



Pressure Drilling Market Opportunities and Drivers

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At Balance

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Good morning ladies and gentlemen. It's my pleasure to be here in Abu Dhabi to open the SPE / IADC Managed Pressure Drilling and Underbalanced Operations Conference at its first international venue. I want to thank the SPE and IADC for giving me this opportunity and for their support of these technologies. It's not always easy to mediate between our two groups who are less like competitors and more like friends separated by a common purpose: to challenge conventional wisdom in an unconventional manner. There has been a lot of debate in the IADC committee over the definition of MPD and UBD so to avoid all of that I will refer to both as Pressure Drilling in my address.

The prevailing economic conditions that define oil today also define the need for new technology to find more. But remember, the confidence we feel when we find it only lasts until we understand the problems of drilling it.

In the current age of oil, producers will need greater access to and production from every oil field, of every color, brown and green, new and old. Though perhaps it is not yet clear, they will need unconventional technology, like pressure drilling, to break through the barriers that convention imposes.

This morning I want to identify the economic features that define oil today and that favor the growth of the pressure drilling technologies of central interest to this conference.

Context Matters

Pressure Drilling 2003:

- Underbalanced (UBD)
- Dual Gradient (DGD)
- Coiled Tubing (CTD)
- High Pressure (HPD)

Is dead

Or so it seemed

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Five years ago, in what seemed like calmer times, pressure drilling was given little more than a sidelong glance. Concepts were still being formed, applications still being developed, and the benefits and value of pressure control were still intangible.

Pressure drilling technologies were said to have, at best, a niche role in the oilfield, some were even declared dead. In a widely read technical journal, one author wrote an article in which he described pressure drilling technology as an example of a failed initiative, a solution in search of a problem, soon to be absent from the technical landscape.

Was the value of pressure drilling overly hyped five years ago? Probably. You know marketing guys. We all need them; I even have one. But let's be fair. Was the author's prediction of pressure drilling's demise wrong?

We are here today because of our entrepreneurial spirit, or maybe it's just our unconventional, stubborn refusal to go away when conventional critics tell us to.

Speaking of conventional critics - when I was a directional drilling trainee back in 1980 with Eastman Whipstock, I was out on Noble 28 for Pennzoil with a legendary directional driller teaching me the finer points of jet deflection in soft formation. He told me that I needed to shave my beard off because I would never get anywhere in the oilfield if I kept it. I was just stubborn enough not to. I wish he could be here now (he would still tell me to shave because of all the grey).

Context Matters

Pressure Drilling 2008:

- Managed Pressure Drilling (MPD)
- Underbalanced Drilling (UBD)
- Automated Pressure Drilling (APD)
- Controlled Pressure Drilling (CPD)
- Optimum Pressure Drilling (OPD)

Is alive

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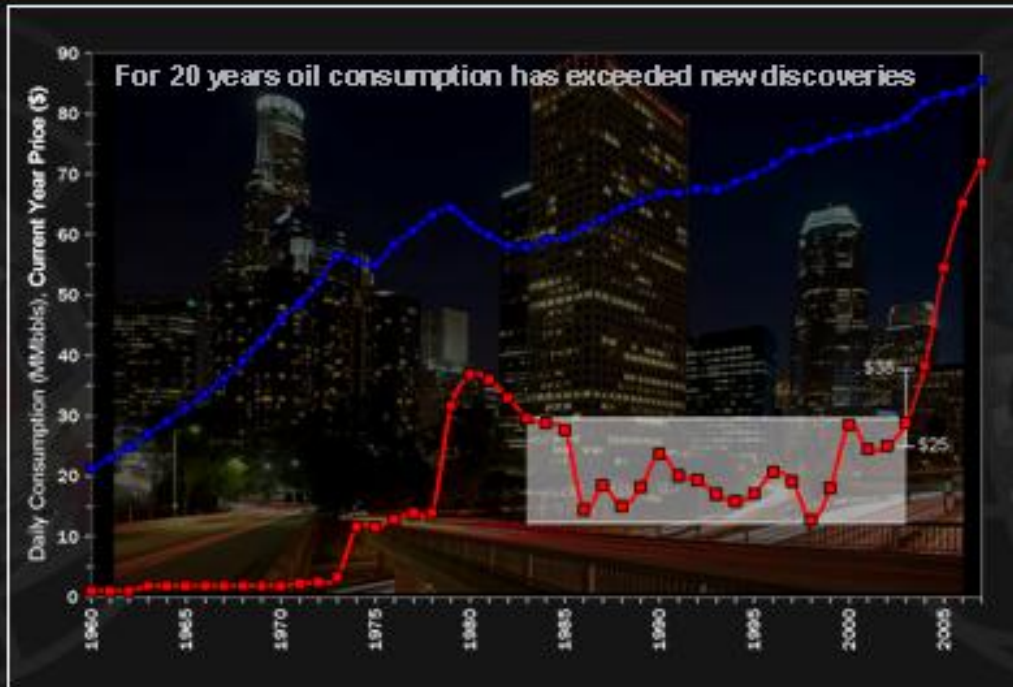
I believe the difference between a critic and an entrepreneur is that the critic never stops telling us why a new product is not useful, the entrepreneur never stops until it is. Now that's stubborn. The story of the oilfield is rich with stubborn entrepreneurs who have tackled the limits posed by nature and convention, and invented the means for others to stretch past them. We are entrepreneurs in a new chapter – it will not be the last one – and, like it or not, prepare for interesting times.

Pressure drilling entrepreneurs have given us technology that has stretched the limits of drilling past convention and nature. We share a deeply rooted – some might say a deeply disturbed – sense of value in the step change it offers. After all, we are telling the entire drilling industry to do that which they worked hard to avoid in the past – shut-in your well, let the pressure build - it's good - you'll like it - trust us.

Today, companies around the world have discovered they can trust us – and we appreciate them for the pressure they let us manage.

So what was it about the landscape five years ago that justified writing our obituary? Well, nothing. The economic features had been in place long before – they've just gotten bigger – or maybe we've just gotten closer, and now see how really big they are.

Rising Consumption & Prices



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Source: EIA

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One of those features is consumption. Has there ever been a time since the discovery of oil when consumption was not growing? It still is, and over the past 5 years, average daily consumption has grown by over 5 million barrels per day.

Another, huge feature is price. Looking back, the 20 year period between 1983 and 2003 was a confident time when the annual average price of crude oil behaved nicely, in a range of 10 to 30 dollars per barrel. But then our world shifted on its axis.

Four years ago, who could have foretold – with believable certainty – that the price of crude would triple. Seemingly sustainable high prices and new technology advances are opening the landscape like never before. Previously unattractive projects have become profitable, fringe oilfields have moved into the mainstream, and no area of the world seems too deep or remote to explore.

Now, more than ever, companies will stretch their ability to explore further and deeper. New technology will be needed to provide safe, cost effective, and reliable access to fields that companies may be able to find, but which may not be easy to drill, or develop.

In one potentially hazardous, shallow gas prospect, beyond the limits of conventional drilling, an innovative, empowering combination of technologies was mobilized to open it up for exploration. A narrow margin of safety at the surface casing shoe and excessively large fluctuations with conventional pressure control compelled the company to implement a new solution.

Automated pressure drilling, drill string telemetry, and pressure while drilling technologies were brought together to form the industry's first closed-loop pressure control system. This system proved capable of detecting kicks early and protecting the shoe, by managing the bottomhole pressure within a very narrow window while drilling, and during induced kicks on the rig.

Peak Oil Production

The effect of depletion in mature oil-producing regions is now ... a much more significant factor in the supply-demand equation.

18 major oil-producing countries are past peak production.

They account for 29% of total world production.

More oil will need to be recovered from oil already found.

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Source: OII Depletion & Peak Oil, BP Statistical Review, EPR F

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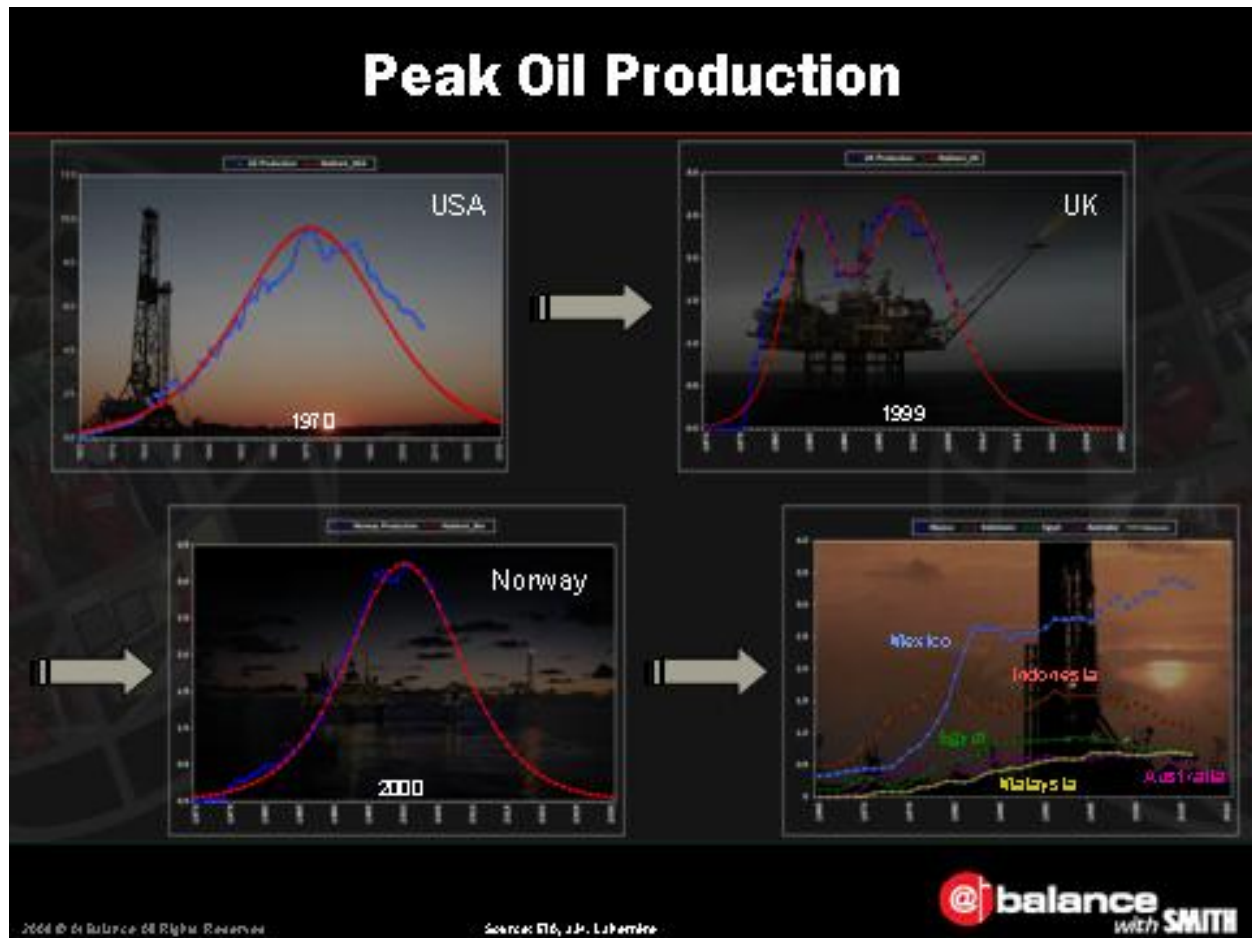
However, we know that our ability to find oil can precede our ability to drill and develop it. We know also that an oil field becomes stubborn with age, denying us access, and refusing to let anything move from its tight enclosures.

Along with the forward looking efforts of oil companies to find new oil, we can expect them to put more focus on their mature fields. This is particularly true of the international oil companies because there are fewer new places to explore, and even fewer open to international investment. Today, less than 10% of the world's remaining reserves are accessible to international oil companies, three quarters are controlled now by national oil companies.

No one argues that world oil production will not peak; many major oil producing countries have already. The question is, has world oil peaked already, and if not, when in the foreseeable future will it do so? Even if I had the whole day I could not address that question.

We do know that new technology will be needed in mature fields, at or past their peaks, to help recover the remaining, proved reserves in place, but stubbornly beyond our reach.

What we can address, is the many ways pressure drilling technology can be used to help extend the peak, or at the very least, slow down the decline rate.



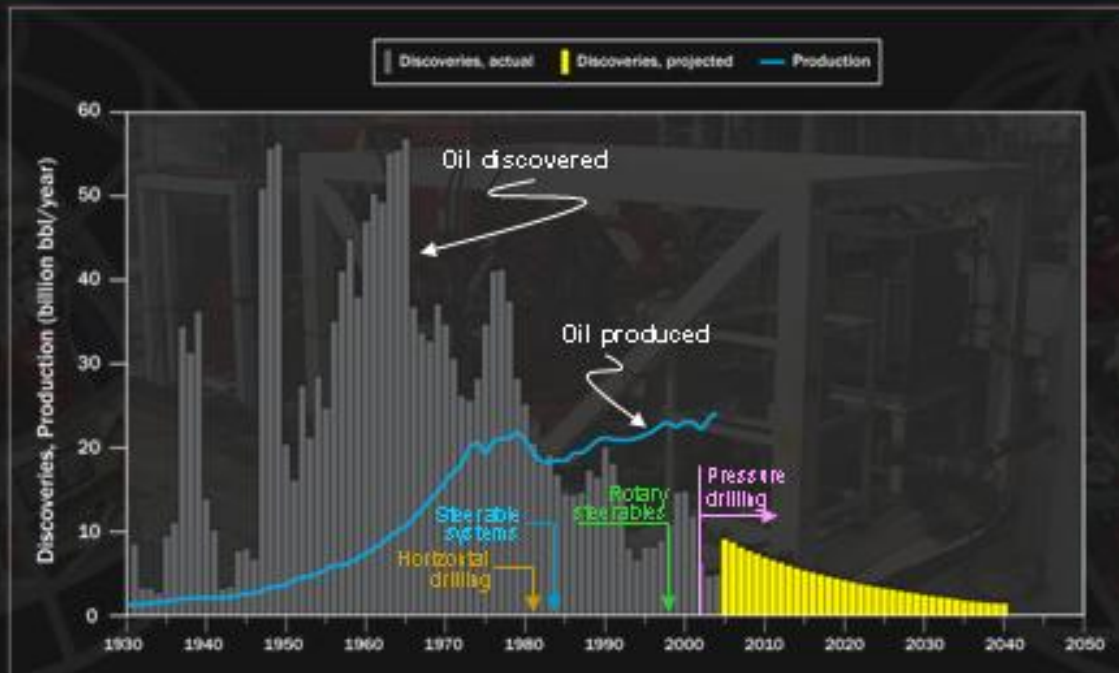
The United States was the first major producer to reach its peak production in 1970, just as Hubbert predicted. After the lower 48 states went into decline, new offshore technology opened up the deepwater Gulf of Mexico to exploration and development, and new drilling and recovery technologies were aggressively applied onshore to slow down the decline.

Less than ten years ago, at about the same time, the United Kingdom and Norway reached peak production and now follow a similar downward slide. There too, new technology has been and is still being sought to open up new areas, and to expand access to and sustain recovery from the old.

Elsewhere, production has peaked in Indonesia, Egypt, Australia, Malaysia, and most recently, Mexico.

These eight countries represent 20% of the world's daily production and companies drilling there have turned to pressure drilling, or are actively evaluating it as a means to maintain access to proved reserves, and stem decline.

Benefits of New Technology



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Source: EIA/Hill

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Frustrated by increasingly difficult and, in some cases, a complete loss of access to mature fields, companies are turning to the very pressure drilling technology that was supposed to have disappeared five years ago. Can pressure drilling help improve production of proved reserves?

New technology has certainly helped in the past. In the early 90s the declining trend in reserve additions was reversed by 3D seismic, deepwater drilling, and horizontal drilling which, without a doubt, was one of the most important technical advances in oilfield drilling. In its modern form, horizontal drilling appeared in the '70s, and was successfully used, commercially for the first time, in the early '80s.

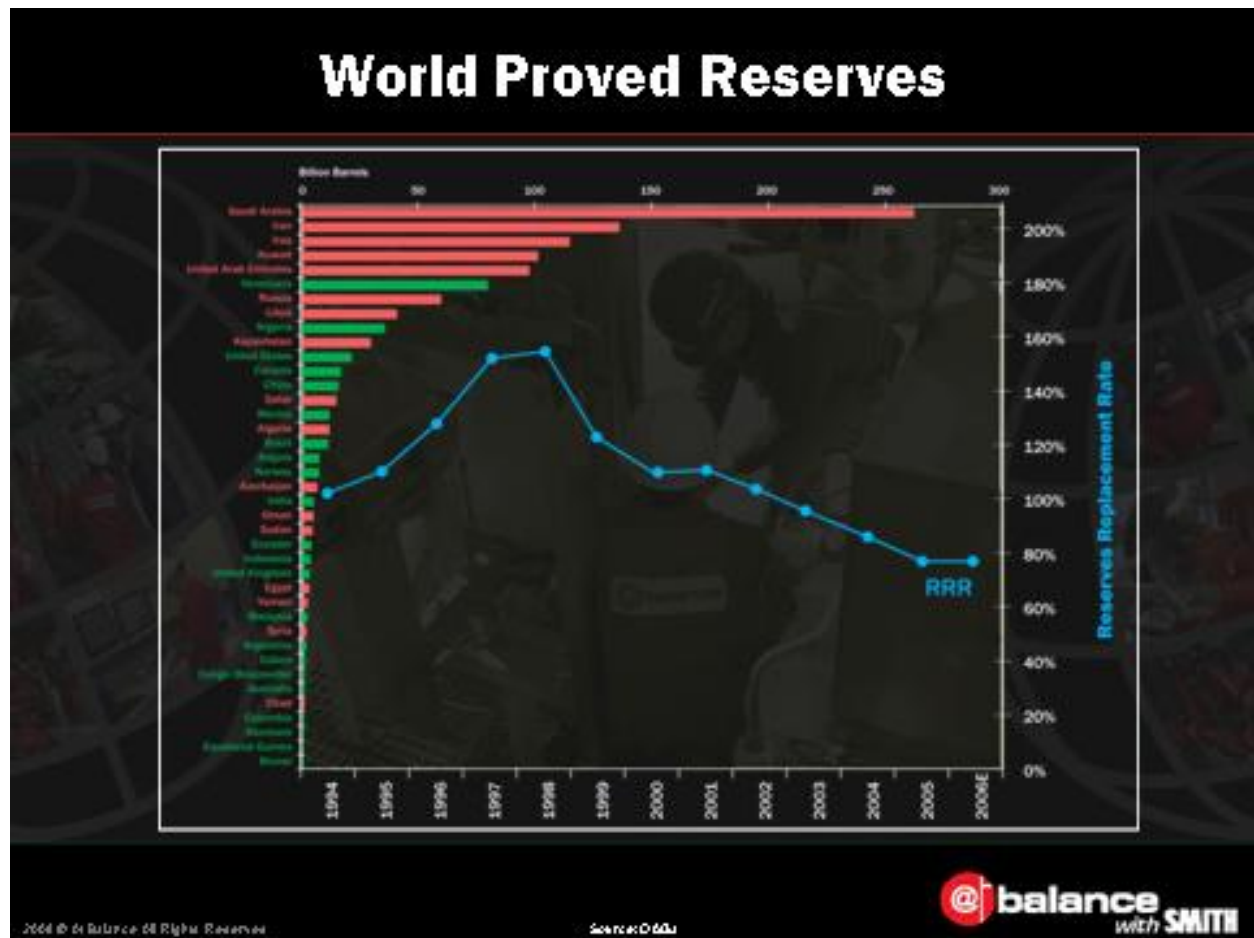
As empowering as it was, horizontal drilling did not deliver its full value until the early '90s, after the invention of steerable systems in the mid-80s, and coiled tubing and rotary steerables, in the mid-to-late 90s. Since then, it has stretched the limits of our reach further than anyone could have imagined. But consider this, in 1982, when an Elf drilling engineer was about to present the results of the first successful horizontal well to an SPE drilling conference, half the audience got up and walked out. Why was its potential value to production improvement ignored?

Maybe because it was unconventional, maybe because drilling is just as stubborn as an old oilfield, or maybe it was the last talk of the day and the hospitality suites were about to open.

In comparison, at a basic level, pressure drilling has been around just as long, since the first bloke was put on a choke to control pressure through a rotating control device. But,

deeper wells, higher pressures, smaller margins, and larger risks will require more – tighter control, faster response, and calibrated performance – now more than ever, as companies learn they can safely drill with statically underbalanced mud.

New technology has helped reverse the decline in reserves replacement and production in the early 90's, and will continue to do so. New automated pressure drilling technology is giving companies access they once had, to oil that was once easier to reach. It has raised success rates in mature, deepwater Gulf of Mexico fields from 20% to 100%, saving money, time, and adding production from previously inaccessible reserves. In Far East fields, it has improved drilling operations by safely reducing mud weights to previously impossible levels. Elsewhere, automated pressure control is enabling drilling in new, ultra deep-water, and HPHT fields.



Today, the bulk of the world's proved reserves are controlled by NOC's in:

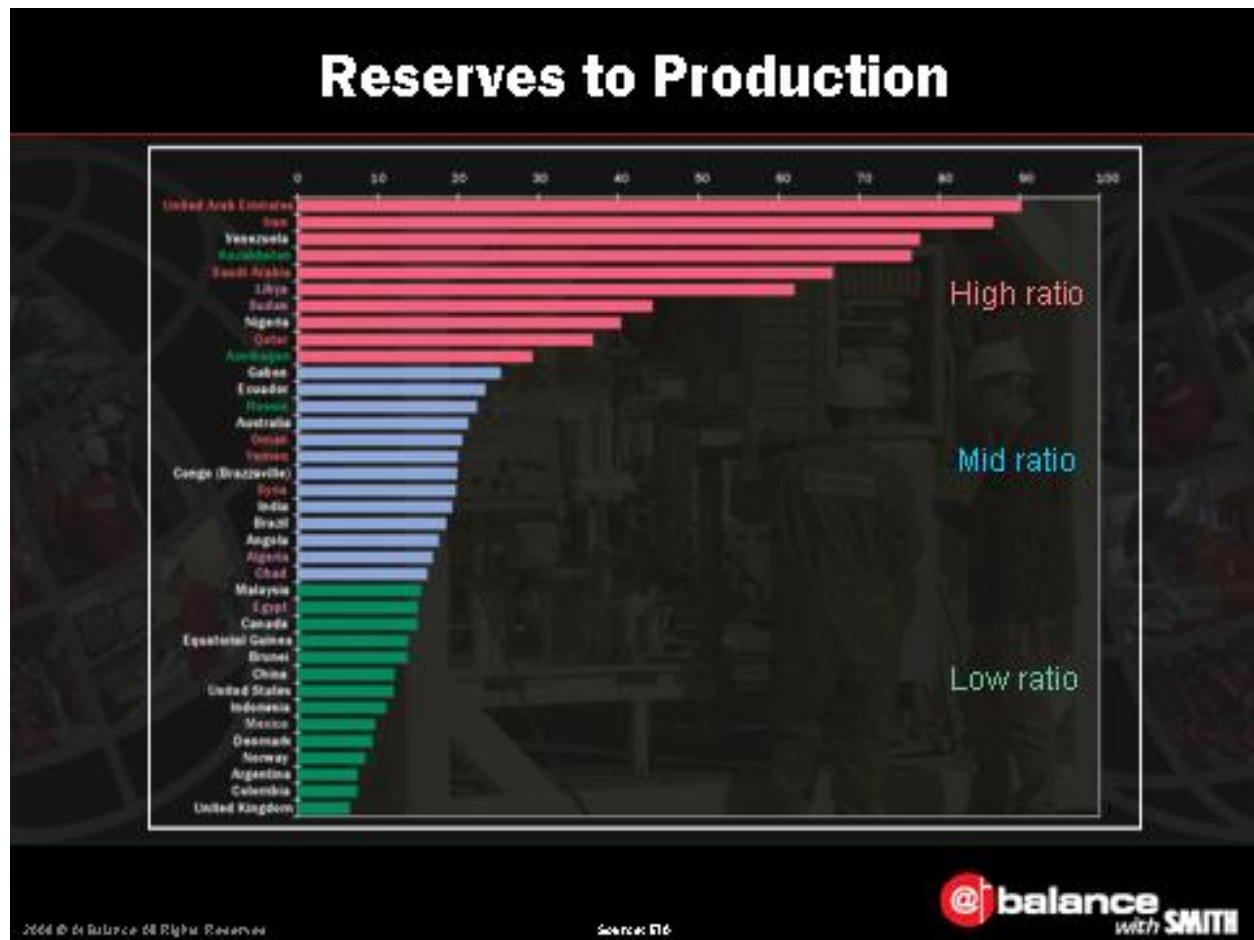
- > The Middle East
- > Russia and the countries of Central Asia, and
- > North Africa

In the past ten years, reserves declined by 16 billion barrels in Mexico, 8 in China, nearly 3 in Norway, and one and a half in the United Kingdom, while globally, reserves increased by less than 10%. This is well below the level needed to keep up with the rapid pace of consumption – up 17%, price – up 300%, and production – down in a quarter of the world's output.

An increase in spend over the past couple of years by the top 25 IOCs reversed the declining trend in exploration which, in part, along with price, helped improve the reserve replacement rate, which had dropped to its lowest level in almost 15 years.

However, the current rate of replacement will be insufficient in another 2-3 years, when support for more than half of the world's consumption will have to come from new reservoirs.

These facts reinforce the need for new technology to maximize access to and production from proved reserves.



When we look at the reserves-to-production ratio we see a natural correlation between it and pressure drilling.

Countries with low ratios, shown in green, tend to produce at or near their maximum rates while those with high ratios, shown in red, are producing at less than their maximum possible rates.

Pressure drilling is being used, and is on the uptake in many of the low and middle ratio countries that have mature producing basins with declining production, and difficult-to-drill pressure profiles.

National and International Oil Companies working in countries with low-to-medium ratios like Oman, Algeria, Canada, the United States, Norway, and the United Kingdom are

eagerly stepping up as early adopters, even as active technology drivers, about which you will hear more over the next couple of days.

It is no coincidence that pressure drilling got its start in the low ratio countries. It should come as no surprise that it will naturally move into the higher ratio countries where the national oil companies are just as eager to slow declining production, extend the life of their mature fields, and maximize their return on investment.

Technology Challenges

- Risk mitigation in green and brown fields
- Production enhancement in mature fields
- More efficient well construction techniques
- Faster, safer drilling
- Quicker regulatory approval
- Improved remote operations

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In the economic landscape surrounding oil today, what challenges will we face, what opportunities will we have?

Advanced pressure management techniques and technologies will be needed to reduce drilling uncertainty and mitigate risks in complex fields, new and old, as companies seek ways to expand access, and increase reserve recovery.

Technology will be required to improve the performance of the existing production base where 70% of the fields have been producing for more than 30 years. Extended production has radically altered the pressure conditions in many mature fields. As we apply our technology to deeper, hotter, more remote discoveries we can anticipate a future when they too will mature, and exhibit the same problems we see today. Indeed, to survive, pressure drilling technology will have to develop broad capabilities for most fields, regardless of location, rig, reservoir, depth, or water.

Development efforts are already providing ways to optimize pressure drilling and fluid systems to reduce losses in severely depleted formations, reduce formation damage,

improve hole cleaning, increase drill rates, maintain wellbore stability and prevent, detect, and control influxes.

Even with the current high price of oil, time, cost, and efficiency will remain critical factors to the success of new projects. If, as expected, in the search for new discoveries companies go further and deeper, into areas on the edge of the possible, then new levels of technical support and service delivery will be needed.

Remote, automated pressure drilling has already been demonstrated as technically feasible in the North Sea. Further advances in remote automation will be required to keep pace with rig automation, the need for more efficient workflow with fewer personnel on board, closed-loop pressure drilling with wired pipe, and real-time service from remote operating centers around the world.

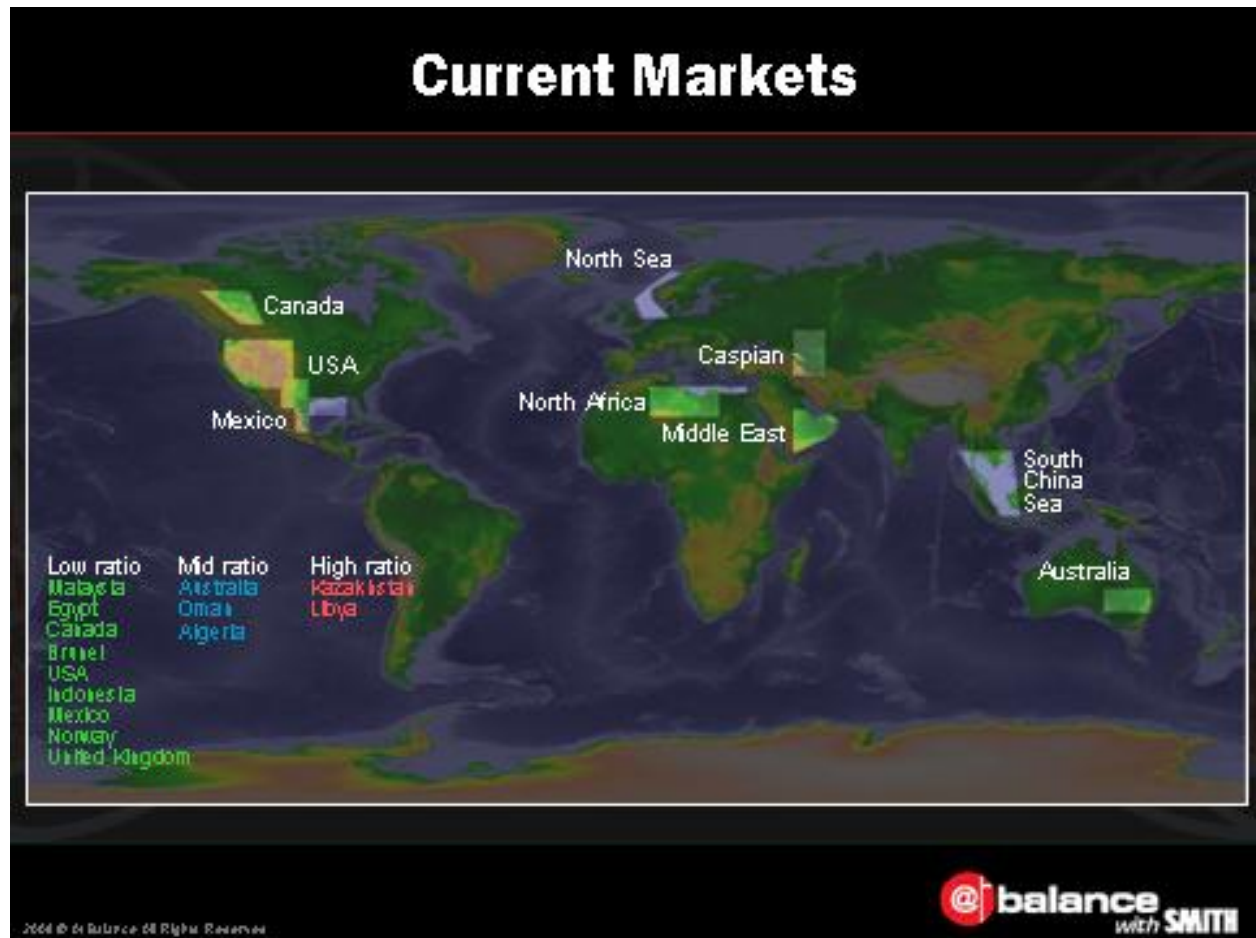
Pressure drilling automation has provided, and future advances will provide even higher levels of uninterrupted, 24/7, monitoring and control. With the growing demand for new and old rigs, working in ever more challenging conditions, greater levels of pressure control automation will be needed to mitigate the inherent risks of the increasing number of new, and inexperienced drilling crews being hired.

I have made several references to pressure drilling successes around the world in different applications. The reason I can state these cases is that we have safely and successfully applied automated pressure drilling techniques in each of these cases.



With the coming push into new areas, companies will face uncertainties in the pressure profiles of geologically remote fields with shallow gas hazards, and deep carbonate and subsalt reservoirs.

In addition, engineering expertise, more accurate hydraulics modeling, and new control systems will be essential to engineer and manage fluid gradients in complex, ultra-deepwater fields where pressure margins may be 1 to 2% of absolute bottomhole pressure, and in deep HPHT fields where temperature and pressure can exceed 200 deg C and 20,000 psi, respectively.



The knowledge, expertise, and procedures being developed in the current operating areas will prepare the way for quicker and easier implementation of pressure control elsewhere.

Pressure drilling is already established in many of the mature onshore and offshore hydrocarbon basins around the world and is still expanding, particularly in Mexico, North Africa, the Mediterranean, and the South China Sea, where companies seek improved access and production.

Further out, the market opportunities for enhanced pressure drilling capabilities in large land development areas of North America, North Africa, and the Middle East will grow as lighter, more compact, and more cost effective, automated systems are introduced.

Growth Markets



Over the next five years, as new pressure drilling technology is launched, more companies will take up managed pressure drilling to lower their reserves-to-production ratios in the areas of the Arctic, South America, the North Sea, the Middle East, and South East Asia.

To be sure, no one pressure drilling technology is suitable for all the applications in all of these areas. The coming growth in demand will drive the expansion of the pressure drilling technology portfolio, to support the different needs of our expanding market.

Finally, the landscape in which pressure drilling finds itself is becoming increasingly competitive. No one can predict what future mergers and acquisitions lay ahead for us. More and more major service companies are shifting from the development of technology to the acquisition of it. As we improve and expand pressure drilling technology, and grow the market, others will take notice. In fact, some already have, as those of you who are familiar with At Balance already know. With this will come more rapid growth in global delivery, infrastructure support, and service expansion to better meet the increased need of the old and new fields around the world.

It remains for us to keep alive the entrepreneurial spirit so deeply ingrained now in managed pressure and underbalanced drilling.

I am confident in the future of pressure drilling because I know that today it takes half the time it used to for a luxury to become a necessity, and for the unconventional to become conventional.



Thank You

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With that said, I expect to see more unconventional technology and a few more beards at the next conference. Don't worry – if there is one thing I know to be true about both – they grow on you.

Thank you and enjoy the conference.