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Industry Analogies for Successful Implementation of Drilling Systems Automation and Real Time Operating Centers

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International Association of Drilling Contractors

Society of Petroleum Engineers



Industry analogies provide real insight for data and work flow

- Requirement to improve sensor quality
- Integrate the Islands of Data Flow
- Create holistic simulators
- Insights from Space, Aviation, Process / Pipeline control centers and Formula 1 racing
- Simplify the driller work environment
- One analogy stands out above the rest

Drilling Systems Automation

- Rapidly growing application
- Requires thus enables more accurate & high frequency data = improved sensors
- Expanding to complete drilling systems
 - Rig drives,
 - Mud treatment,
 - Downhole systems
 - BOP controls
 - Etc,

Parallel Data Flows – not integrated

- Drilling operations and performance data
 - measures and describes how the operation is performing and how the product (the well) is being delivered.
- Wellbore data
 - measured continuously and intermittently by service providers through specialist sensors in surface and downhole tools that is transmitted to the operator.
- Equipment status
 - measures the condition of equipment and provides information to determine service and repair interventions.

Simulator comparisons

Drilling

- Initially well control
- Then rig floor / pipe handling
- Hardware In the Loop
- Recently modeling of drilling operations (DWOP)

Industry

- Aviation – training unexpected situations
- Formula 1
 - High fidelity predictions
 - Model of the vehicle
 - Now used for complex surgical procedures

Industry Analogies

Data & Work Flows

Data Flow Analogy

Rating the Analogy Impact

Rating the Well Type Application

Rating the Data Flow Analogy

Criteria	Space	Aviation	Control centers	Formula 1
Simulations	Yes	Yes	No	Yes
Manage equipment condition	Yes	Partially	Partially	Yes
Understand the “scene”	Yes	Low uncertainty	Not necessary	Yes
Focus on reliability	Yes	Yes	Consistent	Yes
Focus on performance	No	No	Defined process	Yes

Simulations are used in multiple analogues

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Data Flow Analogy

Remote equipment condition management is common

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Data Flow Analogy

Interpreting an uncertain environment is unique

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Data Flow Analogy

Focus on reliability is broad

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Data Flow Analogy

Focus on performance is unique to the Formula 1 Analogy

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Data Flow Analogy

Space and Formula 1 compare very favorably in data flow analogy

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Data Flow Analogy

Rating the Impacts of the Analogy

Criteria	Space	Aviation	Control centers	Formula 1
Managing uncertainty in a dynamic environment	Med	Low	Low	High
Updating subsurface models in real time	Med	Low	Low	High
Data sensing requirements	High	High	High	High
Predictive capability	Med	Low	Low	High
Crisis reaction	Med	High	High	High
Man / machine interface	Med	High	High	High
Instrument displays - especially for the driller	Med	High	High	High
Real time decision making capability	Med	High	High	High
Simulation	Med	High	Low	High
Performance improvement capability	Low	Low	Low	High

Managing uncertainty in a dynamic environment

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Analogy Impacts

Updating subsurface models in real time

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Analogy Impacts

Data sensing requirements

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Analogy Impacts

Predictive capability

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Analogy Impacts

Crisis reaction

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Simulation	Med	High	Low	High
Performance improvement capability	Low	Low	Low	High

Analogy Impacts

Man / Machine Interface

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Simulation	Med	High	Low	High
Performance improvement capability	Low	Low	Low	High

Analogy Impacts

Instrument displays for the operator

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Simulation	Med	High	Low	High
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Analogy Impacts

Real time decision making capability

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Predictive capability	Med	Low	Low	High
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Simulation	Med	High	Low	High
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Analogy Impacts

Simulation

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Analogy Impacts

Performance improvement capability

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Analogy Impacts

Formula 1 leads Aviation and Control Centers

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Analogy Impacts

Well Types

Alignment of the analogy

Criteria	Space	Aviation	Control centers	Formula 1
Projects	High	Low	Low	High
Customize	High	Low	Low	High
Batch	Low	Medium	Medium	High
Repetitive	Low	Medium	High	High

Exploration Wells

Factory Style Drilling

Project well types align to Space and Formula 1

Criteria	Space	Aviation	Control centers	Formula 1
Projects	High	Low	Low	High
Customized	High	Low	Low	High
Batch	Low	Medium	Medium	High
Repetitive	Low	Medium	High	High

Well Type Application

Customized well types align to Space and Formula 1

Criteria	Space	Aviation	Control centers	Formula 1
Projects	High	Low	Low	High
Customized	High	Low	Low	High
Batch	Low	Medium	Medium	High
Repetitive	Low	Medium	High	High

Well Type Application

Batch well types align to Formula 1 then Aviation and Control Centers

Criteria	Space	Aviation	Control centers	Formula 1
Projects	High	Low	Low	High
Customized	High	Low	Low	High
Batch	Low	Medium	Medium	High
Repetitive	Low	Medium	High	High

Well Type Application

Repetitive well types align to Formula 1 and Control Centers then aviation

Criteria	Space	Aviation	Control centers	Formula 1
Projects	High	Low	Low	High
Customized	High	Low	Low	High
Batch	Low	Medium	Medium	High
Repetitive	Low	Medium	High	High

Well Type Application

Well Types alignment strongly favors the Formula 1 analogy

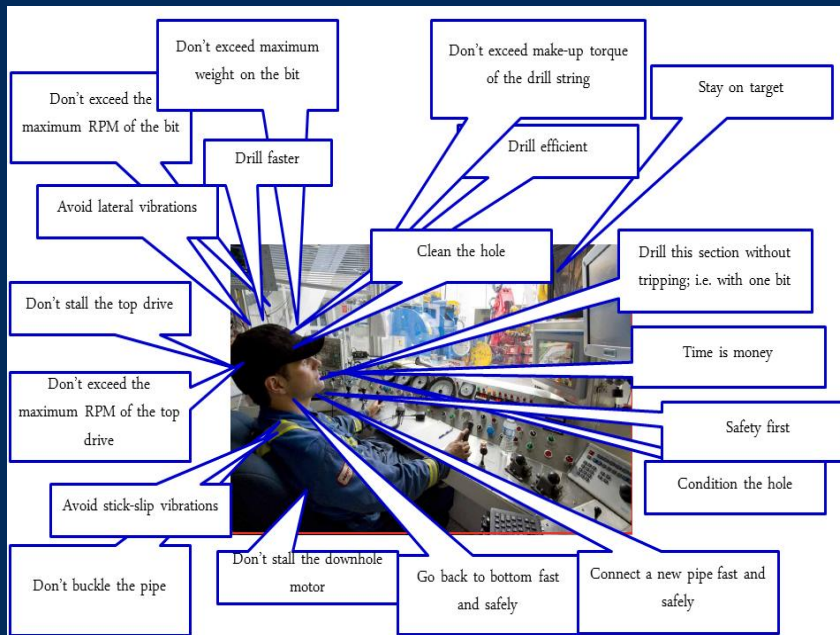
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Repetitive	Low	Medium	High	High

Space flight matches the project and customized end of the spectrum

Control centers match the repetitive end of the spectrum

Get out of my office

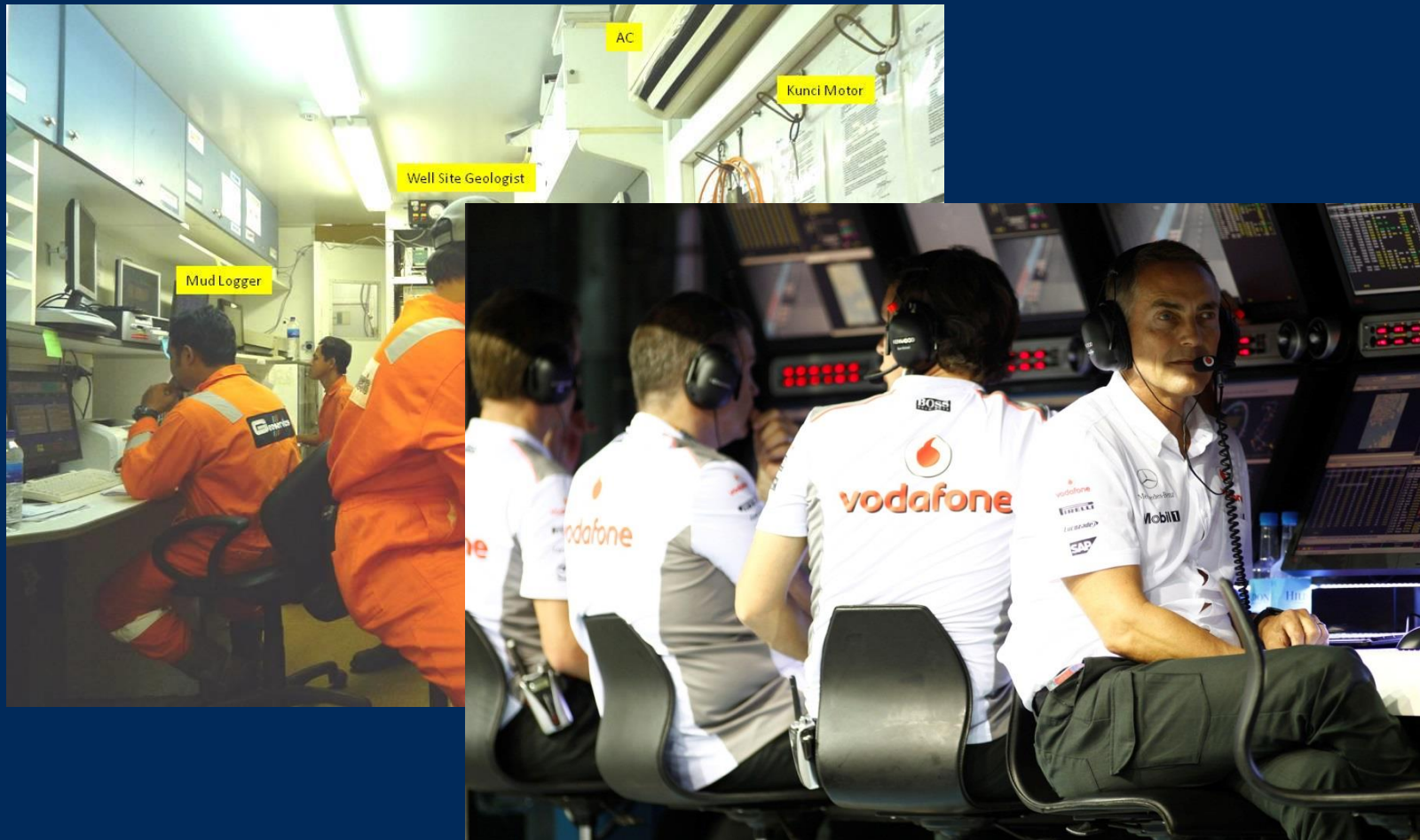
“Leave me alone, I know what I am doing” Kimi Räikkönen



Courtesy Shell



Who would you rather have support you site operations?



Can you monitor 300 data feeds simultaneously in real time?



F1 is expanding into industry

- Pharmaceuticals
 - More efficient planning processes
 - Data modeling
 - High speed process control
- Air Traffic Control
 - Predictive technology and simulation
- Health care
 - Condition measurement and prediction
 - Complex surgical procedures

When complex well construction becomes adaptive it will require:

- Significant automation at the site
- Hierarchical, real time data management.
- High data rate telemetry, globally.
- Storage and management of immense data volumes in real time
- Predictive modeling and fast decision making
- Simulations of technology, equipment and performance

When complex well construction becomes adaptive it will require:

- Significant automation at the site
- Historical real time data management.
- High bandwidth connectivity
- Storage of large volumes of data
- Storing large volumes in real time
- Predictive modeling and fast decision making
- Simulations of technology, equipment and performance

**Formula 1 technologies
offer solutions**

Manufactured wells flow at a very high pace

- Integrated, autonomous systems
- Multiple machines into one hierarchical system
- High data rate to remote center with real time management
- Condition measurement and prediction

Manufactured wells flow at a very high pace

- Integrated, autonomous systems
- Multiple machines into one hierarchical

Formula 1 technologies offer solutions

time

- Hi management
- Condition measurement and prediction

Do you want to win?

CHANGE THE GAME





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Thank You

John de Wardt

Feedback is the breakfast of Champions!



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