



EXEBENUS

EXEBENUS PULSE®

Real-time insight & Full-time confidence.

31 May 2021





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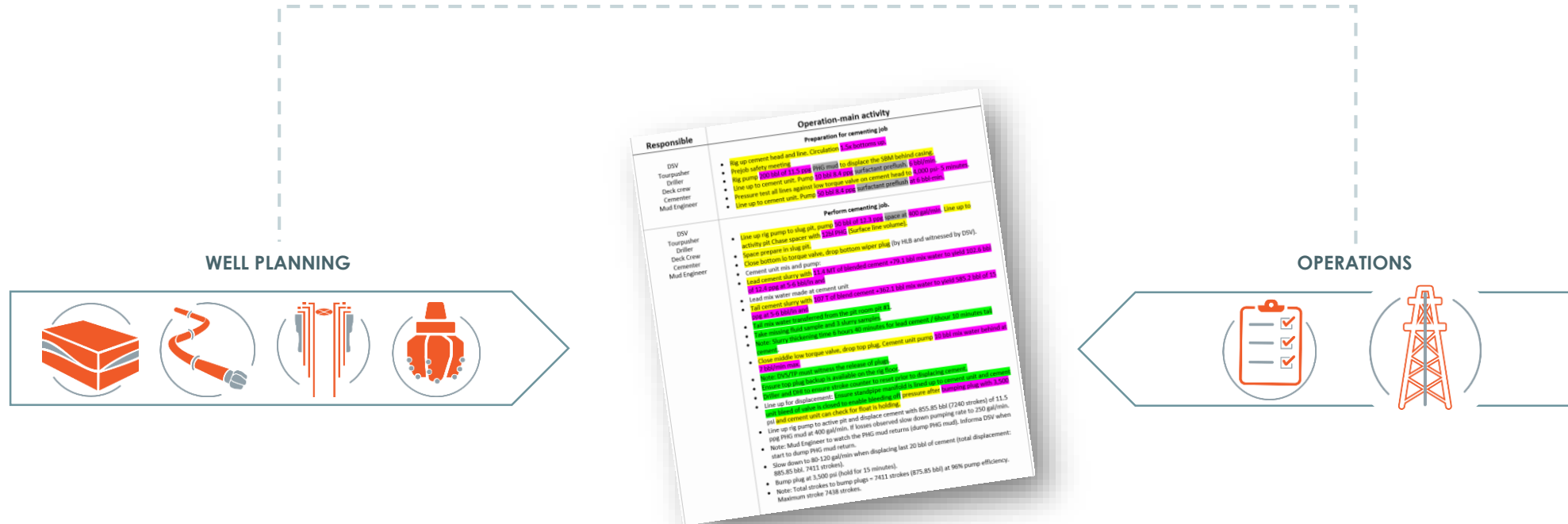
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## Today's work process – text rich, PDF documents



 NO COMMON LANGUAGE

☒ NO STANDARDS

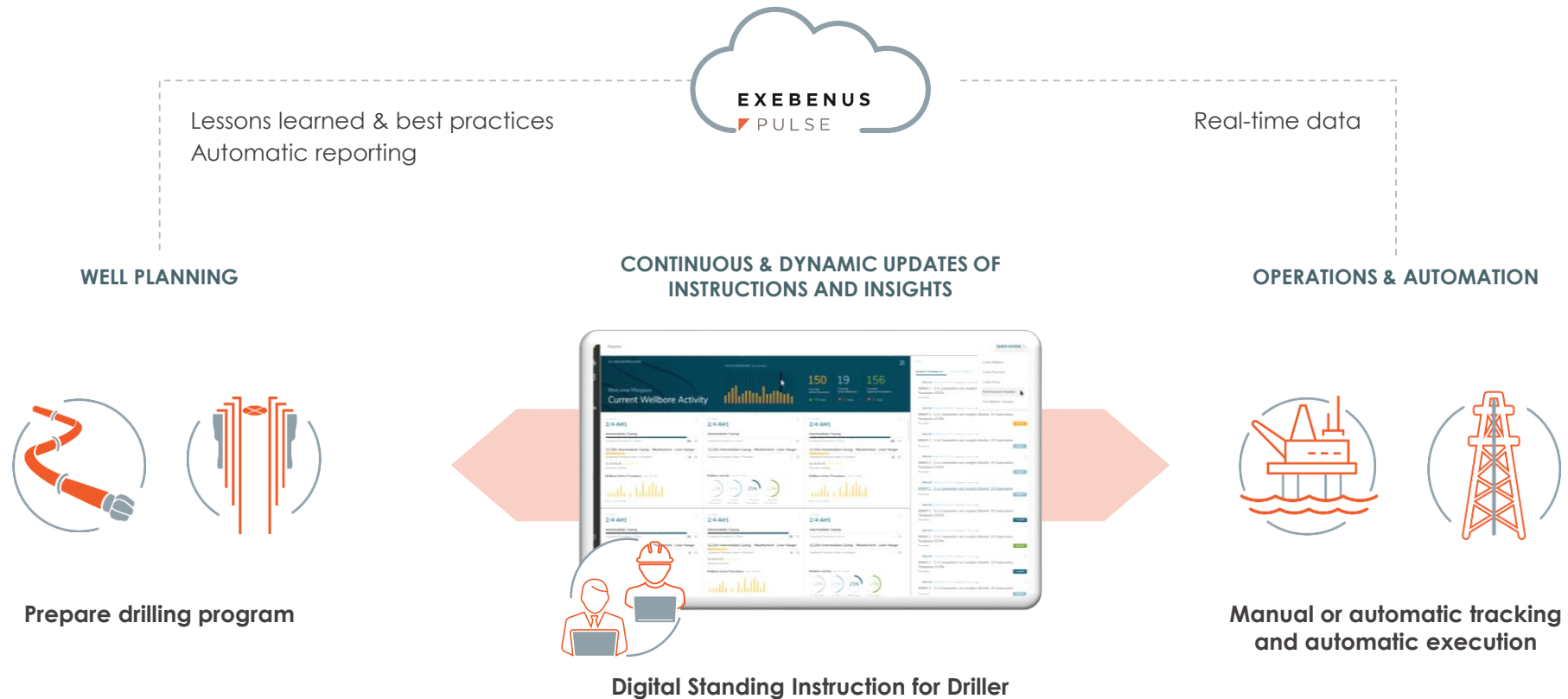
☒ NO DIGITALIZATION

☒ NO CONSISTENCY





# Exeбенus supports digitalization and standardization



✓ INCREASE QUALITY

✓ REDUCE HUMAN ERROR

✓ REDUCE DOWNTIME

✓ ENABLE AUTOMATION

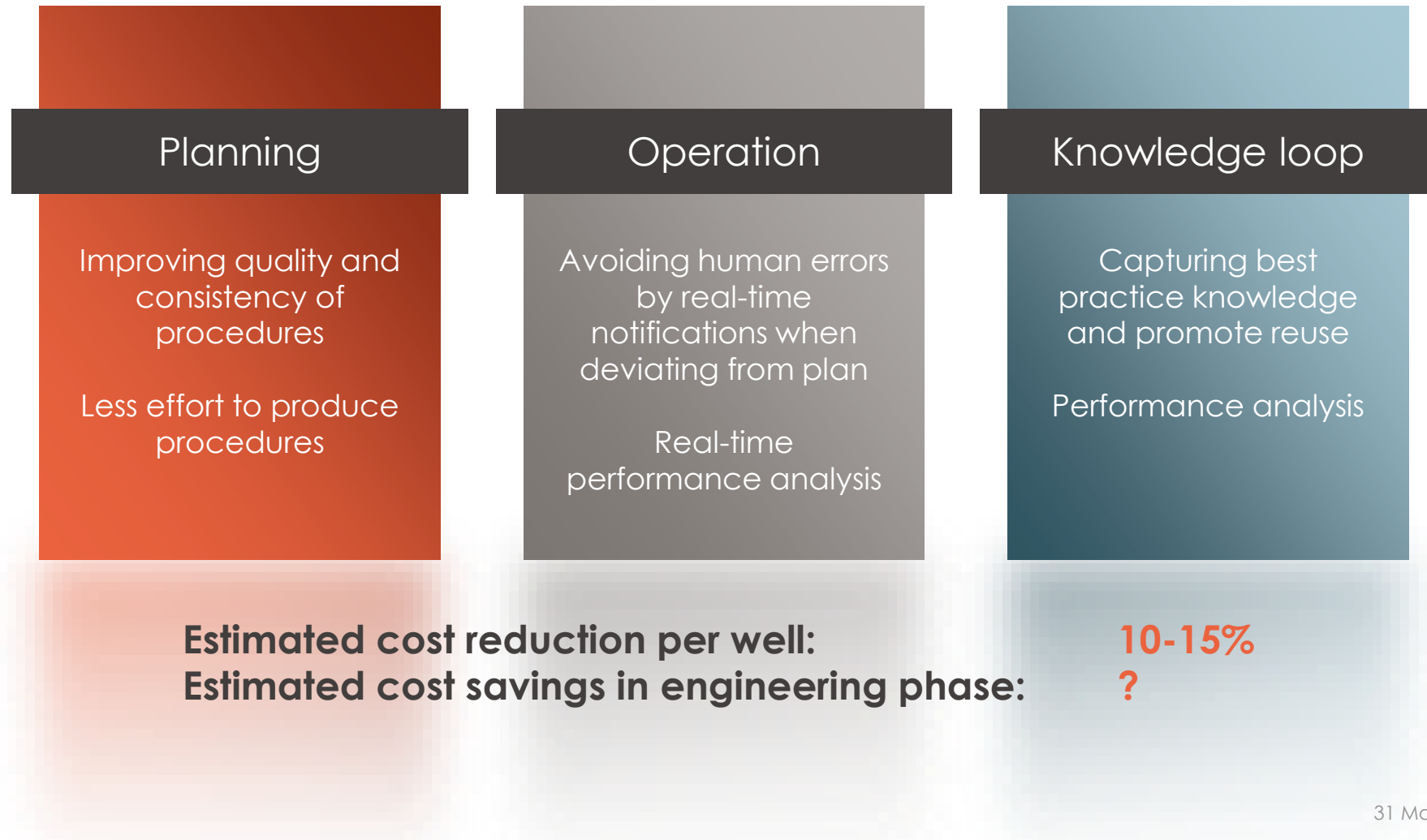




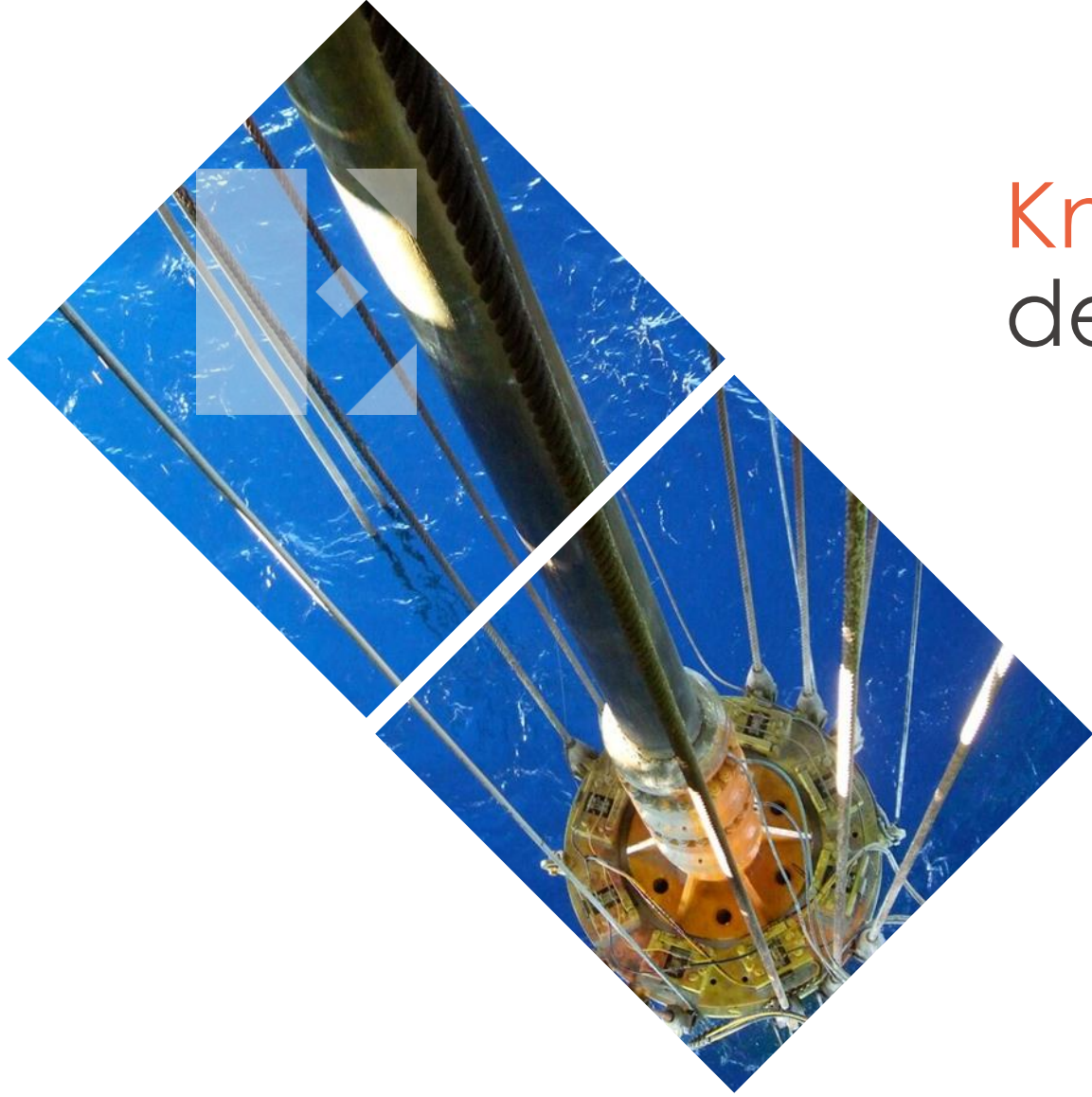




# Exeбенus Pulse value proposition







Know why you  
deviate from plan





# Exeбенus Pulse setup

2. Run in hole Run in hole

1 PLANNED TIME 0d 01:20:00s

2 START 31-7-2019 23:34:30 END 1-8-2019 24:56:40 IDLE TIME 0d 00:03:50s

3 ACTUAL TIME ACTIVITY 0d 01:21:50s

2.1 Make up TCP gun assembly for B lower perforation.

5 START 31-7-2019 23:34:30 END 1-8-2019 24:03:20 ACTUAL TIME 0d 00:28:45s

862 m

2.2 Flow check - static well prior TIH.

START 1-8-2019 24:07:05 END 1-8-2019 24:24:00 ACTUAL TIME 0d 00:16:50s

Keep pressure steady (rig pumps) for time 20 min 17 min

864 m

Completion  
Lesson Learned added in operation  
The safety clamp did not fasten properly to the TCP guns,

1=Planned time 2= Start, end and idle time 3=Actual time 4=Task notifications  
5=On plan validation 6=Deviation from plan notification 7=Operational lessons learned



← Demo A - Demo Field

ACTIVE Changes saved

OVERVIEW

PROCEDURE

WELLBORE

STRING

Datalogs

Pre-operation

Operation

Post-operation

1. Run in hole Run in hole

2. Make up Make up Liner hanger assembly

3. Make up Verify that liner hanger is connected to string

4. Run in hole Run in hole

1.1 Trip in

Running speed 0.3 m/s

Bit MD Bit MD 1200 m – 1590 m

Details

SYSTEM SUB-ACTIVITY	START	END	
connection	23-11-2019 07:01:16	23-11-2019 07:01:54	✓
connection	23-11-2019 07:02:38	23-11-2019 07:05:10	✓
lowerstring	23-11-2019 07:05:24	23-11-2019 07:06:46	✓
connection	23-11-2019 07:06:54	23-11-2019 07:08:00	✓
lowerstring	23-11-2019 07:08:36		

Notes

Make-up and Torque Guidelines:

Currently active sub-activity : Trip in

Next: Change handling equipment

Mechanical Risk Local

Closely monitor hookload and utilize AHC as the 11-7/8" shoe passes through the following: -BOP and wellhead -16.15" seal assembly / casing hanger

Mitigation:

- BOP and
- wellhead 16.15" seal assembly / casing hanger

Severity  Probability

ASSISTANT DRILLER

Check Local

Check torque on 1st 5 doubles. If no movement, spot check every 10th double.

Checked by Jan K Igland, Drilling Engineer at Exebenus AS 19:08 2-5-2021

Stop

Tripping in 11 7/8" liner





Follow your plan  
automatically track &  
validate activities as  
they occur



✓ 1. Meeting Pre-job safety meeting

## Expand all Off

**1.1 Pre-job safety meeting** Hold JSA to cover running TCP assembly. Document on IADC.

🕒 START DD:MM:YY 00:00:00 🕒 END DD:MM:YY 00:00:00 🕒 ACTUAL TIME 0 d 0 h 0 min 0

862 m



Asset	Risk Standard
1. Cash	Low
2. Government bonds	Low
3. Corporate bonds	Low to Moderate
4. Stocks	High
5. Commodity	High
6. Cryptocurrency	Very High

Ensure good communication between all involved.

**Mitigation:** Test radio communication prior new main operations


Severity  Probability 

TOOLPUSHER  
Check Standard

All personnel involved in the operation to be present and understand their task related to the ongoing operation. Plan work and communicate.

## Post-operation

2. Run in hole Run in hole

 **PLANNED TIME**  
0d 01:20:00s

### 2.1 Make up TCP gun assembly for B lower perforation.

🕒 START DD-MM-YY 00:00:00 🕒 END DD-MM-YY 00:00:00 🕒 ACTUAL TIME 0 d 0 h 0 min 0

040



ASSISTANT DRILLER  
Check Local

Check for falling objects in Derrick prior tripping

Currently active sub-activity : Pre-job safety meeting

➡ Next: Make up

ENABLE SKIP MODE >>

Settings

Start

# RIH with TCP gun assembly, pressure test flowhead





# RIH with TCP gun assembly, pressure test

Time and depth log 0d 04:16:05s								
PROCEDURE START 31-7-2019 23:00:30								
PROCEDURE END 1-8-2019 03:18:05								
PROCEDURE IDLE TIME +0d 00:52:35s								
operation	start	stop	planned time	actual time	idle time	planned depth	actual depth	more
3.3 Close	1-8-2019 01:33:50	1-8-2019 01:54:25		0d 00:20:30s		1735 m	1735.3 m	
3.4 Pressure up - cement pu...	1-8-2019 02:05:15	1-8-2019 02:08:05		0d 00:02:50s		1735 m	1735.3 m	
Increase pressure (cement ...	1-8-2019 02:05:15	1-8-2019 02:05:35		0d 00:00:20s				
Keep pressure steady (ceme...	1-8-2019 02:05:35	1-8-2019 02:08:05		0d 00:02:30s				
3.5 Observe pressure drop - ...	1-8-2019 02:08:05	1-8-2019 02:08:25		0d 00:00:20s		1735 m	1735.3 m	
Reduce pressure (cement p...	1-8-2019 02:08:05	1-8-2019 02:08:25		0d 00:00:20s				
4. Pressure test surface lines	1-8-2019 02:15:00	1-8-2019 02:22:25	0d 00:10:00s	0d 00:07:50s	+0 d 0 h 0 min			
4.1 Pressure - cement pump	1-8-2019 02:15:00	1-8-2019 02:22:25		0d 00:07:25s		1735 m	1735.3 m	
Increase pressure (cement ...	1-8-2019 02:15:00	1-8-2019 02:15:50		0d 00:00:50s				
Keep pressure steady (ceme...	1-8-2019 02:15:50	1-8-2019 02:21:55		0d 00:06:05s				
Reduce pressure (cement p...	1-8-2019 02:21:55	1-8-2019 02:22:25		0d 00:00:30s				
5. Circulate	1-8-2019 02:31:55	1-8-2019 03:18:05	0d 00:40:00s	0d 00:47:40s	+0 d 0 h 0 min			



A photograph of an offshore oil rig at sunset. The sky is a vibrant orange and red, transitioning to a blue and grey sky with clouds on the right. The rig's yellow structure is silhouetted against the sky. In the foreground, a dark, textured surface, possibly a deck or a field of reeds, is visible. A white diagonal line runs from the top left to the bottom right, separating the orange sky from the blue sky. A white diamond shape is superimposed on the right side of the image, framing the rig's structure.

EXEBENUS

EXEBENUS CURRENT ML™

Real-time predictive situational awareness





## Machine learning business value

# Stuck pipe is a key cost driver for the industry

**Stuck pipe is a major cause of NPT with an estimated industry cost exceeding \$580 Mill USD per year for the industry**

- Stuck pipe mainly results from differential sticking (25 %), packed hole (42 %) or jammed pipe (20 %)
- Stuck pipe occurs predominantly during tripping/reaming (56 %), while drill string is stationary (30 %), and during steady drilling operations (14 %)\*
- Early alerts allow the rig crew to implement corrective action before getting stuck and avoid the stuck pipe

\* Skalle, P., Aamodt, A., & Sveen, J. (1998, November). Case-Based Reasoning, a method for gaining experience and giving advice on how to avoid and how to free stuck drill strings. IADC Middle East Drilling Conference, Dubai, Nov. 3-4, 1998. In Proceedings of IADC middle east drilling conference (Vol. 1, p. 11).

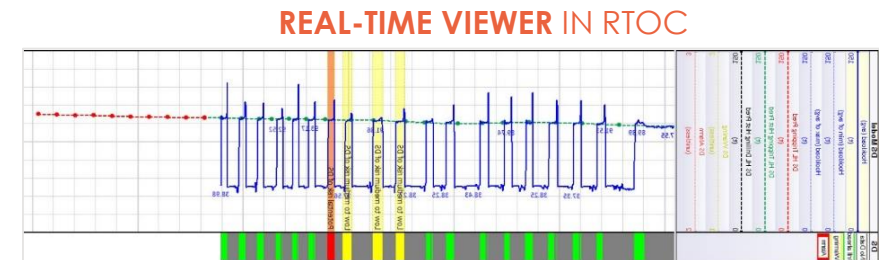
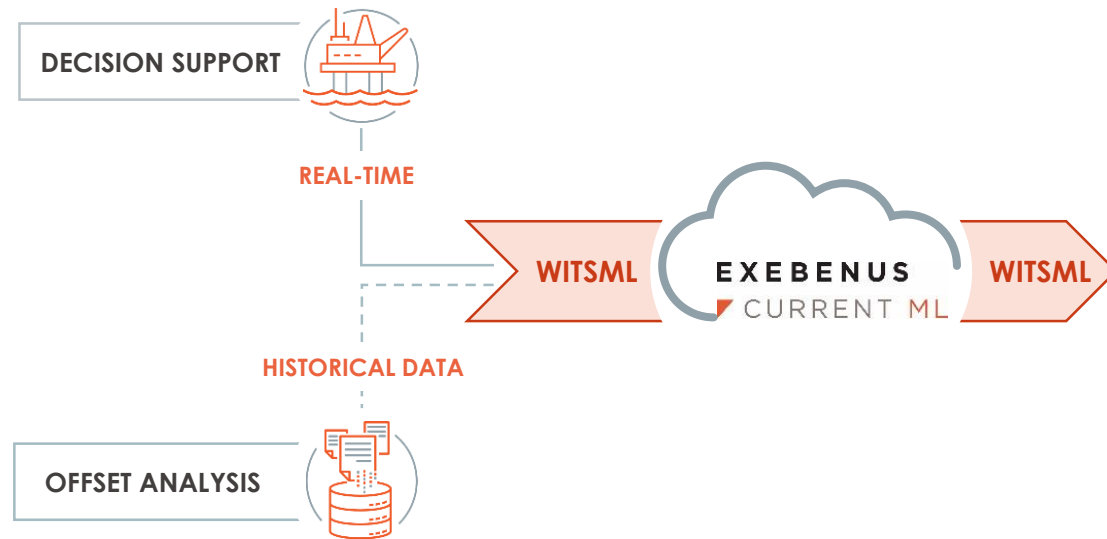




# Exeбенus Current ML

For offset analysis and real-time predictions

- 'One Problem – One Model'
- Vendor neutral plug & play – easy to interpret additional log in WITSML viewer
- No human interaction required
- For real-time operation center engineers and data analysts







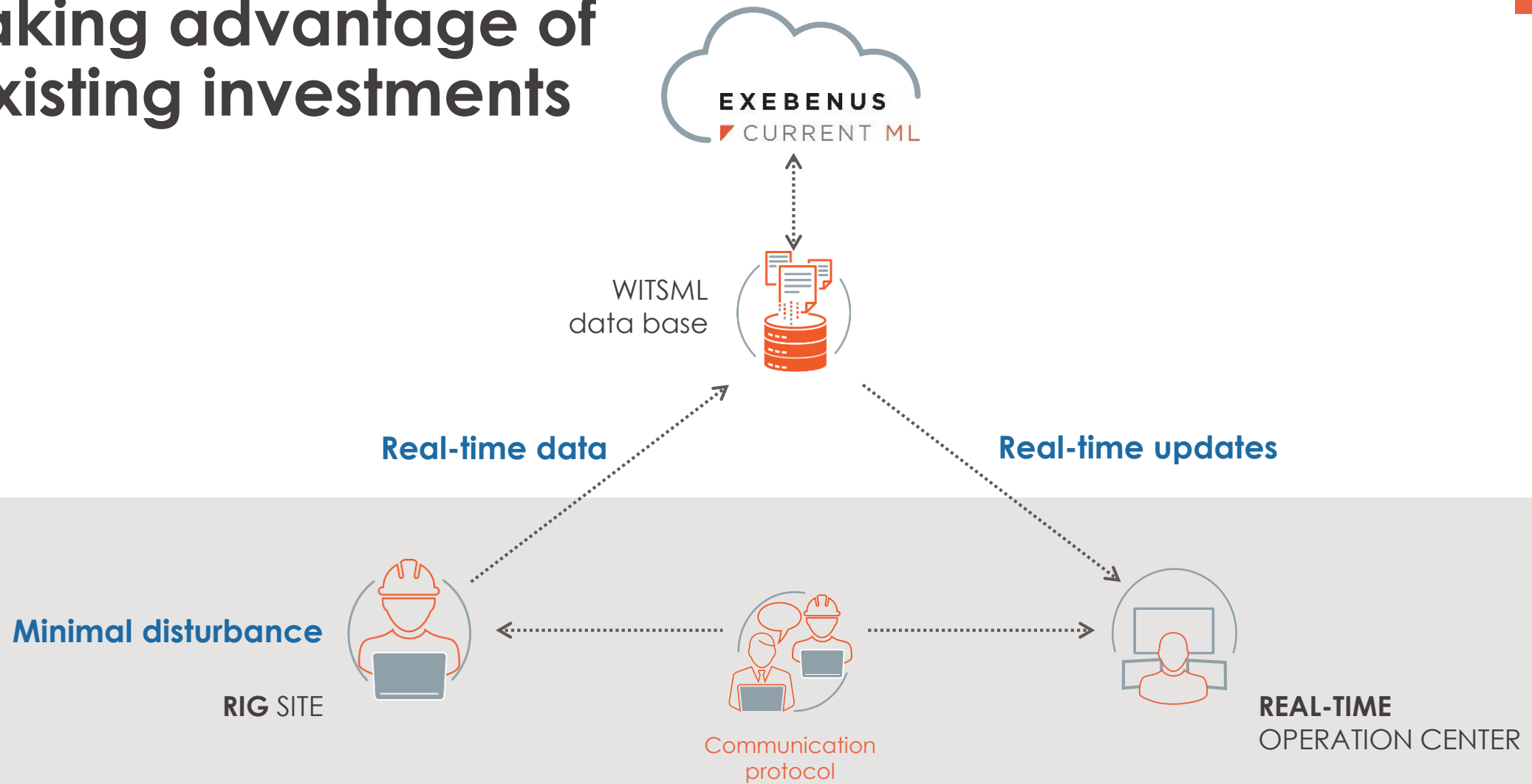
# Stuck pipe

- Differential sticking (DS)
- Wellbore geometry (WG)
- Hole cleaning (HC)





# Taking advantage of existing investments







# Agents' predictive warnings and lead times

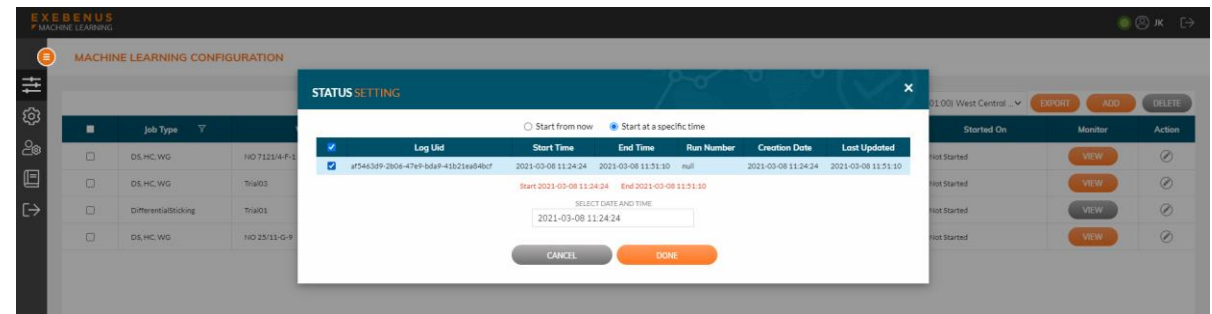
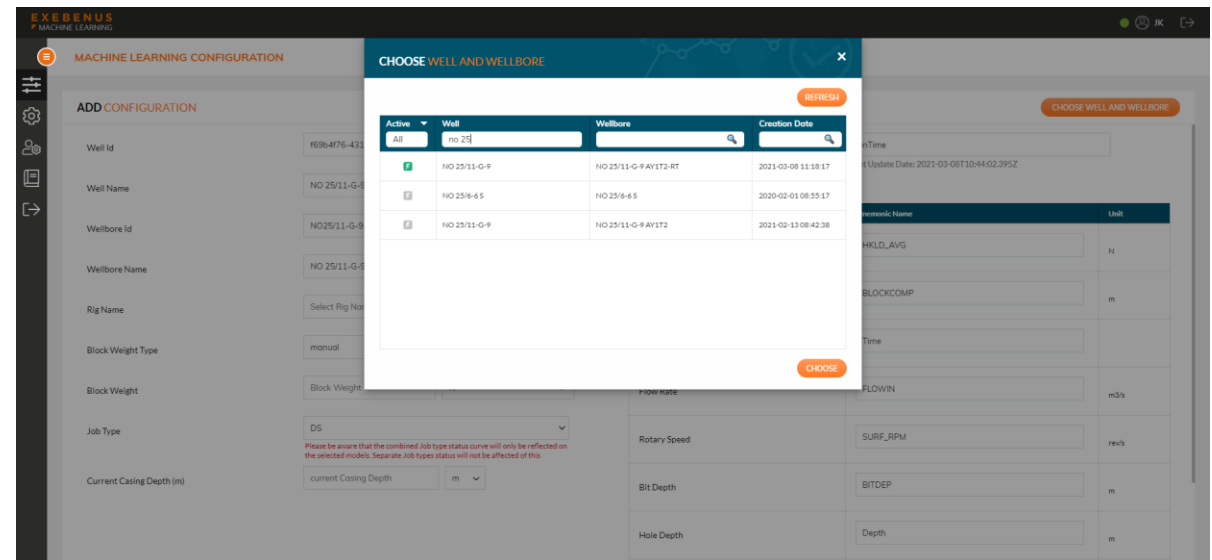
STUCK PIPE ML AGENT	PREDICTIVE TIME	INPUT DATA
<b>Differential sticking (DS)</b>	Up to four hours ahead	Time, bit depth, hole depth, hookload, flow rate, RPM, block position
<b>Wellbore geometry (WG)</b>	Up to four hours ahead	Time, bit depth, hole depth, hookload, flow rate, RPM, trajectory, block position
<b>Hole cleaning (HC)</b>	Up to one hour ahead	Time, bit depth, hole depth, hookload, flow rate, RPM, trajectory, mud density in, ROP, stand-pipe pressure





# Easy and fast configuration of new operation

- Browse for wellbore on WITSML server
- Select wellbore
- Select Agents to run
- Auto curve mappings & config - check
- Start agents – runs throughout wellbore
- Run multiple wellbores in parallel









# Customer engagement levels

## Demo

The purpose of a live demo is to show case and discuss some of the key capabilities of Exeбенus Current ML agents in interaction with you.

01

## Trial

With a minimum risk, cost and exposure we trial Exeбенus Current ML agents using your historical WITSML data.

02

## Pilot

Perform live tests on processes and capabilities of Exeбенus Current ML agents on your own live data. We will provide introduction training for selected users.

03

## Implementation

During a few weeks Exeбенus Current ML Agents is setup and integrated with your company's standards and processes.

04





# EXEBENUS

## Thank you!

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Live  
Pulse

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