International Association of Drilling Contractors

IADC ART Data, Controls and Sensors (DCS) Subcommittee
09.00-11.00 Wednesday, 20 April 2022
Hybrid meeting
IADC Headquarters, Crown 1 Conference Room
3657 Briarpark, Ste 200
Houston, TX 77042

In Attendance:

Alyssa Franklin, IPT Global
Andrew McKenzie, NOV
Andy Westlake, Seadrill
Ashley Fernandes, Precision Drilling
Assaad Mohanna, NOV
Brandt Lanzet, NOV
Calvin Holt, Drilldocs
Cody MacDonald, IPT Global
Duncan Blue
Dustin Daechsel, Shell
Dustin Torkay, Seadrill
Ernie Prochaska, NOV
Fred Florence, RigOps
Hans Schmidt, Expro
Gene Stahl, Precision Drilling
James Forester, NOV
John Sutler, BP
Kamalpreet Kaur, NOV
Karma Slusarchuk, Parker Wellbore
Konstantin Puskarskij, Maersk Drilling
Kristopher Pearce, IPT Global
Lars Raunholt, Canrig
Majid Moosavinia, Pruitt
Marco Perez, Weatherford
Mark Anderson, Ensign
Maxine Aitkenhead, Data Gumbo
Mike Party, Hess
Nathan Moralez, BP
Pradeep Annaiyappa, Nabors
Read Minshall, NOV
Richard Cully, IPT Global
Robert Prince-Wright, Berkeley & Imperial LP
Robert van Kuilenburg, Noble Corporation
Robert Wylie, xnDrilling
Serafima Schaefer, Exebenus
Shashi Talya, Halliburton
Tom Yost, NOV
Tony Eschete, Caterpillar
Victor Yung, Volant Products
Linda Hsieh, IADC
Stephanie Carling, IADC

Nathan Moralez, BP, and Andy Westlake, Seadrill, made welcoming remarks. Stephanie Carling gave a safety briefing, and Linda Hsieh briefed the group on IADC's anti-trust policy.

The subcommittee then heard presentations from 5 guest speakers:

- Dan Allford, Offshore Robotics, CEO (see slides)
- Ashley Fernandes, Precision Drilling, VP of Drilling Technology
- Brandt Lanzet, NOV, Drilling Specialist, Automation Programs (see slides)
- "Field experience with robotics on drilling rigs," Lars Raunholt, Canrig Robotic Technologies, CEO (see slides)
- "Illuminating Black Box Decisions in Automated Systems," Rick Cully, IPT Global, Sr. Product Owner (see slides)

Moving on to DCS Subcommittee business:

- Andy Westlake noted that the IADC Rig Sensor Stewardship Guidelines would go live soon. It was suggested that early adopters of the guidelines could be invited to a future DCS meeting to share their learnings.

- Nathan Moralez noted that the Drilling Rig Control Systems Minimum Safety Features Guidelines have still not been completed. If anyone in the industry is interested in volunteering to take that project up and carry it through the finish line, please contact Linda Hsieh at linda.hsieh@iadc.org.

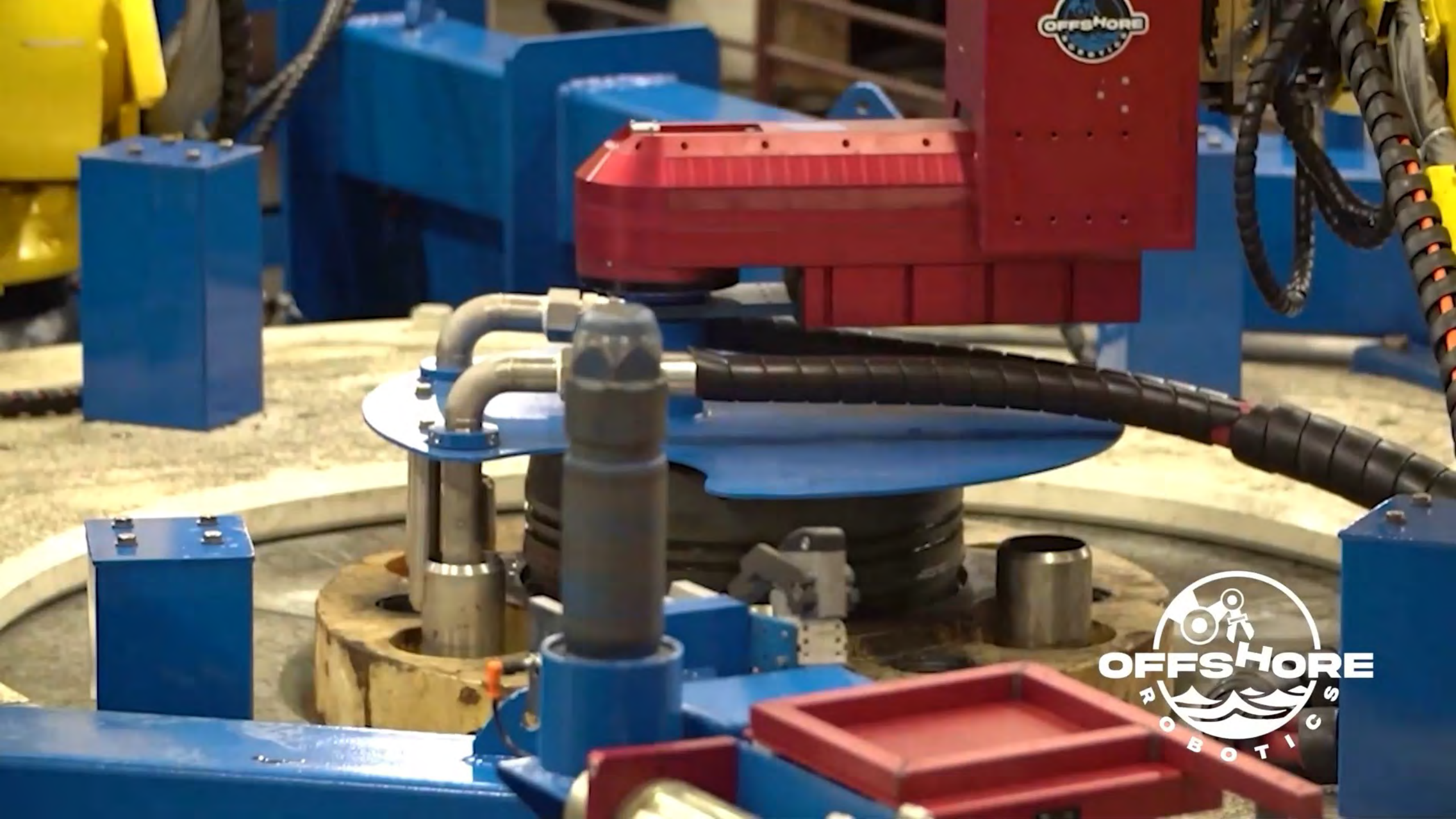
- Nathan Moralez and Andy Westlake suggested the group consider forming a workgroup to explore ways to advance human interactions with automation systems. The goal is to prevent issues like automation complacency in order to reduce the risk for catastrophic failures related to automated systems. A potential deliverable from the group could be a set of industry guidelines or recommended practices around training people to better understand their interactions with automation systems. Suggestions for this potential workgroup include:
    - Collaborate with the SPE Human Factors Technical Section to incorporate different perspectives.
    - Start by looking at roles on the rig and removing loading the driller with extraneous demands/information/interfaces/alarms.
    - Consider why we need automation and define why it's really necessary, look at statistics to see where benefits are.
    - Workgroup should begin by visiting drilling contractors' training simulators to understand the automation systems already in use on today's rigs. Precision and Nabors are possible ones to visit.

  The DCS can begin a workgroup anytime it chooses once 1-2 workgroup leaders are identified; these leaders would serve as "project champions" who can arrange/run workgroup meetings and report results back to the DCS. If anyone is interested in volunteering, please contact Linda Hsieh at linda.hsieh@iadc.org. If the workgroup decides it would like to produce any kind of tangible deliverable, such as guidelines, reports, RPs, then approval would need to be obtained through IADC's committee project approval process before the project can begin.

Nathan Moralez then announced that he intends to step down from the DCS Chair role this year and suggests that individuals interested in stepping up to a leadership position with the DCS reach out to Linda Hsieh at linda.hsieh@iadc.org. He then adjourned the meeting.

First Robotic Riser Run

APRIL 2022


OFFSHORE
OFFSHORE
ROBOTICS

Photos from First Robotic Riser Run:

TRANSOCEAN DRILL SHIP: APRIL 2022

OFFSHORE ROBOTICS

THANK YOU

DAN ALLFORD
CEO
dan@offshore-robotics.com

www.offshore-robotics.com

Tomorrow’s drilling rig – today.

Realize autonomous process operation with a system of intelligent control, advanced material handling, and remote operation.

For decades, NOV has engineered and developed technology with purposeful innovation, commitment to improving, and dedication to our customers – and our craft. Land or offshore, NOV's autonomous solutions can be integrated into existing equipment and controls, giving you the ability to retrofit your rig operation to fit your needs. As the industry evolves, we continue to deliver process improvements that pioneer how wellbores are constructed.

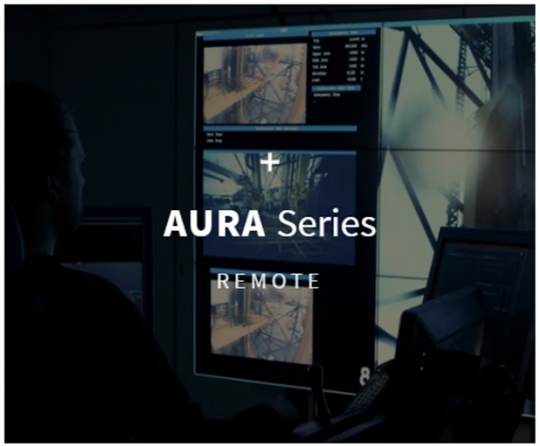

INCREASE SAFETY
+


BOOST EFFICIENCY
+


MAXIMIZE VALUE
+

The future is now.

The NOV Automation platform consists of three main areas of focus: materials handling, controls, and remote solutions. The products in each of these areas work collectively to make automating your rig a reality – today.



CLOSE

NOVOS

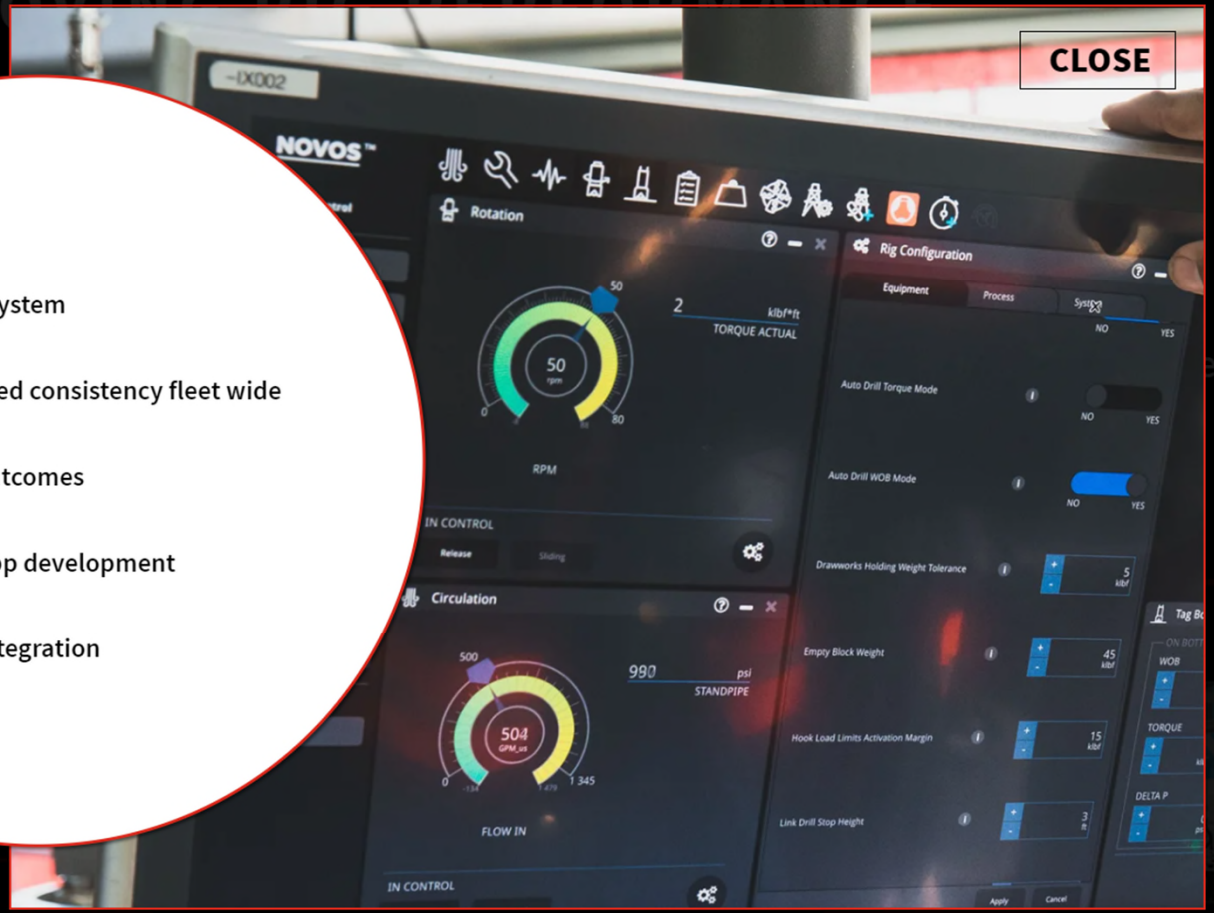
Reflexive drilling system

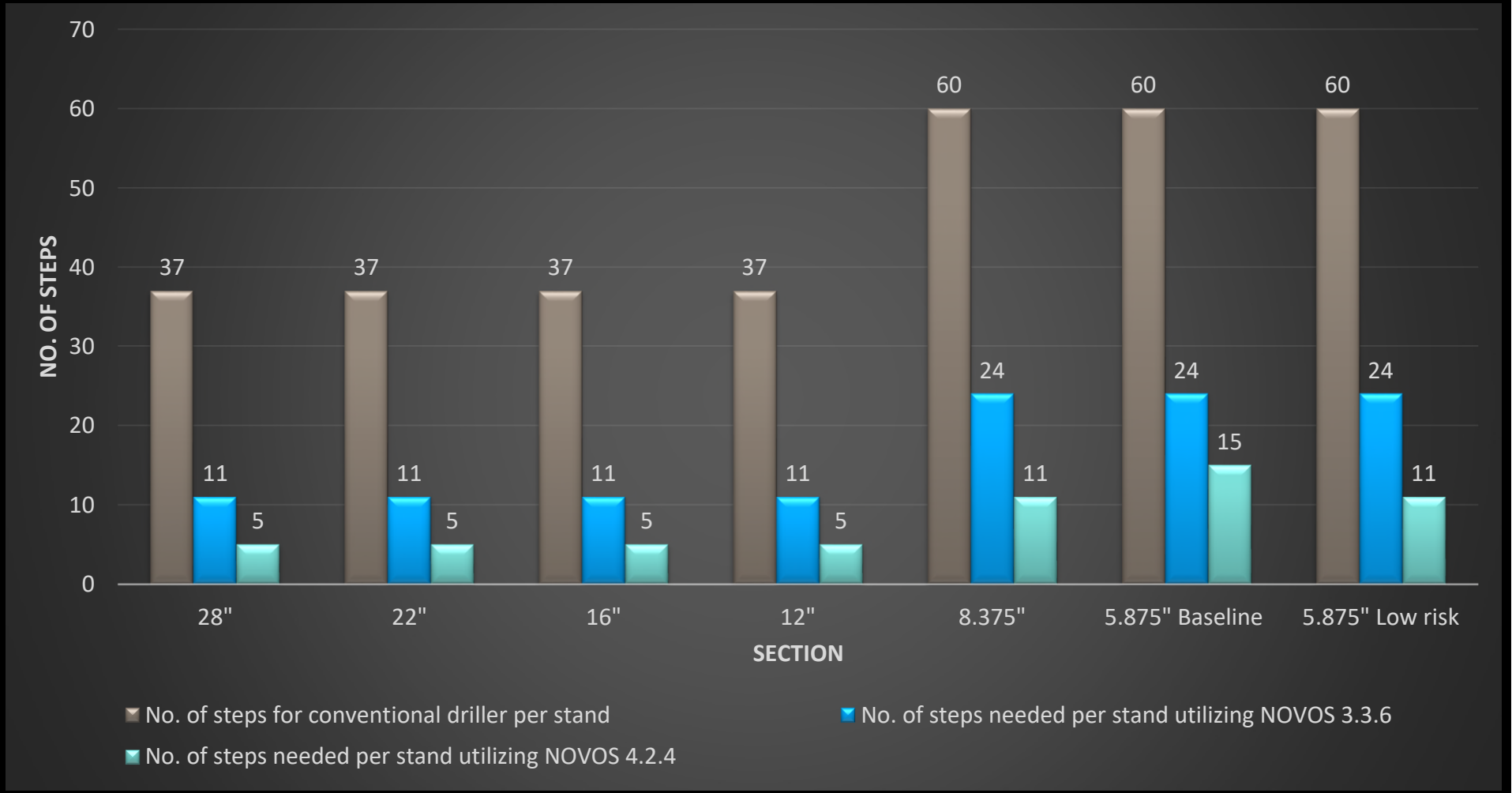
Provides unmatched consistency fleet wide

More predictive outcomes

Open to custom app development

Third-party app integration




70
60
50
40
30
20
10
0
NO. OF STEPS
37
11
5
37
11
5
37
11
5
37
11
5
60
24
11
60
24
15
60
24
11
28"
22"
16"
12"
8.375"
5.875" Baseline
5.875" Low risk
SECTION
No. of steps for conventional driller per stand
No. of steps needed per stand utilizing NOVOS 3.3.6
No. of steps needed per stand utilizing NOVOS 4.2.4

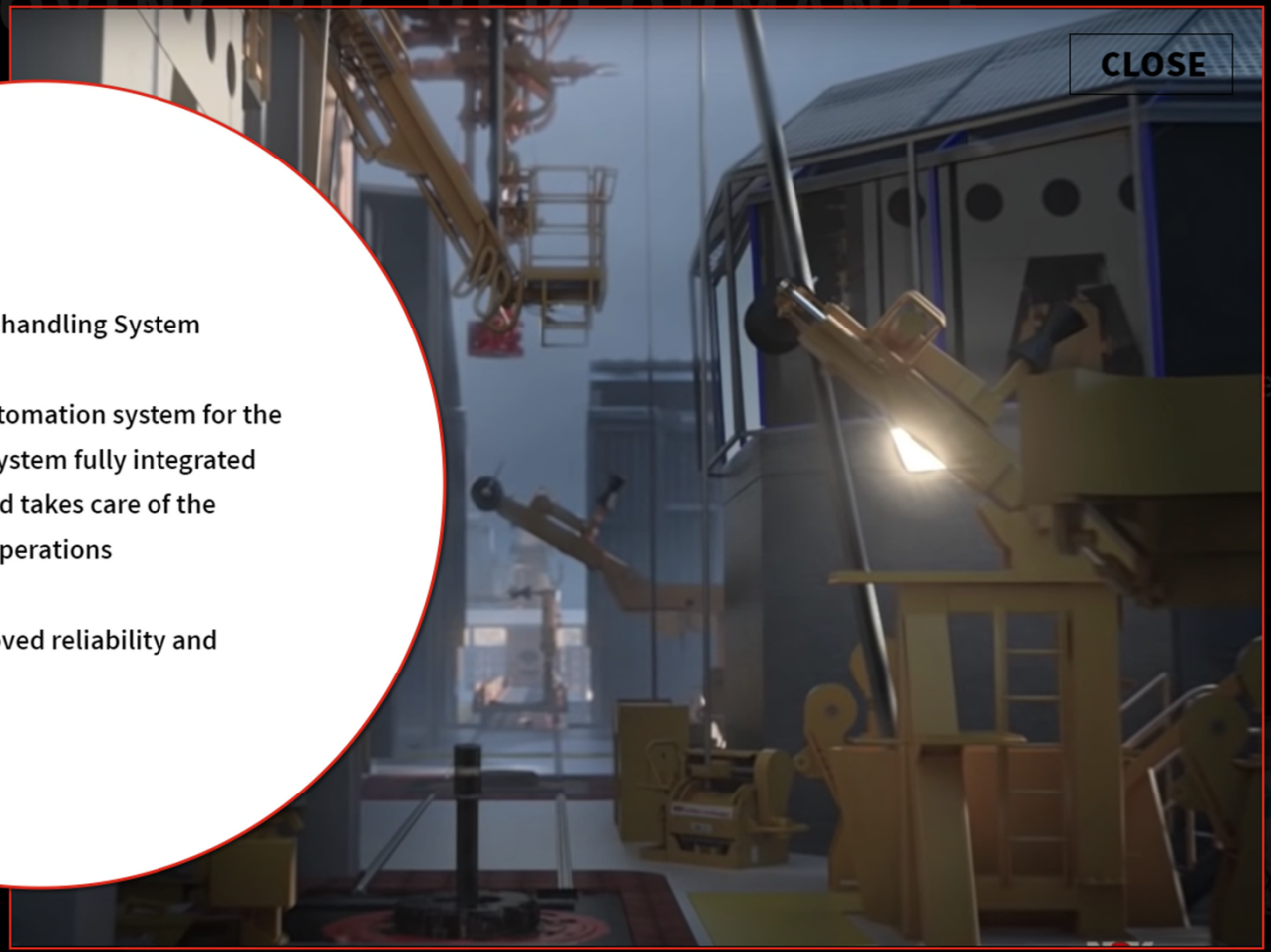
CLOSE

MMC

Automatic Pipehandling System

Our process automation system for the pipehandling system fully integrated with NOVOS and takes care of the pipehandling operations

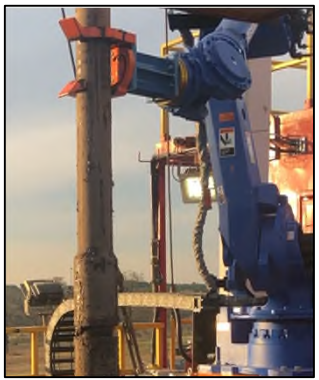
Focus on improved reliability and performance



Robotics

ATOM-RTX

- Upper and Lower Robotics Arm installed and Operational at STC Test Rig
- Tripping Tubulars to and from Fingerboard
- Tailing Tubulars to and from PipeCat
- Doping, Stabbing and Mud Containment
- Integrated to Amphion, MMC, and NOVOS



AURA™

- Next generation technology for visualization and collaboration
- Remote operation

The future is now.

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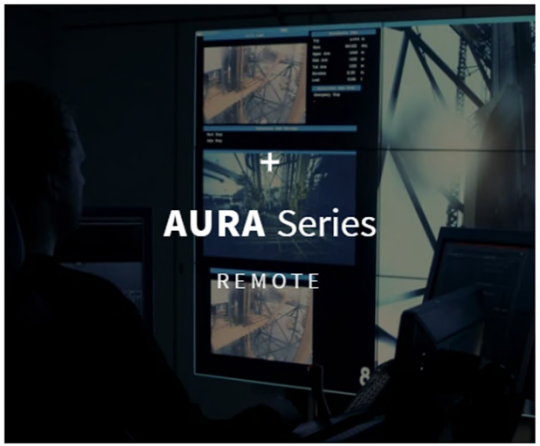


Healthy & Safe
RIGSENTRY™
Condition Monitoring
System & Services
Consistent & Optimized
NOVOS™
Drilling Automation
NOV Rigs
The world's
most advanced
drilling equipment

Field experience with Robotics Human factors

April 20, 2022

Lars Raunholt, CEO
Canrig Robotic Technologies AS

Summary

Over the last 8 years a significant amount of testing has been performed

- Workshop tests of stand-alone robots
- Pilot test of drill floor robot on semi-sub offshore Norway
- Pilot test of robotic pipe handler on land rig in US
- Full scale tests of robot system in purpose-built test site
- Various levels of integration with 3rd parties

2019 Drill floor robot: Five months offshore test

- 952 operations carried out in Main and Aux well center. 22 subs handled
- Possible for an all-electric robot to operate in hostile offshore environment
- **Crews trained in advance. 50 % of crews excited, 50 % very negative**
- **Involvement of people is key**

2021-22 Pipe handling in land drilling operation

- Two years test on land rig as part of new rig design
- Eight months drilling in Permian:
  - 2 million feet drilled, tripped and cased
  - Fully-integrated part of drilling operation
- **Operated by “normal” drillers**
- **Very successful integration**

2020-22 Full robotic system

- Automated tripping from pipe deck or set-back
  - No driller cabin
  - High level commands
  - Less crew
- **No field experience yet**
- **Game changer requires new mind-set**

Illuminating Black Box Decisions in Automated Systems

Rig Automation and Human Factors

Gain human understanding and trust in automated systems enabling users to respond appropriately and benefit from automation.

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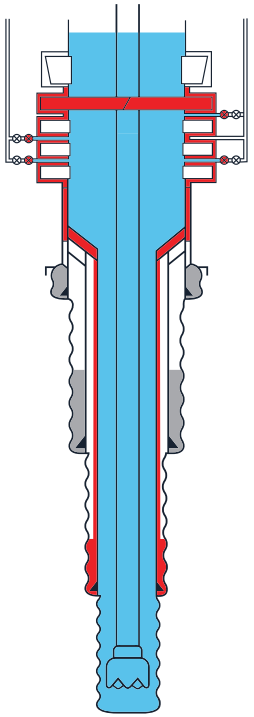
Well Integrity Management



ABOVE THE WELLHEAD

Well Control Equipment Management

BOP, Manifold, MPD, Production Tree, ROV, Coiled Tubing
Schematics & Testing Solutions

BELOW THE WELLHEAD

Well Barrier Management

Comprehensive Wellbore
Schematics & Testing Solutions

Real-Time Monitoring

Assurance Workflows & Data Integrations

Example – The Airline Industry*

- Air France 447 (AF447) Crash in 2009 precipitated the aviation industry's concern about "loss of control" incidents, and their link to automation.

- Loss of control incidents are the most prevalent cause of fatalities in commercial aviation.
  - 43% of fatalities in 37 separate incidents.

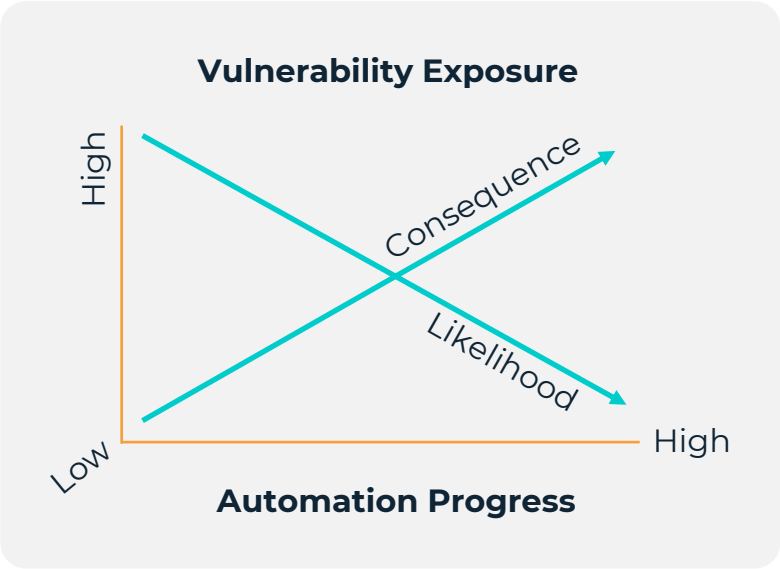
- Research examines how automation can limit pilots' abilities to respond to such incidents, as becoming more dependent on technology can erode basic cognitive skills.

- The case reveals how automation may have unanticipated, catastrophic consequences that can emerge in extreme conditions:
  - Unexpected, unusual events (icing air speed indicators caused auto-pilot deactivation and alarms)
  - Startled and suddenly required to perform less practiced operations (fly manually at high altitude)
  - Incomplete messages (stall alarms disabled at low speed to eliminate "false alarms")
  - Unanticipated possibilities (pilots will always know if they are stalled)

*The Tragic Crash of Flight AF447 Shows the Unlikely but Catastrophic Consequences of Automation - Nick Oliver, Thomas Calvard, and Kristina Potočnik, HBR, September 15, 2017

The AI & Automation Black Box Problem

- People struggle to trust the decisions and answers that AI-powered tools provide
- Problematic AI/Automation doesn't explicitly share how and why it reaches its conclusions
- Programmers can remove these layers of obfuscation, until then there will be an air of discomfort around trusting the technology



What We Can Do

Investigate bad scenarios

Expose decision rationale

Examine voting systems

DO NOT assume users understand

Provide only necessary information clearly

Pilot automation and gather feedback

IPT's Experience Illuminating Black Boxes

History of automating integrity tests
- Well barriers & well control equipment

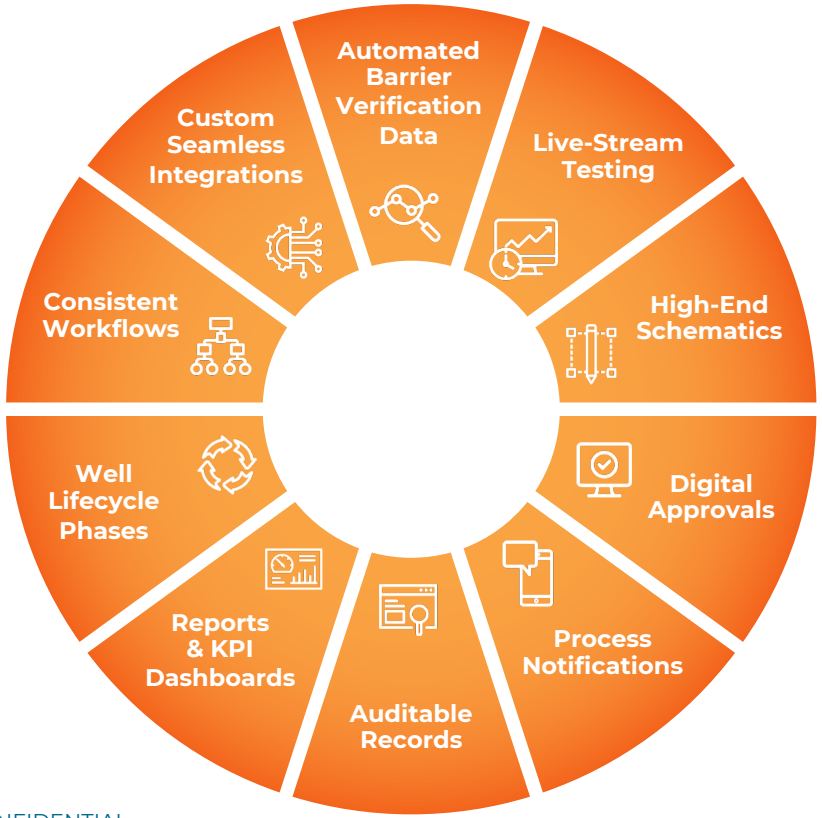
Early feedback on "Pass/Fail" assignments
- "How does it work?"
- "Why did this pass(fail)?"

Continued work on analysis and results
- Greater assurance
- Better application

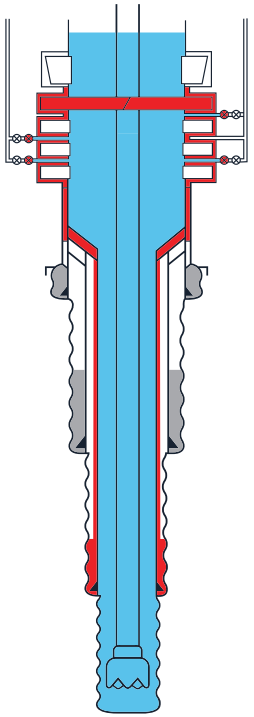
Cross-industry collaboration
- Continuous evolution and improvement

Higher sophistication of algorithms

More awareness of the need for human's understanding and trust



Well Integrity Management



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