving 56 feet of rathole bottom clearance. The recommended practice is to fill the rathole with heavy mud of higher density than the cement slurry. Nevertheless, the rig crew filled the rathole with mud of 14 ppg, while the tail cement density was 16.74 ppg. Being heavier than the mud in the rathole, the cement fell into the rathole and displaced the rathole mud into the cement column.

After Burning for 36 Continuous Hours, The Rig "Deepwater Horizon" as It Goes Down in Flames

It is quite evident that the cement job of the production casing of the Macondo well is rife with several hypercritical flaws. And it was up to the cement evaluation log and well integrity tests to detect the failure of the cement job.

The Cement Evaluation and Well Integrity Tests

On the morning of the accident, BP decided to send home the Schlumberger team that was planned to perform the cement bond log. This decision to call off any cement tests was primarily based on that the rig crew didn't measure any losses during the cement job. These measurements were made by sensors and paddles that were found to be improperly calibrated in the post accident investigations.

And by cancelling the cement tests, the negative-pressure test (in which the well is brought to an underbalanced state to check for formation fluids flow into the well) was the only test performed to check the integrity of the cement job at the bottomhole of the Macondo well.

However, testimonies of BP personnel revealed their lack of experience with this test. They admitted that they only had an "oversimplified" view of what constitutes a successful negative-pressure test. And with no standard procedure for running or interpreting the test in either BP or Transocean (in fact the regulations in BP did not obligate running a negative-pressure test at all), the negative-pressure was conducted and interpreted improperly, as follows:

In order to avoid disposing of two pills of lost circulation materials—that were mixed and weren't used—onshore, as regulations allow disposing of such materials offshore if they were circulated through the well, the BP personnel used these lost circulation materials as a spacer to displace the mud from the well to bring the well to an underbalanced state for the test. This type of spacer was never used before by BP or by Transocean, moreover it wasn't tested whether it is suitable as a spacer or not.

After displacing the mud to above the BOP, the rig crew started the negative-pressure test by shutting the annular preventer ,and opening the top of the drill pipe at the rig floor and watching out for flow. The crew managed to bleed off the pressure in the drill pipe twice to 0 psi and no outflow was observed in each time. However, when the drill pipes were closed, the pressure jumped back up to 773 psi in the first time and to 1400 psi in the second. But for the test to be successful, not only there must be no flow when the drill pipe was opened, but also the pressure must remain at 0 psi when the drill pipes are closed.

Being unable to correctly interpret the increase in pressure anomaly when the drill pipes were closed, BP well site leader ran a second negative-pressure test, monitoring the flow and pressure on the kill line this time instead of the drill pipe. In this second test, the kill line was opened for 30 minutes without any observed flow and when closed, no pressure build up was observed, nevertheless the pressure on the drill pipes remained 1400 psi. With the second test complying to the conditions of a successful negative-pressure test with no outflow when the line is open and no backup pressure when the line is closed, the BP personnel and the rig crew considered the test successful and concluded that the well integrity has been confirmed.

Yet they failed to recognize that this second pressure test was unreliable since the LCMs used as a spacer plugged the kill line giving false indications of no outflow, and that the increased backup pressures on the drill pipes encountered in the first test were a direct indication of fluids flowing into the well forming a kick.

And although it wasn't the first time for the Deepwater Horizon rig crew to experience kicks while drilling the Macondo well, it was the first time for the kick to go undetected.

Well Control Failure

After the well integrity has been secured. The rig crew job on the Macondo well was done. The crew started to prepare the well for temporary abandonment by displacing the heavy mud in the riser with the much lighter sea water. During the mud displacement, the crew relied on the mudlogger to detect kicks by monitoring the volume of the mud pits. He performed a "visual" check on the pits and reported that the level of the mud was constant. However, the rig crew failed to notice the—subtle but constant—increase in the drill pipe pressure, as shown in the post-accident investigations, although the pumps were pumping the seawater at a constant rate. This pressure increase was a direct indicator that mud was being pushed up by the hydrocarbons influx.

In fact the crew never realized that a kick had occurred until it developed to be a blowout, when the drilling fluids were already spewing from the rotary on the rig floor at 9:40 p.m. The immediate response of the crew was to divert the flow from the riser to the mud-gas separator, instead of diverting the kick overboard into the sea using the diverter line which could have mitigated the accident. Then the annular preventer on the BOP was closed to shut in the well.

But it was already too late. By the time the crew acted, natural gas was already in the riser above the BOP stack, expanding quickly in its diverted route up to the mud separator. The separator—not designed to handle high volume flows—was rapidly overwhelmed by the immense natural gas surge, and vented the hydrocarbons uncontrollably in every direction including back on the rig floor, exposing the gas to several potential ignition sources, including engine rooms, and electrical equipment. And on the 20th of April 2010, at 09:50 p.m., the first explosion occurred. The last efforts made by the crew members on the bridge were trying to activate the Emergency Disconnect System (EDS), which upon activation, seals the well by closing the blind shear ram, and disconnect the rig from the BOP. However, the first explosion damaged the cables to the BOP and the disconnecting sequence never started.

The final hope for the crew was that the Automatic Mode Function (AMF), also known as the "Deadman" System, which—as the name implies—automatically closes the blind shear rams once the electronic communication between the BOP stack and the rig floor is lost. Nevertheless, the "Deadman" System failed too. Later investigations attributed the failure to low battery charges in one of the two control pods required for initiating the closing sequence, and a defect in the solenoid valve (which opens or closes the hydraulic circuit to activate the BOP) in the other control pod. And shortly after the first explosion, another explosion occurred engulfing the entire rig in flames.

Conclusion

The Gulf of Mexico oil spill accident wasn't caused by a single fatal fault or error. It was rather due to several sequential separate oversights and mistakes in well design, cementing of the production casing, and well control. Each of these blunders could have been just a small lapse if it was detected and treated in the subsequent jobs. But it was the buildup of these oversights that made the accident tremendously catastrophic, and also made it an ideal case for us to study.

New Technologies Applications in Reservoir Evaluation (2)

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This article is the sequel to the article published in the previous issue, in which I shared with you some of the technologies that Schlumberger has deployed in the past few years in order to help our customers in a better characterizing of their reservoirs. The new technologies that will be explained with focus on the reservoir evaluation and delineation, with additional focus on the methodologies used to interpret some of the data acquired through an open hole wireline acquisition.

HP-Rock: Side Wall Coring

Wireline side wall coring is a service often included in the reservoir evaluation program; it provides key rock properties. These properties could be provided by the continuous core, but for logistical reason, side wall cores are more practical.

Since 1980, when mechanical side wall coring was introduced, improvements have been made to achieve Routine Core Analysis (RCAL) on side wall cores. Nevertheless, limitation lays on the small size of the sample. Moreover, the measurement uncertainty remains high compared to the core plug. Also, in the heterogeneous formations, the smaller volume of rock is expected to be intrinsically less representative of the bulk reservoir properties. Many of the so called special core analysis and rock mechanic measurements are not expected to give valid results or considered impractical due to insufficient volume of core material.

Last year, the field test results of the wireline rotary sidewall coring were presented. The new tool can acquire sidewall cores slightly larger than the standard laboratory cores by 1.5 inches in diameter and 3 inches in length. Every aspect of the new coring system has been tailored to achieve a reliable and easy well-site operation with a real time intelligent drilling control and efficient recovery in a broad range of lithologies. An innovative system of core handling and preservation techniques ensures the recovery, traceability and integrity of each core from the moment they are cut downhole till they reach the laboratory. To the right is a picture of the new rotary coring tool and its specifications.

Among these new features is the digital telemetry compatibility, which makes it easier to combine the tool with the existing wireline tools that allow running an image log over the cored interval to exactly identify the core locations or run an inclinometer tool for the same purpose. The improved telemetry capabilities reflect on the tool operation as well. Accordingly, we can modify and/or monitor torque, weight on bit, and rate of penetration. These parameters can be either manually changed or changed through an automatic optimization algorithm.

Fig.(1): The New Rotary Coring Tool & Its Specifications

Physical Specifications	
Nominal Diameter	4.75 in
Maximum Diameter	5.25 in
Length	38.8 ft
Weight	1521 lbm
Environmental Specifications	
Maximum Pressure	25,000 psi
Maximum Temperature	350 °F
Borehole Sizes	6 to 14 in
Sampling Specifications	
Cores Per Descent	50
Core Diameter	1.5 in
Core Length	3 in
Lithology Hard Time	25,000-psi UCS
Lithology Soft Time	100-psi UCS

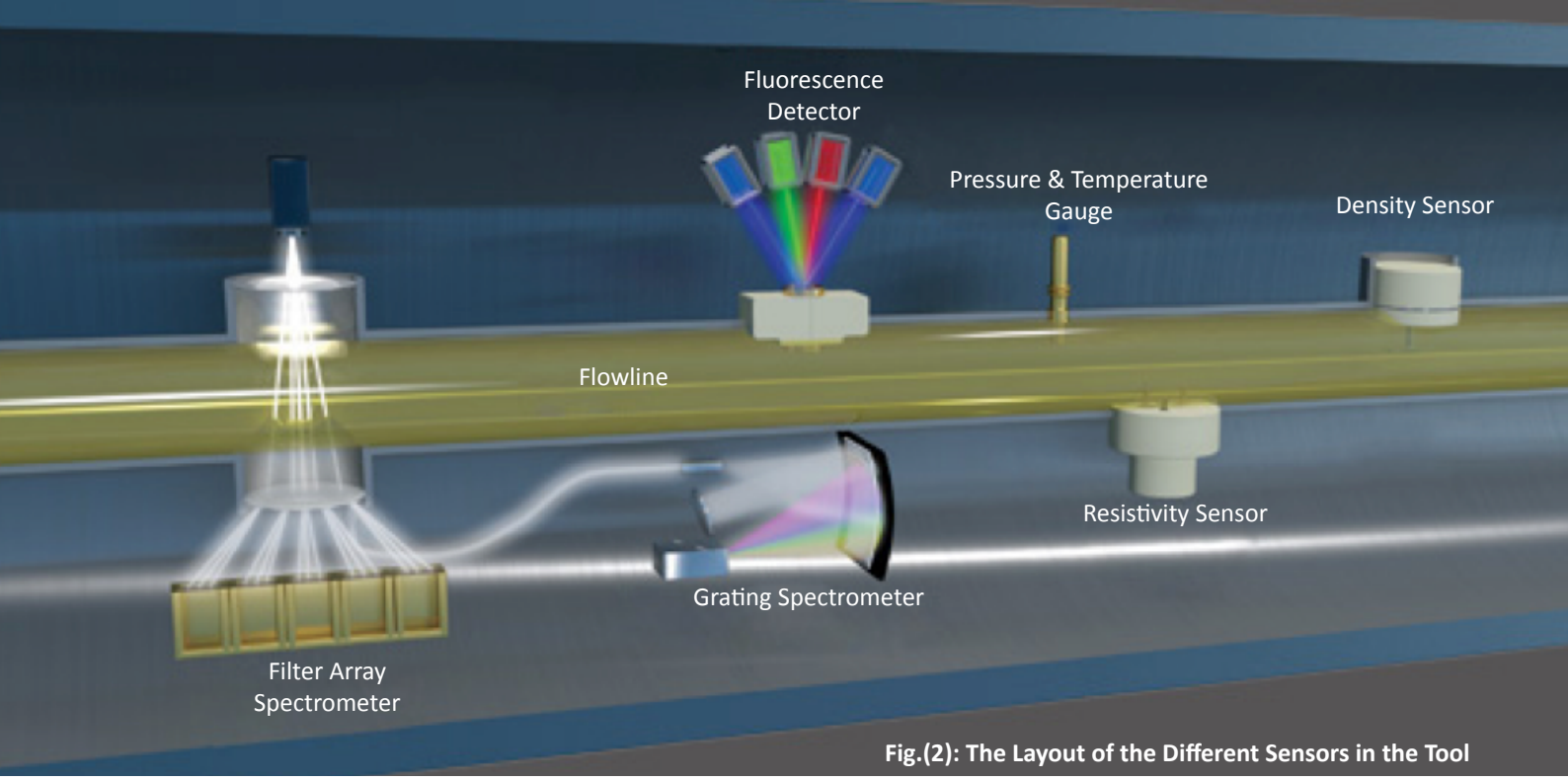

Fig.(2): The Layout of the Different Sensors in the Tool

IFA: InSitu Fluid Analyzer

The InSitu Fluid Analyzer system delivers quantitative real time fluid measurements at reservoir conditions. You shouldn't rely on estimated values or wait for laboratory sample analysis any more. The InSitu Family measurement suite includes composition (C_1, C_2, C_{3-5}, and C_{6+}), Gas-Oil-Ratio (GOR), CO_2, color, fluorescence, density, pressure, temperature, resistivity, and pH for comprehensive downhole fluid analysis (DFA). By investigating fluids at their source, you gain previously unobtainable insight into fluid composition and distribution.

There are three main objectives for the downhole fluid analysis:

1. Sample assurance: Collection of a single phase sample through the real time monitoring of the fluid and the contamination level to minimize the time at station. The objective is to collect a sample that is representative of the reservoir fluid.

2. Estimation of fluid properties: this started with the introduction of the LFA when the GOR was introduced. It then continued in 2004 with CFA and now we have IFA with broad fluid characterization applications such as CO_2, fluorescence, density, viscosity, pH, and resistivity of formation water measurement.

3. Reservoir characterization: we can have a better understanding of compartmentalization, compositional gradients, thin beds evaluation, and pin down fluid contact with a greater accuracy.

The objective of operating companies is obtaining accurate fluid data as it is critical in all stages, from the reservoir characterization (to evaluate zonal connectivity) to completion design (deciding the perforation strategy), material specification, facilities sizing, flow assurance, corrosion, and scale strategy to end with the enhanced oil recovery phase.

The IFA tool is run in a typical formation sampling tool string above what is called Pump Out module. In the IFA, the Grating Spectrometer with sixteen channels is newly introduced. It measures hydrocarbon composition in four groups: C_1 (Methane), C_2 (ethane), C_{3-5} (propane, butane pentane), and C_{6+} (hexane and heavy oil components). We can compute GOR with more accuracy thanks to a newly developed algorithm which extends the computation from heavy oil to gas condensate.

The new IFA includes a filter spectrometer equipped with 20 channels with twice the capacity of LFA or CFA. Three channels are used to detect carbon dioxide (CO_2) while the other three are used for measurement of formation water pH. The broader spectrum allows a characterization of fluid color related to the relative asphaltene gradient. The OCM contamination program has been updated to account for all the twenty channels input rather than two as in the previous generation software. This downhole fluid analyzer, IFA, is capable of detection when the borehole fluid or drilling mud is coating the detection window and the sensor is reading the drilling fluid rather than the formation fluid.

Another sensor is added to this tool to measure the fluorescence and the gas reflectance, primarily used for single phase assurance. The InSitu Fluorescence reservoir fluid fluorescence measurement detects free gas bubbles and retrograde condensate liquid dropout for single-phase assurance while conducting DFA and sampling. Fluid type is also identified. The resulting information is useful in defining the difference between retrograde condensates and volatile oils, which can have similar GORs and live-oil densities. Because the fluorescence measurement is also sensitive to liquid precipitation in a condensate gas when the flowing pressure falls below the dew-point, it can be used to monitor phase separation in real time to ensure the collection of single-phase samples.

An SOI gauge provides the flow line pressure and temperature to translate them back to the virginal reservoir conditions by employing the equation of state (EOS) algorithms.

A DV rod has been added to the tool manufacturing to provide fluid density measurements. Measuring density downhole at reservoir conditions provides numerous advantages over surface measurements, especially for determining pressure gradients in thin beds or carbonate transition zones. This real-time measurement directly yields the slope of the pressure gradient for the identification of fluid contacts. The InSitu Density reservoir fluid density measurement is based on the resonance characteristics of a vibrating sensor that oscillates in two perpendicular modes within the fluid. Simple physical models describe the resonance frequency and quality factor of the sensor relative to the fluid density. Dual-mode oscillation is superior to other resonant techniques because it minimizes the effects of pressure and temperature on the sensor through common mode rejection, which improves the accuracy of the measurement. The InSitu Density measurement is made under flowing conditions, and the resonant is resistive to corrosive fluids.

Additionally, a resistivity cell has been added to provide information during sampling operation such as fluid resistivity. This element is important when sampling with module such as the dual packers as they are not equipped with a resistivity cell sensor.

The Promising Future of Petroleum Oriented Nanotechnology in Drilling

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Suez University

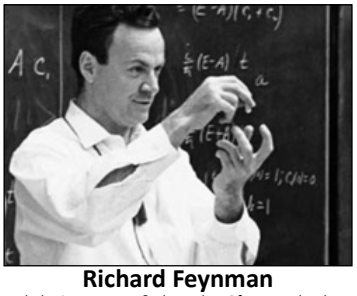
Introduction

On December 29, 1959, the American physicist Richard Feynman lectured, "There's plenty of room at the bottom,'' Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules to build and operate another proportionally smaller set, and so on, down to the needed scale.

In this article, I'll try to provide an overview of the latest Nano-technological solutions in the O&G industry, cover the recent research developments that have been carried out around the world, and pave the way for many researchers who are interested in the integration of these technological advancements.

Definition

Nanotechnology is the use of very small pieces of material, at dimensions between 1 and 100 nanometers, by themselves or their manipulation to create new larger scale materials, where unique phenomena enable novel applications.



Richard Feynman
Nobel Prize Laureate & The Father Of Nanotechnology

Engineered Nanomaterials

There are many new material terminologies used in this trend of technology. To give a short overview of some of the different types of nanomaterials, four types can be mentioned:

I. Fullerenes and Carbon Nanotubes

A fullerene is any molecule composed entirely of carbon in the form of a hollow sphere, ellipsoid or tube. Spherical fullerenes are also called buckyballs (Figure 1: C60 buckyball). Cylindrical ones are called carbon nanotubes or buckytubes.

Carbon nanotubes (CNTs) are allotropes of carbon with a cylindrical nanostructure. Nanotubes have been constructed with length-to-diameter ratio of up to 132,000,000:1. Nanotubes are categorized as single-walled nanotubes (SWNTs) and multi-walled nanotubes (MWNTs). (Figure 2; Multi-walled carbon nanotube)

ii. Quantum Dots

Quantum dots, also known as nanocrystals, are a specific type of semiconductors. They are 2-10 nanometers (10-50 atoms) in diameter. (Figure 3 ; Core-Shell EviDot)

iii. Nanoparticles (NP)

A small object that behaves as a whole unit in terms of its transport and properties. Nanoparticles are sized between 1 and 100 nanometers. (Figure 4 TEM (a, b, and c) images of prepared mesoporous silica nanoparticles with mean outer diameter: (a) 20nm, (b) 45nm, and (c) 80nm. SEM (d) image corresponding to (b). The insets are a high magnification of mesoporous silica particle.)

Petroleum Oriented Nanotechnology

Egypt's demand for oil is increasing rapidly. Oil consumption has grown by more than 30% in the past ten years. Also, the hydrocarbon reserves in Egypt have witnessed an average increase of 5% per year over the past seven years, while the average recovery factor is still stuck at 35%. Nanotechnology holds the solution to this local and worldwide production challenge as it helps increase the recovered oil and explores new fields. It can decrease the cost of production by eliminating problems that occur throughout the field development operations.

The Petroleum oriented Nanotechnology applications have pierced through different petroleum disciplines. This article will focus on the Nanotechnology applications in drilling.

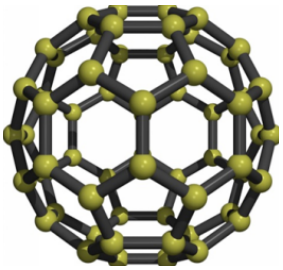


Fig.(1)

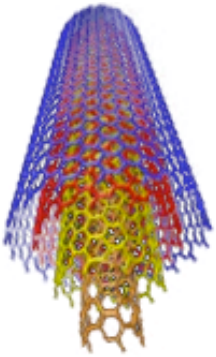


Fig.(2)

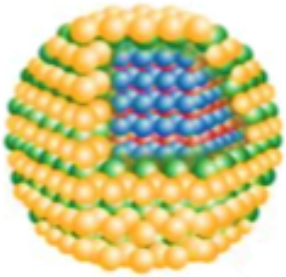


Fig.(3)

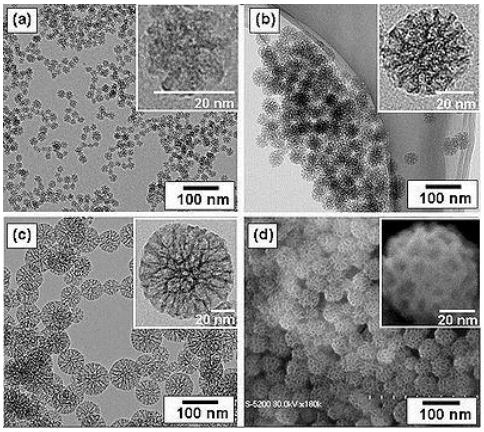


Fig.(4)

Figures(1-4): Different Types of Nanomaterials
CNT (Fig.2) and NP (Fig.4) are the main types used in the Oil and Gas Industry.

Due to the great development in drilling operations, the conventional drilling and stimulation fluids tend to perform poorly. Hence, the formulations of smart fluids (Nanofluids) are the best tool to solve fluid related problems.

Nanofluids for oil and gas field applications are herein defined as drilling, drill-in, completion, stimulation or any other fluids used in the exploration and exploitation of oil and gas that contain at least one additive with particle size in the range of 1-100 nanometers.

Drilling Fluids

Drilling Fluid density

The density of drilling mud is an important parameter, yet the exact control of drilling mud density is difficult. However, the use of super paramagnetic nanoparticles in drilling mud for optimum density showed good results. Additives of nanoparticles in drilling mud could be separated with electromagnetic fields.

Drilling Fluid loss of circulation

The prevention of loss of circulation by micro and macro material-based LCMs showed limited success in these environments. Tailored Nanos (nanoparticles) with the potential to build structural barriers are expected to provide effective sealing of the porous and permeable zones, or fractured and cavernous formations. Multi-functional Nanos possessing both sealing and strengthening potential are expected to eliminate the scope of induced loss of circulation.

HTHP Environment

The stability of additives at HTHP conditions is mandatory to fulfill the functions of a fluid system. Thermally stable smart fluids are essential to drill a well safely and economically in such environments. Nanos—especially Carbon Nanotubes CNT due to their high surface area, temperature and pressure tolerance—are expected to be the materials of choice.

Drilling problems

Pipe Sticking Problems

Nano-material based drilling mud with the potential to reduce the adhesive tendency of mudcakes by forming a thin non-adhesive nano-film on the drill string surface can reduce the pipe sticking problem. Nanofluids capable of depositing a thin mudcake in a highly permeable zones are expected to significantly reduce the scope of differential pipe sticking.

Torque and Drag

Micro and macro material-based drilling muds have limited capability to reduce torque and drag problems. Nano-based fluids can provide a reduction of the frictional resistance between the pipe and the borehole wall due to the formation of a continuous and thin lubricating film in the wall-pipe interface. Moreover, the tiny spherical nanoparticles may create an ultra-thin bed of ball bearing type surface and thus can allow easy sliding of the drill string.

Drilling Cement

After a certain section length of an oil well has been drilled, the casings are introduced and fixed with cement. Carbon Nanotubes and nanoparticles are added to the cement slurry to accelerate the cement hydration process.

The mechanical properties of nano-Fe_2O_3 and nano-SiO_2 cement mortars were experimentally studied and results showed that the compressive and flexural strengths of the cement mortars mixed with the nanoparticles were higher than that of a plain cement mortar.

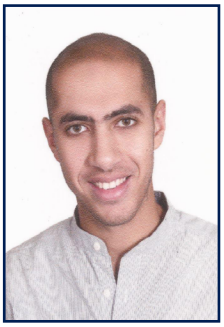
Drilling Bits

Drilling bits may be used in hard, tough formations, besides high pressures and temperatures. Prolonging the life of drill bits minimizes the lost time in round tripping the drill string for replacing bits. This can be done by either electroless or electrolytic plating comprising superabrasive nanoparticles. The superabrasive nanoparticles may comprise at least one component selected from diamond, cubic boron nitride, boron carbide, silicon carbide, aluminum oxide, tungsten carbide, polycrystalline diamond, and diamond-like carbon.

Conclusion

The precise manipulation & control of matter at dimensions of 1-100 nanometers have revolutionized many industries. Nanotechnology allows us to do more with less and hence increase the efficiencies of different processes making them simpler, faster, safer, and cheaper.

GTL (Gas-To-Liquid)
Beyond the Future



Mohamed Ismail Mohamed
Senior Student, Faculty of Petroleum & Mining Engineering
Suez University

Gas-To-liquids (GTL) technology makes it possible to use natural gas, rather than crude oil, as the raw material for a range of valuable liquid products. These include cleaner fuels for cars, planes and materials that go into making chemicals and lubricants.

Basic GTL technology was invented in 1923, when two German scientists, Franz Fischer and Hans Tropsch, discovered the catalytic conversion of carbon monoxide and hydrogen (synthesis gas) into synthetic hydrocarbons. Technical advances in GTL development have surged substantially in the last decade allowing the GTL technology to be competitive at the current oil and natural gas prices. Since the late 1990s, major oil companies with commercial GTL histories such as Sasol, Shell, ExxonMobil, ConocoPhillips, have announced plans to build GTL plants to produce GTL fuels.

Process

1. Separating the Gas

After producing natural gas, water and condensates are separated from it. Other components, such as sulphur are also removed and cleaned. The gas is then cooled and the natural gas liquids (NGL) are removed via distillation. The remaining pure natural gas (methane) flows to the gasification unit.

2. Making Synthesis Gas

Making synthesis gas from the natural gas (methane) can be done by many processes such as: partial oxidation (PO), steam reforming (SR) and auto-thermal reforming (ATR), but the most common process is the partial oxidation process.

i. Partial Oxidation (PO)

Natural gas reacts with pure oxygen in an open flame at temperature of 1200-1500°C.

$CH_4 + ½\ O_2 \rightarrow CO + 2H_2 +$ Residual Heat (ΔH=-36 KJoule/mole)

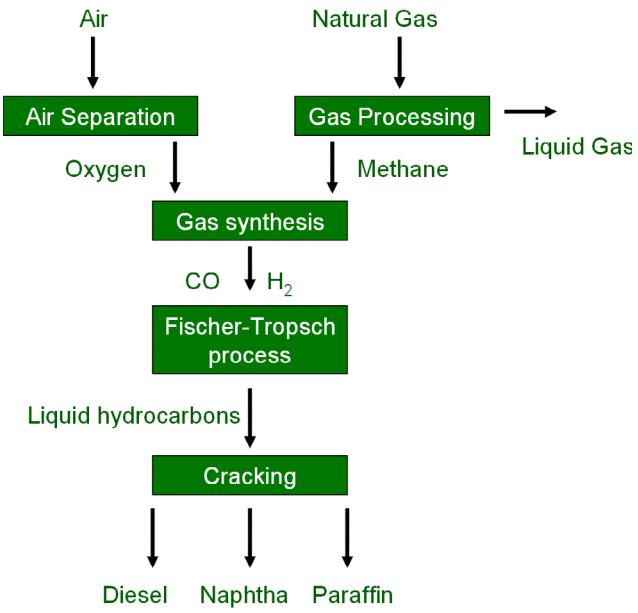
It was found that the use of a catalyst like nickel or cobalt can improve the production.

ii. Steam Reforming (SR)

The steam reforming (SR) process converts natural gas (methane) with steam on a nickel catalyst at 800-1000°C and 30 atm to a hydrogen rich synthesis gas.

$CH_4 + H_2O \longleftrightarrow CO + 3H_2$ (ΔH= +206 KJoule/mole)

A large steam surplus is required to suppress carbon formation in the catalyst.



iii. Autothermal Reforming (ATR)

This process is a combination of the previous two processes (PO and SR) in a single step. Benefits are: lower reaction temperature, lower oxygen consumption, and an (H_2/CO) ratio of 2:1 that is ideal for the Fischer-Tropsch synthesis.

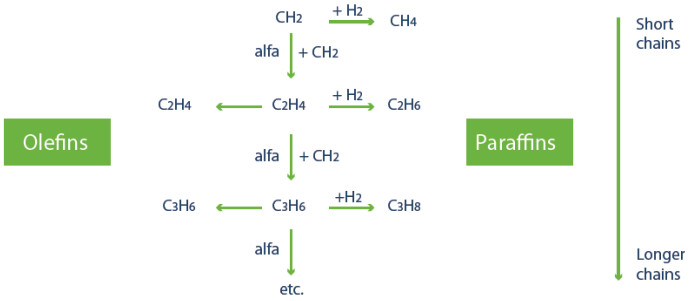
$CH_4 + ½\ O_2 \rightarrow CO + 2H_2 +$ Residual Heat (ΔH= -36 KJoule/mole)

$CH_4 + H_2O \rightarrow CO + 3H_2$ (ΔH= +206 KJoule/mole)

3. Making Liquid Waxy Hydrocarbons (Fischer-Tropsch Synthesis)

i. Process

- The purpose of Fischer-Tropsch synthesis (FTS) is to combine CO and H_2 into carbon chains by reacting carbon monoxide and H_2 in the presence of a catalyst, heat, and pressure.
- In FTS, CH_2 groups are formed by the hydrogenation of CO ($CO + 2H_2 \rightarrow CH_2 + H_2O$ + heat). The CH_2 molecules can be progressively grown into long chain hydrocarbons on the active surface of a catalyst.



- The overall reaction creates an olefin or paraffin with a chain length or carbon number 'n'. The chemical reactions are:

  $nCO + (2n+1)H_2 \rightarrow C_nH_{2n+2} + nH_2O$ + Residual Heat **(Paraffins)**

  $nCO + 2nH_2 \rightarrow C_nH_{2n} + nH_2O$ + Residual Heat **(Olefins)**

- Additional products reacted during FT synthesis are reaction water containing oxygenates, such as alcohols, acids and ketones.
- Fischer-Tropsch reactors operate within a temperature range of 225 to 365°C at pressure from 0.5 to 4 MPa. Selection of pressure and temperature depends on the desired products.
- CO_2 is formed by a side-reaction in which CO reacts with water to form CO_2 and H_2. This is called the water-gas-shift reaction (WGS):

  $CO + H_2O \longleftrightarrow CO_2 + H_2$ + Residual Heat

  The gained hydrogen from the WGS reduces the hydrogen demand for FTS. WGS proceeds at about the same rate as the FT reaction continues.

ii. Catalyst

- "**The more efficient the catalysts, the better the productivity of the project and the greater the financial return,**" says Carl Mesters, Shell Chief Scientist Chemistry and Catalysis.
- A variety of catalysts can be used for the Fischer–Tropsch process, but the most common are the transition metals like cobalt, iron, and ruthenium. Nickel can also be used, but tends to favor methane formation (methanation).
- Cobalt catalysts are more active for Fischer–Tropsch synthesis when the feedstock is natural gas.

4. Making GTL (Gas To Liquids) Products:

- The long hydrocarbon molecules from the FT reactor are contacted with hydrogen and hydrocracked into a range of smaller molecules of different lengths and shapes.
- Distillation separates out products with different boiling ranges.

GTL Products

Gas to liquids industry produces environmentally clean superior fuels that meet the stringent environment & performance specifications.

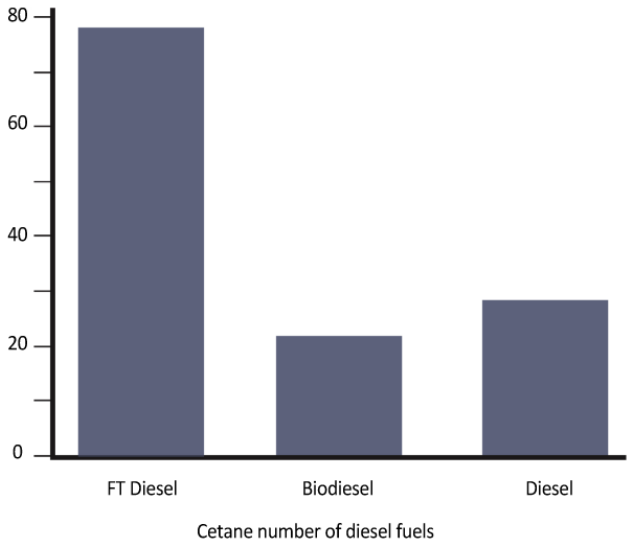
1. GTL Naphtha is used as a chemical feedstock for plastics manufacturing.

2. GTL Kerosene with near zero aromatics can be blended with conventional Jet Fuel (up to 50%) for use in aviation (GTL Jet Fuel) or used as a home heating fuel.

3. GTL Normal Paraffins are used for making more cost-effective detergents.

4. GTL Gas-Oil (Major Product) is a diesel-type fuel that can be blended into the global diesel supply pool to increase its cetane number.

5. GTL Base Oils are used to make high-quality lubricants.



Cetane number of diesel fuels

Economics of the GTL Technology

- Economic studies in the nineties of the previous century stated the minimum economic production capacity of GTL to be 50,000 bbl/day. By the beginning of this century, the continuous development of the GTL technology enabled reaching a capital cost of 20,000 $/bbl/day. This value has made the GTL plants economic even when their production capacity is much less than the above-mentioned value.
- The increase of oil prices increases the cost of the refined barrels of petroleum products and consequently, decreases the profitability of the refining process; this matter will encourage the investors to search for cheaper sources of petroleum products. GTL technology is an option.
- According to the recent calculations, it is found that within the existing oil prices (which are around 100 $/bbl), the wellhead prices of the natural gas that can keep the GTL technology economic and profitable are around 5-6 $/MMBtu.
- The GTL Technology is economic in countries that have large gas reserves such as Russia, Qatar, Algeria and Egypt.

GTL and the Environment

- According to the United Nation Organization of Health, man has polluted the planet Earth in the 20th century only by a degree which exceeded the entire pollution in the planet lifetime. Most of this pollution came from using the on-road fuels such as gasoline and diesel.
- Extending the GTL industry will provide an ideal solution to the environment pollution problem. Since it will stop the flaring of the associated natural gas and simply industrialize and change it into valuable liquid fuels, use its products as feedstock to other industries or blend the products of the GTL technology with refineries products to improve their specifications and reduce the harmful environmental emissions.
- Process integration can also be achieved by making use of the residual heat from various steps of the process to make steam that helps drive large compressors. Moreover, process waste water can be used as cooling water and to generate steam.

The United Kingdom Government Lifts Ban on Hydraulic Fracturing for Shale Gas

The UK government lifted the ban on shale gas exploration, which uses a controversial method of extraction that has come under scrutiny from environmentalists. The ban lift raised Fears over possible water and soil pollution, which provoked environmental agencies to step up demonstrations against this contentious decision. The ban, which was lifted with immediate effect, now means the UK will be able to unlock a wealth of unconventional gas reserves buried deep underground and could help with rampant domestic demand, which is currently the highest in Europe.

The UK's Secretary for the Department of Energy and Climate Change Edward Davey

said "We are still in the very early stages of shale gas exploration in the UK and it is likely to develop slowly. It is essential that its development should not come at the expense of local communities or the environment. Fracking must be safe and the public must be confident that it is safe."

The British government placed a temporary halt to fracking last summer after it said two small seismic tremors were experienced while Cuadrilla Resources was fracking for shale gas at their Preese Hall site in Lancashire in April and May 2011.

Shale gas could loosen some of the UK's heavy reliance for its gas needs from country's such as Qatar and Russia. Cuadrilla believes it could supply a quarter of the UK's gas needs from the resource in Lancashire. If the UK was more self-reliant for its domestic gas needs, it would also help bring energy prices down, which has been reflected in the US with its glut of unconventional gas supply, pushing prices down.

Shell Announces Pauses in Alaska Drilling Program

Faced with several continuing problems with its Arctic drilling assets, Shell announced on February 27 that it is pausing its planned drilling in 2013 in Alaska's Beaufort and Chukchi seas while the company prepares its equipment and plans for a resumption of its drilling program "at a later stage."

"We've made progress in Alaska, but this is a long-term program that we are pursuing in a safe and measured way," said Shell Oil Co. President Marvin Odum. "Our decision to pause in 2013 will give us time to ensure the readiness of all our equipment and people following the drilling season in 2012."

The company said that Alaska remains an area with high, long-term potential for Shell and that it is committed to resume drilling in the state's Arctic offshore in the future.

Jordan Denies Reports over Importing Gas from Israel

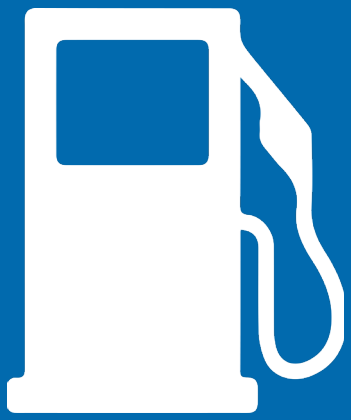
Jordanian Ministry of Energy and Mineral Resources dismissed reports alleging that it imports natural gas from Israel. "There are no secret talks between Jordan and Israel to import natural gas," said the ministry in a statement, the state-run Petra news agency reported.

Jordan, which imports about 96 percent of its energy needs annually, was forced recently to import expensive heavy fuel after repeated cuts in natural gas supply from Egypt.

The statement came after the Israeli daily, Haaretz, reported on Sunday that the partners in Israel's Tamar natural gas field have been conducting secret talks in recent months to export gas to Jordan that would power a potash plant on the Jordanian side of the Dead Sea.

The gas would be delivered through the Israeli gas pipeline that serves Israel Chemicals' Dead Sea Works plant in Sodom. Extending the pipeline to reach Jordan would not require a large investment, Haaretz reported.

Egyptian Gas Stations Prepare for Rationing



Egyptian gas stations will begin distributing gasoline and diesel fuel under a coupon system in July, according to the Egyptian Minister of Petroleum and Mineral Resources Osama Kamal. The plan aims "to rationalize subsidies and petroleum product consumption by limiting the quantity distributed on the markets, ultimately reducing consumption," said Radwan Fathallah, marketing studies adviser at the ministry.

"The Ministry of Supply & Internal Trade and the Ministry of Petroleum are working to improve their intercommunication, to prevent black market fuel sales," said Amr Mukhtar, director of planning at the Ministry of Supply's subsidies department.

Oil Outlook Uncertainty After Chavez's Death

The outlook remained uncertain both inside and outside Venezuela following President Hugo Chavez's death from cancer on March 5. Venezuelan government offices worldwide closed between March 6 and 8 as the South American oil-producing country began a national mourning period.

Some observers said that Vice-President Nicolas Maduro, who became acting president until elections are held, will likely continue Chavez's policies, including selling some of the country's crude oil to some neighboring countries at below-market prices.

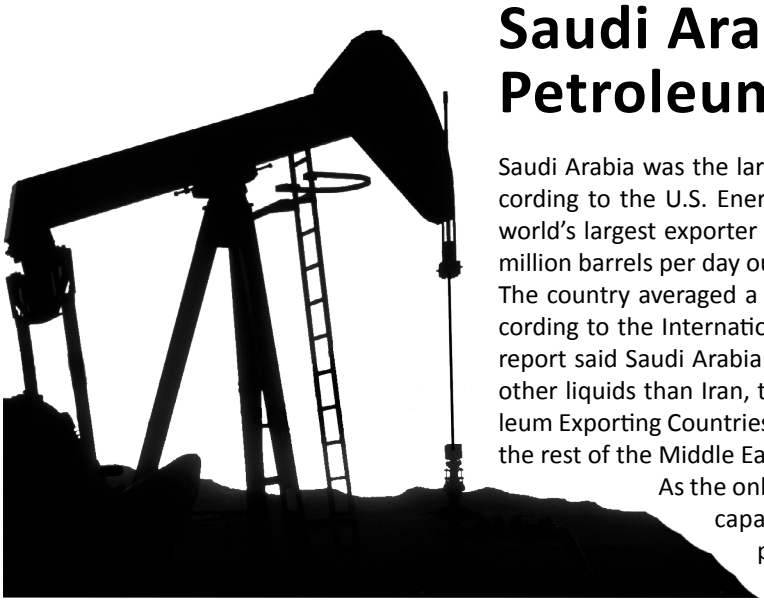
"Toward Latin America, Chavez embarked on a generous 'oil diplomacy' strategy, selling millions of heavily subsidized barrels to energy-poor Cuba, an important ally, and to Argentina and Bolivia," said Daniel Greenberg, a history professor at Pace University in New York.

Dana Gas Makes Significant New Gas Discoveries in Egypt

Dana Gas PJSC, the Middle East's first and largest regional private sector natural gas company, has announced that it has made two new onshore gas discoveries in the Nile Delta Basin of Egypt, After this discovery, the Company expressed its commitment to pursuing long term partnership with the national Egyptian companies.

Initial estimates indicate that together the two discoveries, known as Alyam-1 and Balsam-1, should increase the company's commercial reserves by 17 (proved) and 95 (proved & probable) million barrels of oil equivalent (MMBOE).

Appraisal drilling will be conducted on both discoveries which are located on the West El Manzala Concession, operated by Dana Gas. The company has already filed a declaration of commerciality and development plans for the two discoveries, which will be tied in to the nearby pipelines also owned by Dana Gas.



Saudi Arabia Announced Largest Petroleum Producer in 2012

Saudi Arabia was the largest producer of petroleum in the world during 2012, according to the U.S. Energy Information Administration. The country was also the world's largest exporter of petroleum and other liquids, sending an estimated 8.6 million barrels per day out of the country.

The country averaged a petroleum production of 11.6 million barrels per day, according to the International Energy Statistics and Short-Term Energy Outlook. The report said Saudi Arabia produces more than three times as much petroleum and other liquids than Iran, the next largest member of the Organization of the Petroleum Exporting Countries (OPEC). Saudi Arabia also produces as much petroleum as the rest of the Middle East combined.

As the only country in the world with extensive spare oil production capacity, Saudi Arabia has an estimated 268 billion barrels of proved oil reserves. The report said that is over 16 percent of the global total of proved reserves in the world.

CHAPTER NEWS

A new season, a new spirit, with the best active team! We started our season with an Opening Day full of entertainment and activities, bringing many events, sessions, and offering new opportunities to the university students. The Opening Day was held at the SPE booth at the faculty premises. After the ceremony, we started our new plan of work in the student registration and inquiry services by creating a full database of all the faculty students, and using our website as a source of information and a platform for personal application submission, and for events registration at the booth.

SPE Sub-Regional Paper Contest

This year, our chapter hosted the SPE North Africa Sub-Regional Paper Contest. The participants representing our faculty dominated the competition securing the first and third places in the contest with technical presentations concerning "Nanotechnology and Its Implications for EOR in Egypt" and "Exploitation of Geothermal Energy in Petroleum Industry."
The SPE paper contest offers the chance for students to present technical papers to the industry experts and compete against other students from their region. The winners will participate in the regional paper contest in Cairo in April 2013.

Kuwait Energy Field Trip

SPE SCU SC gave the chance to twelve students from the faculty to be a part of an internship program at the field of Ras Ghareb of Kuwait Energy in Egypt. The field trip program was divided into three periods and each period was a four-day trip for four students. The students had the opportunity to take a tour of the field wells, warehouse, and process station.

Egyptian Engineering Day

Finally and in the eleventh year of the Egyptian Engineering Day (EED), Petroleum Engineering projects were added for the first time as a result of the cooperation between SPE SCU SC and EED organizers. The EED is an annual exhibition for engineering students in all disciplines to showcase their projects in a three-day conference that attracts thousands of visitors. Six Petroleum Engineering projects participated in the competition to promote the petroleum engineering science and profession in Egypt.

Halliburton Egypt School

This year is very special for drilling engineering students; our chapter was able to provide four opportunities in Halliburton technical school of drilling that was held in October 2012. Then, in February 2013, five opportunities were provided to visit Halliburton Yard, giving the students the chance to learn more about the different operations carried out by the different segments of the company. This distinguished accomplishment is due to the great contribution of our main academic sponsor, Halliburton Egypt.

El-Safaa School for Special Needs Children Visit

In one of our community service activities, we arranged a visit to El-Safaa school; a not-for-profit school for serving special needs children. During our visit, A group of our members spent the day with the children at the school, and increased their level of awareness about who those children are and how they can help them to incorporate them into the society.

SPE Egypt Chapters Day

In the SPE Sports Day, teams from all SPE student chapters in Egypt competed against each other in different sports. Our teams won the first place in football, basketball, and table tennis tournaments.

Bayan & Zedny HR Courses

The development of our team has always been paramount for our chapter, with increased focus this season. We were able to partner with two renowned training centers in this field, namely Bayan and Zedny. Through Bayan we provided a comprehensive ten-hour human resources training package for our team members.
The training included HR planning, recruitment, and evaluation along with other related topics. Zedny, our second partner, provided a project management course for the chapter leaders to render them more effective in managing the chapter's various projects.

SPE FUE Chapter Induction

Spreading the culture of student activities in all petroleum engineering universities all over Egypt is one of our targets this year. Our chapter members decided to help the Future University in Egypt (FUE) students to found a new chapter in their university. Our chapter and the FUE students celebrated the opening of the SPE FUE chapter where our chapter president and vice president gave a presentation about the SPE and its importance, and an introduction to the petroleum industry in general.

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At Halliburton, solving customer challenges is second only to keeping everyone safe and healthy. We don't compromise our focus on HSE for better business results. Our commitment to safety will minimize the impact on the environment, control risks to our employees, and maintain safe work practices. Our dedication will match our commitment so that each and every Halliburton employee takes personal ownership of their own safety and the safety of others.

Turning our commitments into practice is at the heart of our Journey to ZERO. Simply stated, it's a concerted effort to achieve ZERO health, safety and environmental incidents every day, all the time. There are many areas within Halliburton where this is happening now. Our ZERO goal is to make it happen around the clock, everywhere.

Halliburton will continue to keep its strategic focus on these key HSE areas:

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- Continuous improvement of technology and processes to mitigate HSE impact

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