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Drilling Decision Management in the Age of Drilling Automation

Richard Meehan

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Outline



- Drilling automation – what, why, how
- How big is the task?
- What is the real challenge?
- Scale free structured approach
- Conclusion



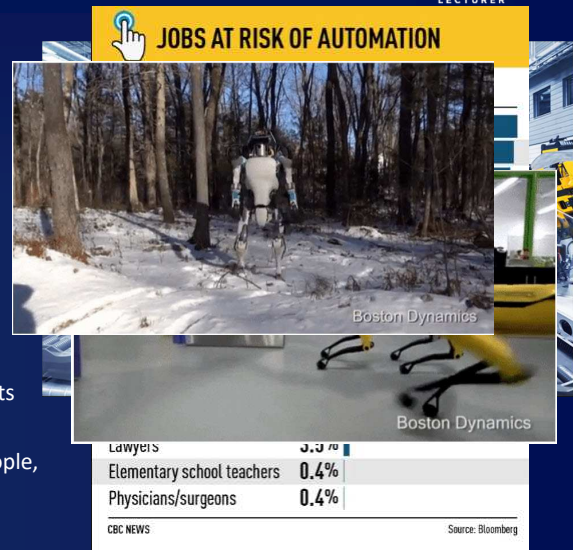
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Automation is coming



- Manufacturing industry
 - Automation increases quality and productivity, and reduces cost
- What is “easy” to automate?
 - Physical jobs, in predictable environments
 - Collecting and processing data
 - Rule based administrative tasks
- What is “hard” to automate?
 - Skilled physical manipulation in unpredictable environments
 - Tasks involving significant social interaction
 - Tasks involving collaboration between distinct entities (people, systems, organizations) in uncertain environments
 - **Decision making**

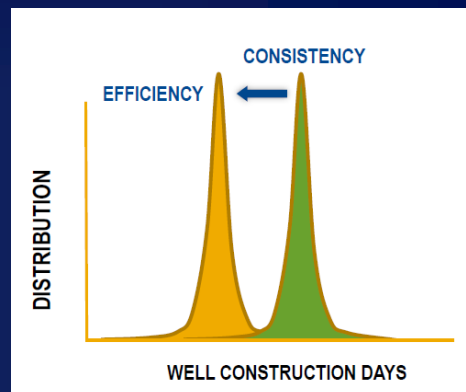


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Drilling Automation



- What is it?
 - Control of machines
 - Control of process
 - Orchestration of behavior?
- Why do we want it?
 - To reduce cost and risk
 - To enhance safety and environmental protection
 - To improve consistency and predictability
- Do we have to adopt it? What will it cost?
- What will help?
 - Analytics
 - Probabilistic control
 - Cloud/edge computing
 - IoT
 - Autonomous robotics

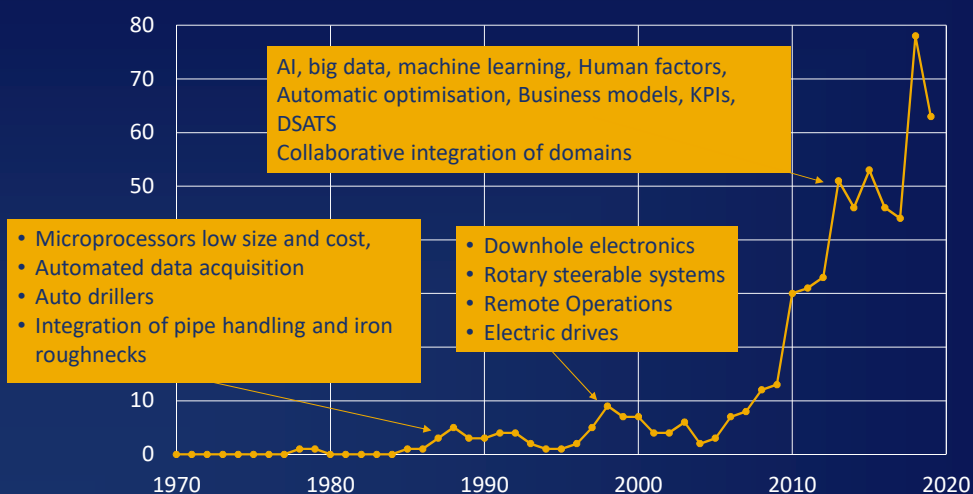


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Clear Growing Interest

OnePetro papers on "Drilling Automation"



- At least 15 groups are offering commercial drilling automation solutions

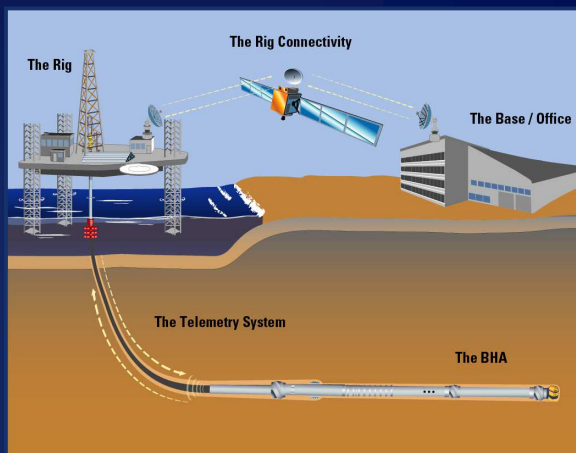
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Well Construction Automation Today



- Drill-a-stand
 - Auto tripping / back-reaming, pipe handling
 - Auto drillstring energy management
- Mud systems
 - Auto fluids analysis / bulk mixing
 - ECD monitoring and control
 - Managed pressure drilling / cementing
 - Auto kick detection & swab/surge control/washout
- Well placement
 - Auto ROP, well path control, Geosteering
 - Auto downlink and survey/Wired DrillPipe
- Remote Operations Centres
- Planning
 - Procedural adherence
 - Dynamic planning
 - Auto BHA design



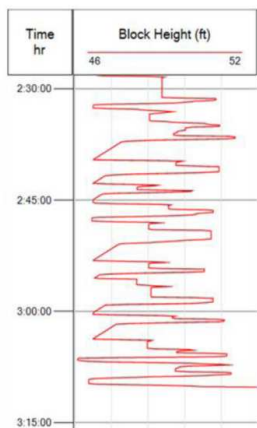
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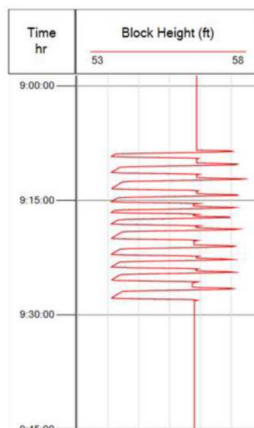
Automation is here ...



Manually Operated Sequence



Automated Programmed Sequence



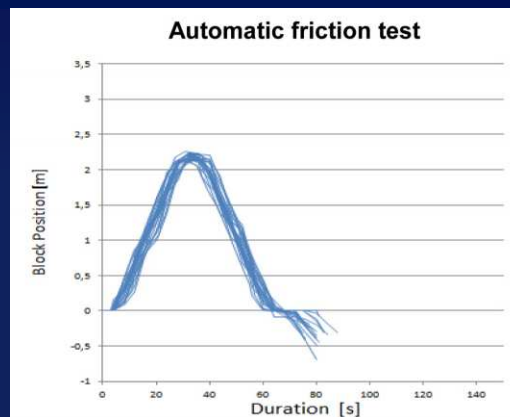
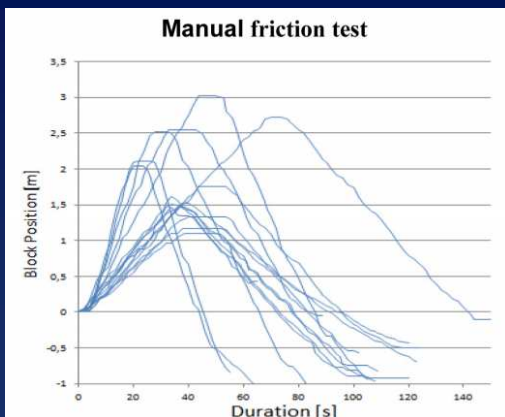
SPE-181047-MS
Business Models and KPIs as
Drivers for Drilling Automation
F.P. Iversen, J.L. Thorogood, J.D.
Macpherson, R.A. Macmillan

“Sequence of pull out of slips, run
in hole, tag bottom, pull out of
hole, place back in slips.”

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Automation is here ...



SPE-177825-MS

Breakthrough in Drilling Automation saves Rig Time and Safeguards Against Human Error
E. Abrahamsen, R. Bergerud, R. Kluge, M King

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Automation is here ...

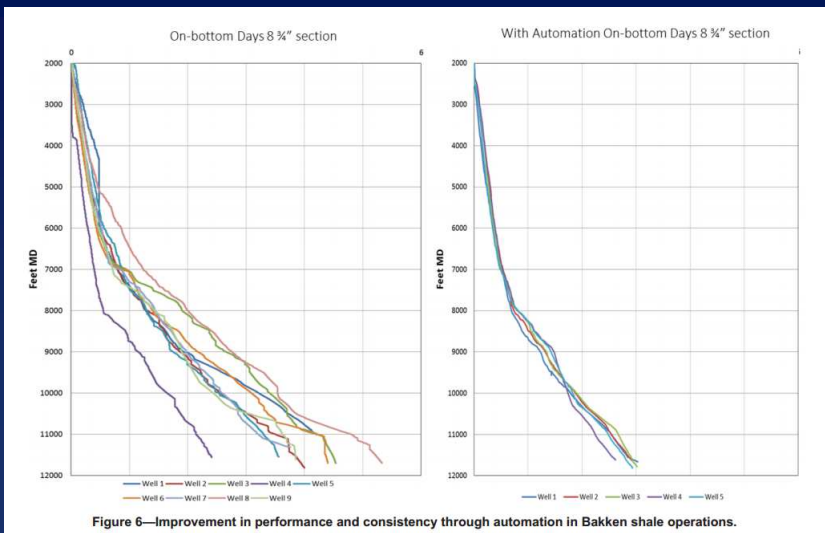


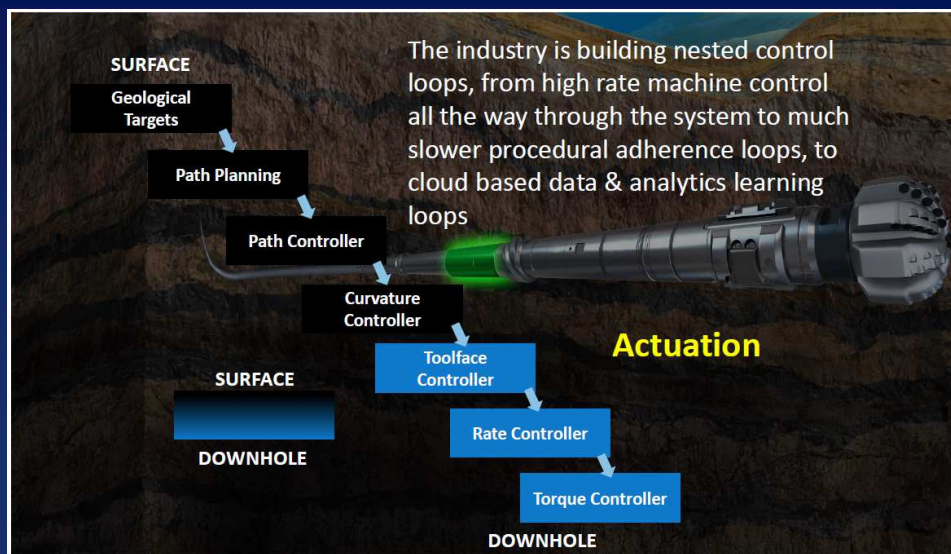
Image from
SPE-181047-MS
Business Models and KPIs as
Drivers for Drilling Automation
F.P. Iversen, J.L. Thorogood, J.D.
Macpherson, R.A. Macmillan

Data from
SPE-178870-MS
Using Wired Drill Pipe, High-Speed Downhole Data, and Closed Loop Drilling Automation Technology to Drive Performance Improvement Across Multiple Wells in the Bakken
Donald K. Trichel, Matthew Isbell, Bruce Brown, Major Flash, Michael McRay, James Nieto, and Isaac Fonseca

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Automation is here ...



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How big is the task?



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How big is the task?



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How big is the task?

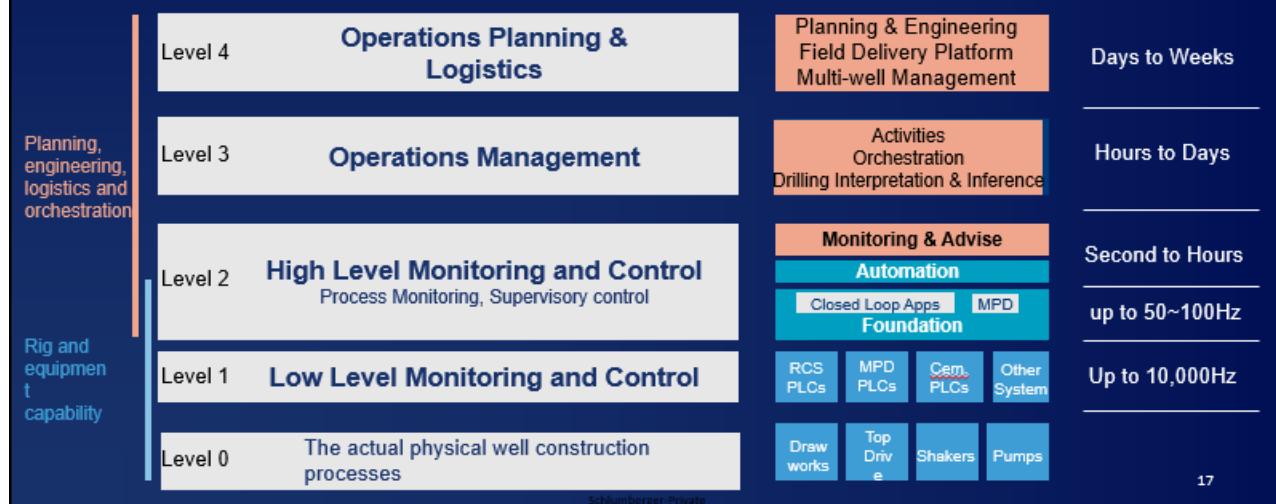


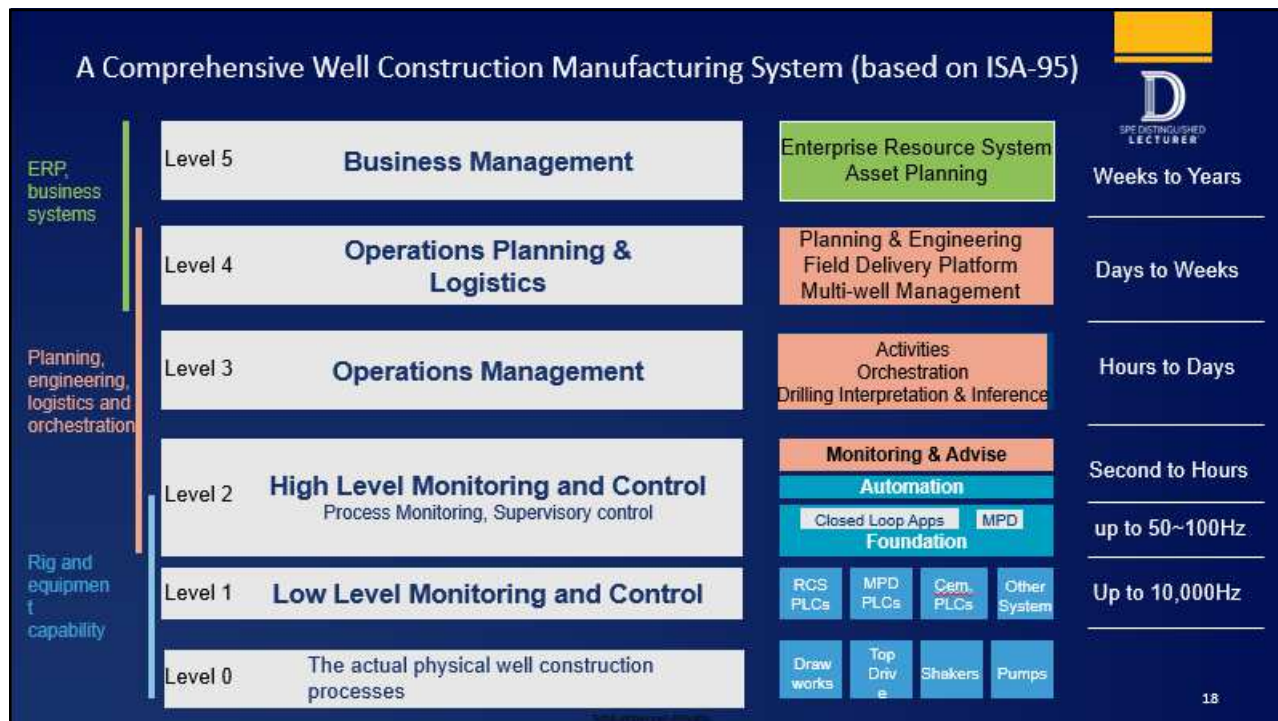
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A Comprehensive Well Construction Manufacturing System (based on ISA-95)

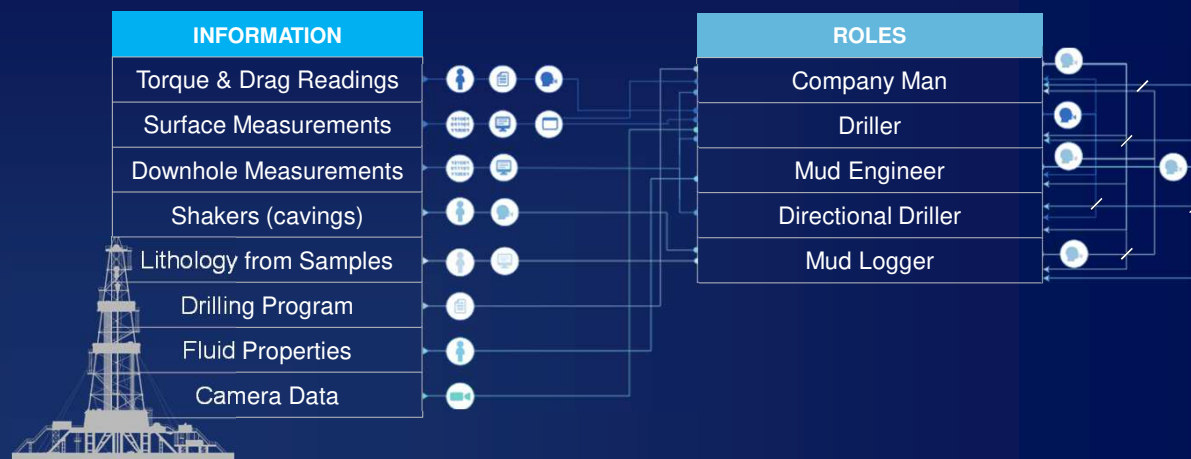


A Comprehensive Well Construction Manufacturing System (based on ISA-95)





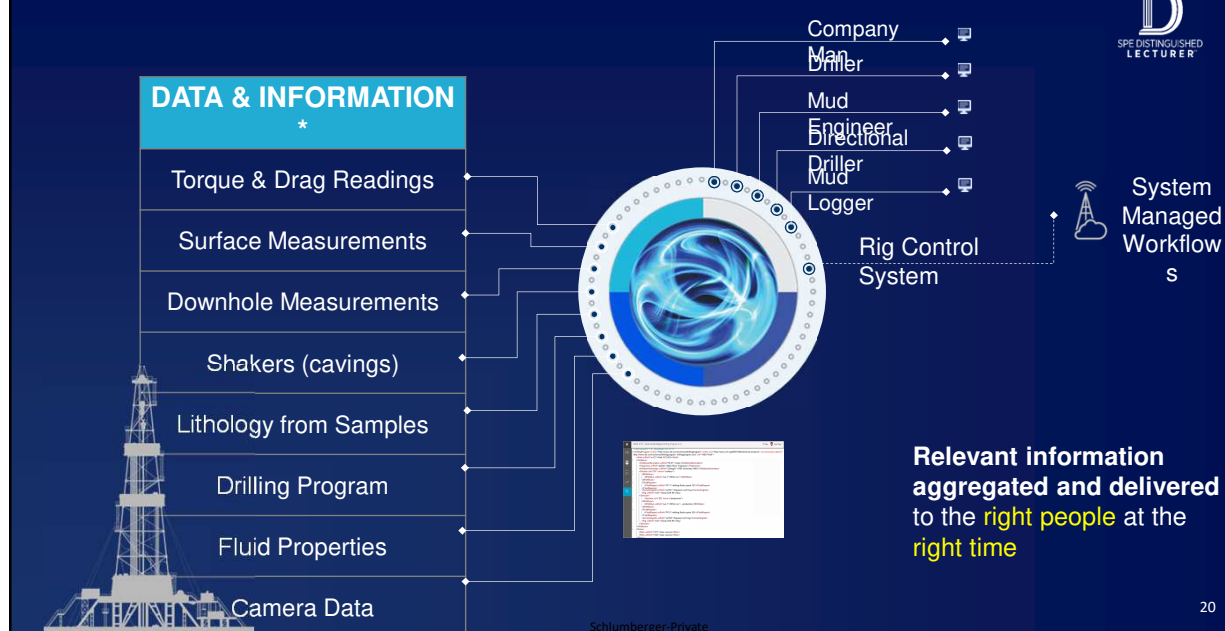
Current State | Managing Well Condition



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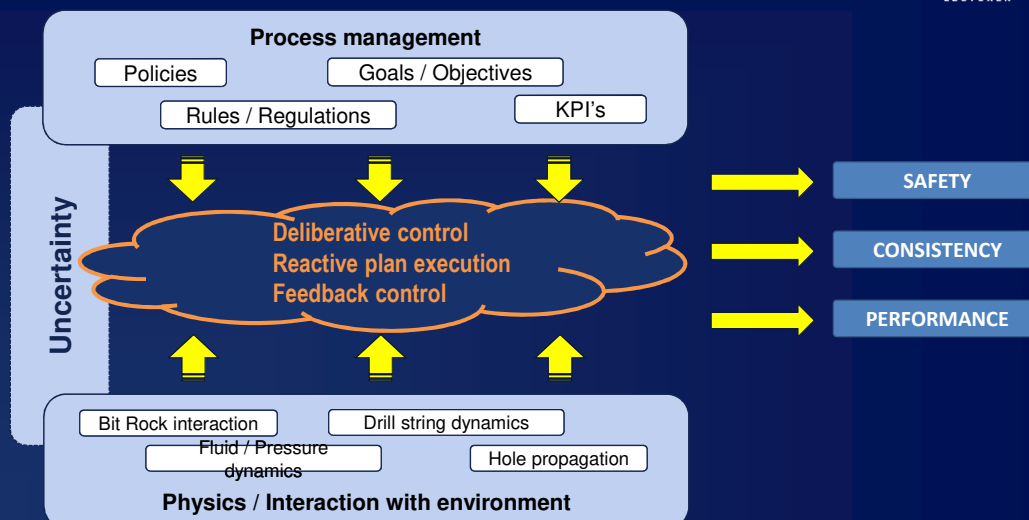
Operations Data and Information Management



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What is the real challenge?



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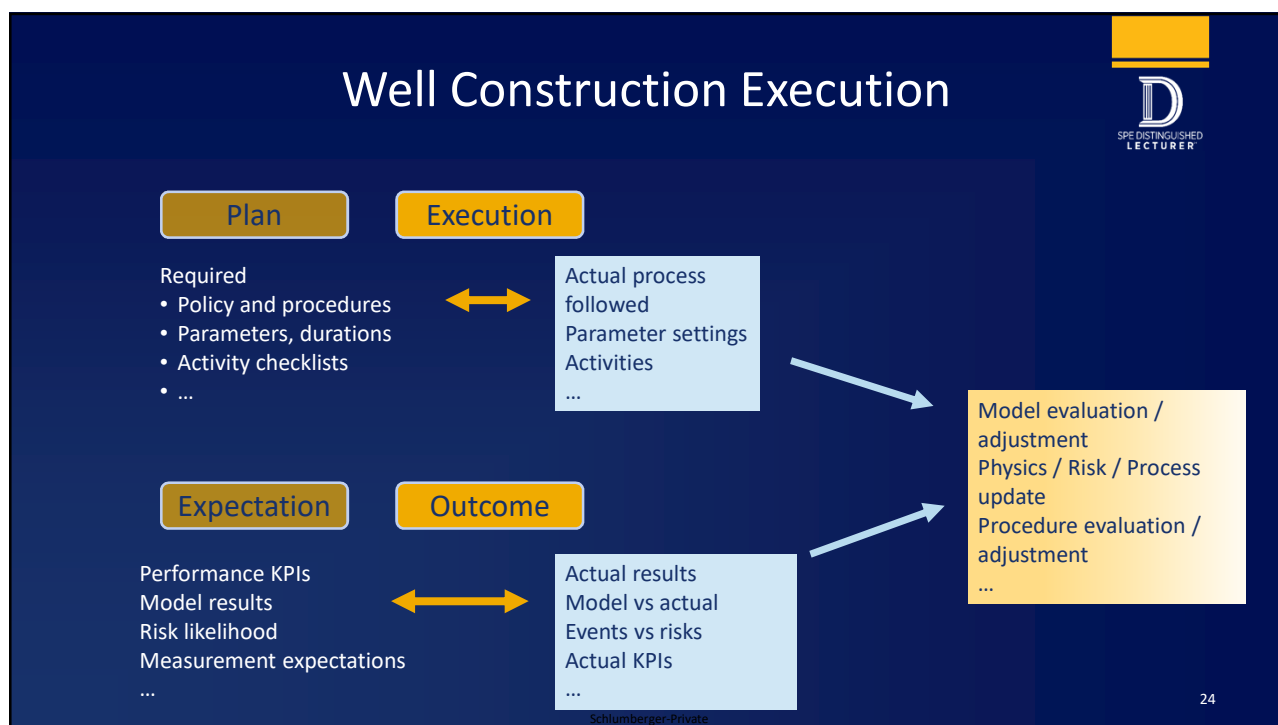
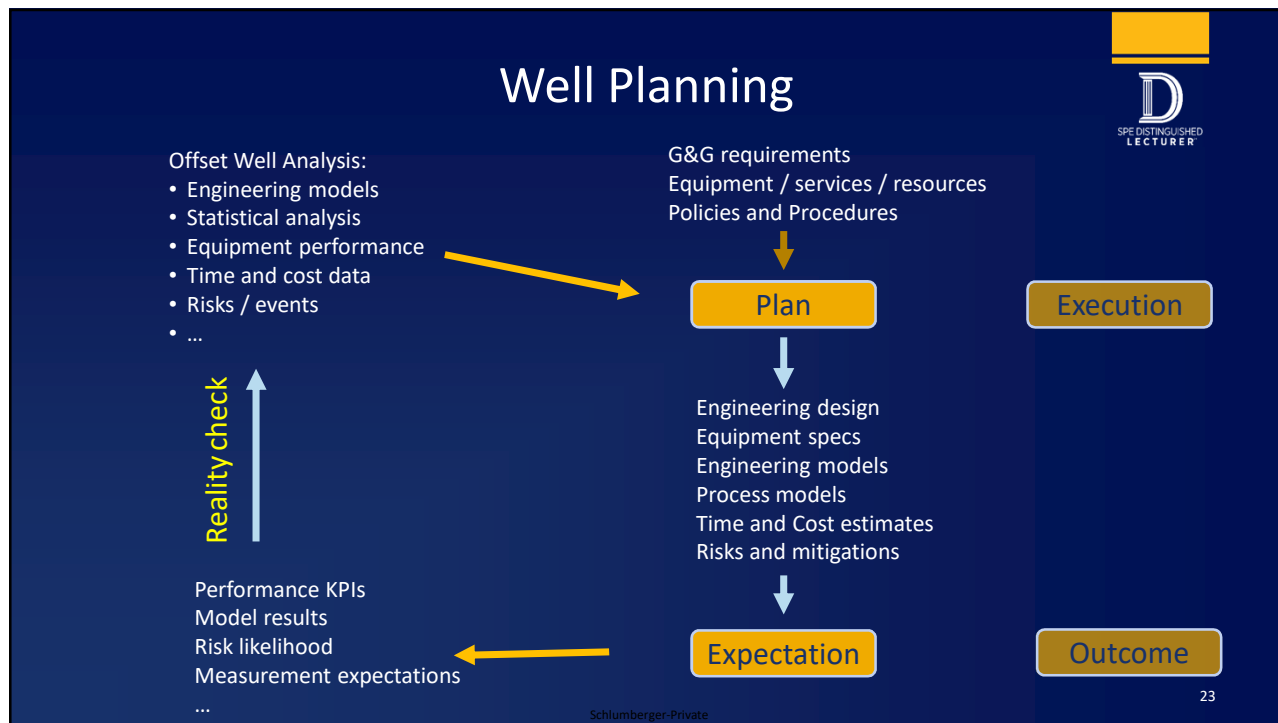
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A scale free approach



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Capturing the Learning



- Updating of:
 - Physics models
 - Process models
 - Drilling SOPs
 - Risk models
- Feedback on
 - Plans and procedures
 - Equipment performance
 - System performance

Every well is a dynamic learning opportunity

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What are the obstacles?



- Business model, Business model, Business model ...
 - Current siloed nature of industry makes collaboration difficult
 - Mix of day rate and incentive contracts reduces focus on system performance
 - Use of, access to, and ownership of data is opaque
- Aversion to risk
 - Liability issues
 - Fear of change of responsibility
- Technical bottlenecks
 - Lack of standards for equipment interoperability slows down implementation
 - Human factors often not considered
 - Situational awareness
 - Too much, then too little, trust in automation

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How do we overcome the obstacles?



- Change business relationships
 - Multiple stakeholders need to work together
 - To develop technology
 - To align incentives
 - To share the risks – and the rewards
 - Standards on data access
- Some things are hard to automate
 - Build hybrid systems
 - Focus on the role of the Human in the loop
 - Training, Neuro-ergonomics, career expectations, ...
- Technology moves faster than adoption – so be prepared to change
 - AI techniques improving every day
 - But be aware of the Hype Cycle ...
 - Leverage existing technology – many systems have under-utilized capabilities
- Goal is end-to-end automation, from design through execution, to learning

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Drilling Decision Management in the Future



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Conclusions



- Automation is here, and it is growing
- Integration of machine automation with process automation will be key
- Advances in AI and ML will offer great potential
- Clarity of process representation is needed
 - Must accommodate business models
 - But, business models will have to change

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Your Feedback is Important

Enter your section in the DL Evaluation Contest by
completing the evaluation form for this presentation
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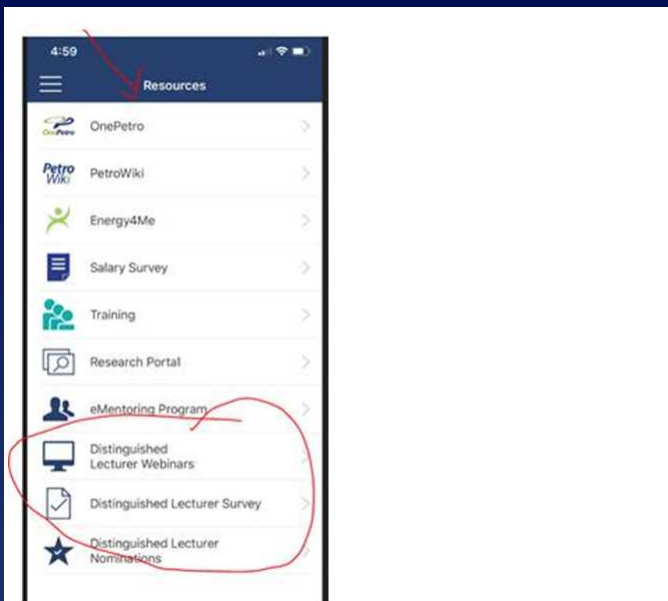


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Boston Dynamics



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