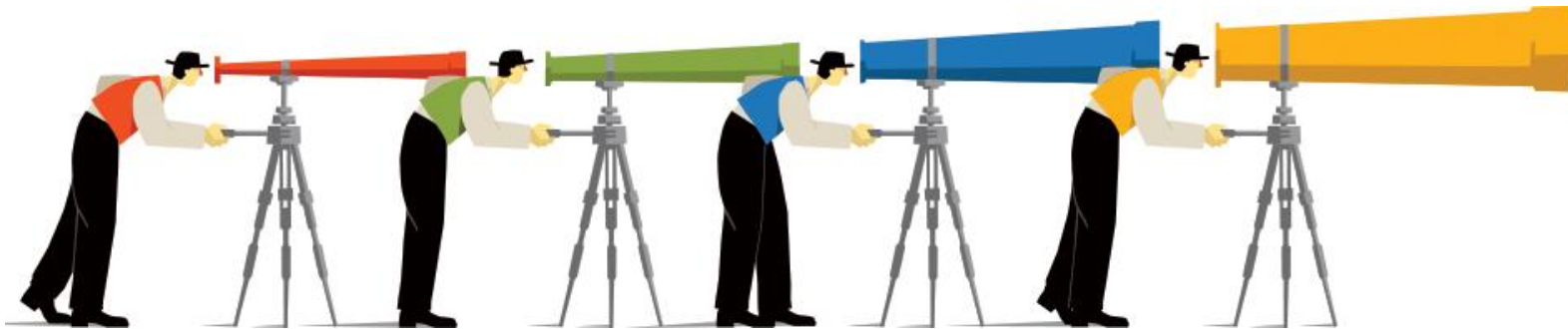


Why are exploration wells so expensive and how to cut costs...?

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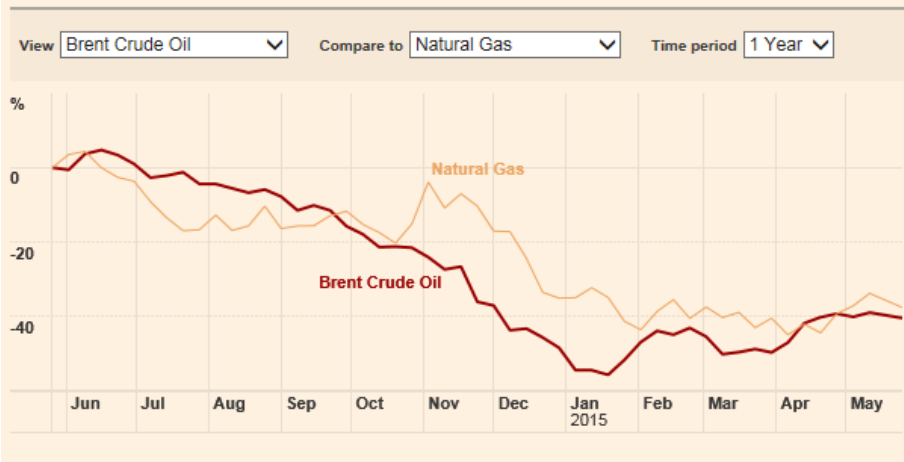
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Market issues

- Soft oil and gas prices since Q3 2014
- Likely future volatility, uncertain price recovery scenarios
- New OPEC long-term Strategy?
- Poor recent exploration results globally
- Reduced industry investment and levels of activity
- Falling supply chain costs
- Lead times down

Commodity performance



Implications for exploration?

- Exploration a long-term investment - spend sharply down
- Portfolio rationalisation - operators looking to buy and sell assets
- Client are protecting value and cashflow, reducing cost, mergers to cut G&A
- Deepwater developments are high dollar – top end of the investment creaming curve
- Less activity > lower costs
- Market fundamentals may help:
 - Rig rates
 - Services rates
 - Materials prices
 - Fuel costs
 - More talent
 - Less competition?

Why Are Exploration Wells So Expensive?

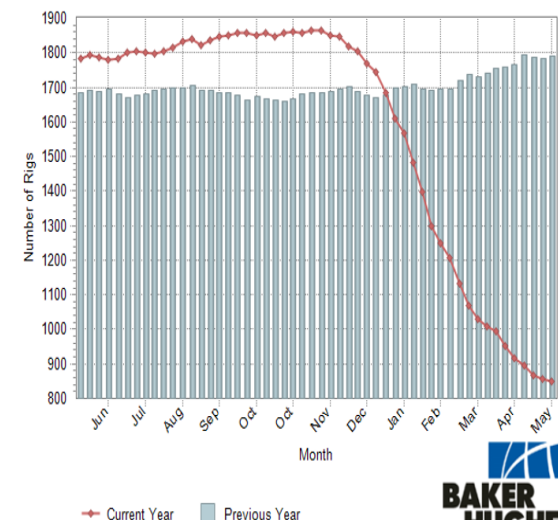
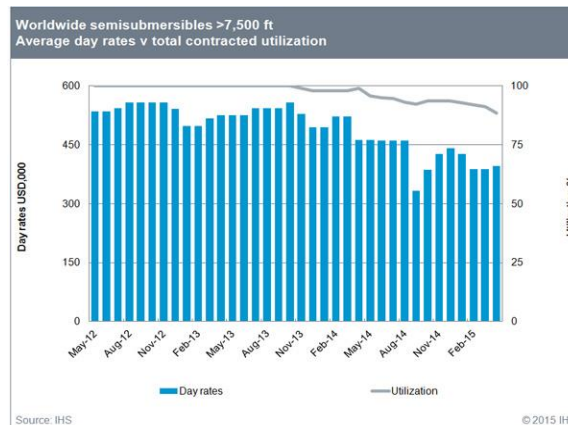
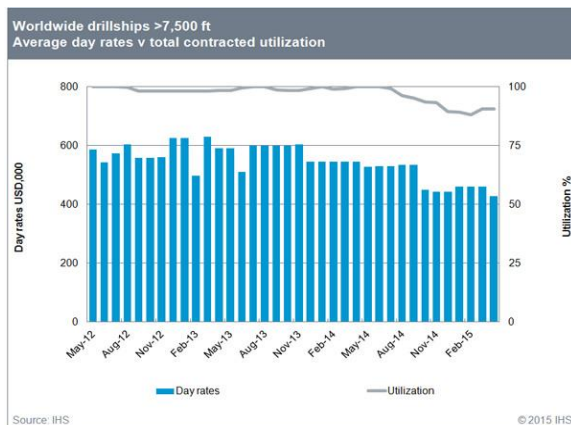
Wells...

- Poor project performance – time / cost / duration and outcome
- Bloated supply chain costs
- Basic lack of contractual incentives for performance
- Non-core for some operators?

Exploration wells...

- High profile
 - conservative decisions and timing
- One-off
 - mob costs
 - short contracts
 - little opportunity for operational learning
 - new teams / players / stakeholders
- Difficult environment
 - deeper water
 - high pressures
 - newer plays
 - geopolitically risky countries
 - environmental sensitivity
- Uncertain subsurface
- Conservative design to cover pressures, side-tracks
- Remote
 - mob costs
 - logistics
 - setup costs
 - Not easy to share costs
- Uncertain Vol
 - tendency to “run the catalogue”
- Usually abandoned...

Rig Utilisation & Day-rate Trends



Supply trends

- In all rig categories, utilisation and day-rate down.
- ...these are current fleet-average numbers – latest fixtures will be even lower...
- New-build inventory status (deepwater rigs)
- When to lock-in new contracts? Timing is key...
- Older, low-spec rigs will be removed from the market
- Same story in services and materials
- Lead times down and more choice
- But...OSCs will consolidate and reduce capacity (Halliburton – Baker Hughes example)



Plan & Execute an Exploration Well as a Project



Well Delivery Process

- Adds rigour to the project – especially if new team / different players
- Forces clarity on objectives, requirements, operational programs
- Scalable to risk (not a tick-box)
- Decision Gates and value challenges are essential components
- Bottom-up, probabilistic cost and time estimates – build in market trends
- Separate top-down targets
- Front-End loading of effort is key
- Brings together the planning and execution teams
- Supports communications at all levels

Aligned participants

- Technical – explorers, well engineers,
- Support – Finance, Contracts, Procurement, Logistics, HSSE, HR
- Contractors & Suppliers – drilling, service companies etc
- Stakeholders – partners, government agencies, environmental groups

Some Tools

- Drilling the Limit
- Incentivised contracts
- LEAN 6-Sigma
- Knowledge management tools
- Crew Resource Management
- Reliability Centred Maintenance

Apply Risk Management & Mitigation Principles

Secure HSSE

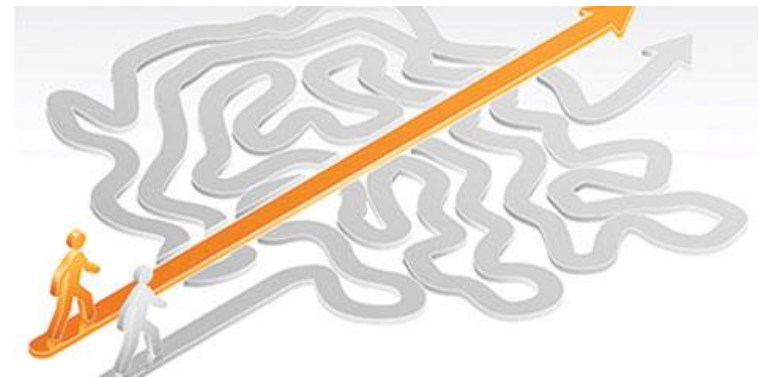
Force conversations eg

- Should we take a more expensive but “hot” rig with strong crew...
- What does that side-track contingency cost?
- How should we prioritise objectives? Keep it simple and accept some scenarios can't be met?
- Plan for the highest pore pressure or P90?
- When should we stop and reconsider?

Challenge scope / options and reduce complexity

- Fully understand value and costs of optionality, eg
 - Retaining option to side-track
 - Planning for highest possible pressures
 - Mobilising a test spread before finding hydrocarbons
 - Running logs “just in case”
 - Designing the well as a “keeper”

Likelihood	Consequences				
	Insignificant <i>Risk is easily mitigated by normal day to day process</i>	Minor <i>Delays up to 10% of Schedule Additional cost up to 10% of Budget</i>	Moderate <i>Delays up to 30% of Schedule Additional cost up to 30% of Budget</i>	Major <i>Delays up to 50% of Schedule Additional cost up to 50% of Budget</i>	Catastrophic <i>Project abandoned</i>
Certain >90% chance	High	High	Extreme	Extreme	Extreme
Likely 50% - 90% chance	Moderate	High	High	Extreme	Extreme
Moderate 10% - 50% chance	Low	Moderate	High	Extreme	Extreme
Unlikely 3% - 10% chance	Low	Low	Moderate	High	Extreme
Rare <3% chance	Low	Low	Moderate	High	High



Optimise Operations – Reduce Variability at Detailed Level

How? Some considerations

- Planning – materials, logistics, rig-floor tools, location, people
- Measurement – logging actions second-by-second (not 15 minutes..) and comparison with best in class (or previous operations)
- Technology – use of appropriate and reliable drill-floor technology. New tracking technology for real-time rig-floor analysis
- Competence – crew training, knowledge, flexibility, troubleshooting, improvising, learning from previous experience
- Just enough process and standards
- Motivation – rig and service company incentives down to individual motivators on the day.
- Leadership – Driller and tool-pusher, company man presence and interest...

Special challenge for exploration – how to “snap into” high performance from the get-go?

Simple example

- Significant variability between rigs on same operations, eg running 9 5/8” casing
 - Rig 1: 20 joints per hour
 - Rig 2: 30 joints per hour
- There is massive value in closing this gap - \$ 230k assuming \$1million/day spread rate, 10 000ft setting depth



Realise The Benefits Of Technology

Hardware

- Managed Pressure Drilling
- Dual activity systems
- Multiple rig pumps
- Multiple ram BOPs / Dual BOPs
- Pipe-handling technology
- Quick-moving, rig-up/down land rigs
- Expandable & swellable tubulars
- Geo-steering
- Wireless and fibre bandwidth
- IoT (Internet of Things)



Systems / Data

- Real-time operating centres to track and support performance and decisions
- Well visualisation / expert systems
- Integrated logistics and tracking
- Reliability-centred maintenance
- Real-time data mining and analytics



What else?

Consider the following...

- Supply chain:
 - Market “window of opportunity”
 - Challenge prices / rates / margins but relationship important so offer something!
 - Explore genuine cost take-outs through spec simplification & speed
 - Leverage scale, exploit different rates
 - Multi-skilling
 - Insourcing key activities
- Increase rig reliability – some deepwater drilling units running at 25% NPT due to
 - Post Macondo focus on BOPs
 - Loss of core subsea engineering skills
- Collaboration between within community of operators, service companies (as per Wood report) eg rig and logistics sharing
- Rebuild drilling and completion capability and high-grade personnel



Lower well costs from holistic performance improvement:

- Safe operations efficiency
- Planning & risk management
- Appropriate new technology
- Supply chain partners
- Processes & standards
- Knowledge & learning
- Leadership & communication
- Above all, great people & teamwork!

Yes, exploration wells will continue to be “expensive” – target them carefully!



