Looking Back, Looking Now, Looking Forward – the path of wellbore surveying

Presenter: John de Wardt, CEng, FIMechE

President DE WARDT AND CO

Program Manager DSA Roadmap / DSABOK

SPE DSATS Director Emeritus

Speaker Bio

- CEng, FIMechE, Distinguished Member SPE, Director Emeritus DSATS
- 1976 – 1994 Shell, Forasol / Foramer, Halliburton
- 1994 – present DE WARDT AND COMPANY Global upstream consultant
- 36 countries, >80 clients, 46 papers / articles, 21 industry committees
- 1980 – Wolff & de Wardt systematic error model SPE paper
- Committee 3 SPE WPTS workshops, various presentations
- Survey best practice advocate with multiple clients

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

I have 4 messages I want to share

I. Communicating the business risk from survey uncertainty to senior management has huge impact on survey choices / development - but how to do it?

II. BOCP risk mitigation from improved surveying is equivalent (often) to subsurface modelling value – but too often both are totally ignored!

III. Drilling engineers lack the education and insight to take valuable decisions in borehole surveying – surveyor SME's and suppliers must step up!

IV. Digitalization and automation require attention to wellbore survey data attributes – how can you influence this advancing need?

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

In the beginning

- Walstrom model from 1950's prevailed – random errors that cancel themselves out
- Shell management alerted to the risk to fail to intercept high pressure gas well blow out in western country – Groningen resurvey changed field
- Wolff and de Wardt teamed to analyze sources of errors in magnetics and free gyros together and respectively – systematic prevails
- Thorogood, Williamson, Jamieson and others pursued improvements
- Then Stockhausen and Lesso 'rang the bell' on TVD and steering

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Then came the next generation

- Dynamically tuned gyros from aerospace
- Mechanical then solid state MWD
- Inertial platforms perfect solution but limited by diameter requirements

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Rather uniquely ISCWSA formed by experts in 1995

- to produce and maintain standards for the industry relating to wellbore survey accuracy
- to set standards for terminology and accuracy specifications
- to establish a standard framework for modelling and validation of tool performance
- to raise awareness and understanding of wellbore survey accuracy issues across the industry

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Use cases I have experienced

- Supplier denying technology hook up in Nigeria despite the catastrophic problem with magnetics
- Nigeria sag correction removed fault
- S China Sea uncertainty inadequate for reservoir modeling – too late
- BOCP plan shows uncertainty requirement similar to required for subsurface modelling, but no one addresses this in survey selection
- Subsurface believes surveys are infinitely accurate because you give them tables to 2 decimal places – this must change
- Modelling subsurface with mag declination and sag errors uncorrected
- Professor at major US Pet Eng university denies ISCWSA e-book

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

What should be next for wellbore surveying

- API RP 78 a great move – issue is to gain implementation
- Drilling today requires continuous surveys (1 ft) – don't need your cheap push back
- Tortuosity is NOT DLS – sorry, lost cause for today's requirements
- Companies develop and own Wellbore Survey Programs – too few actually do this
- University upgrades on education, including Petroskills – get real and implement ISCWSA e-book

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Digitalization and automation advancing rapidly

- Digitization
  - to convert something into a digital format such as data or documents
- Digitalization
  - to convert business processes over to use digital technologies
- Automation
  - operating with minimum human intervention

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Digitalization and automation requires

- Timely and accurate survey data
  - Low latency / high accuracy / high frequency
- Collaboration between companies
  - Interdependency / interoperability
- Modified workflows focused on well lifecycle deliverables
  - Redefine tortuosity acquisition and calculation

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

The 3 C's and Well Construction

COMPETE

Separate Products

- Motors
- Rotary Steerable
- Top Drive
- Cement Unit

COMPLEMENT

Interconnected Services

- Remote Directional Svc
- GeoSteering
- Vibration mitigation
- Cement Services

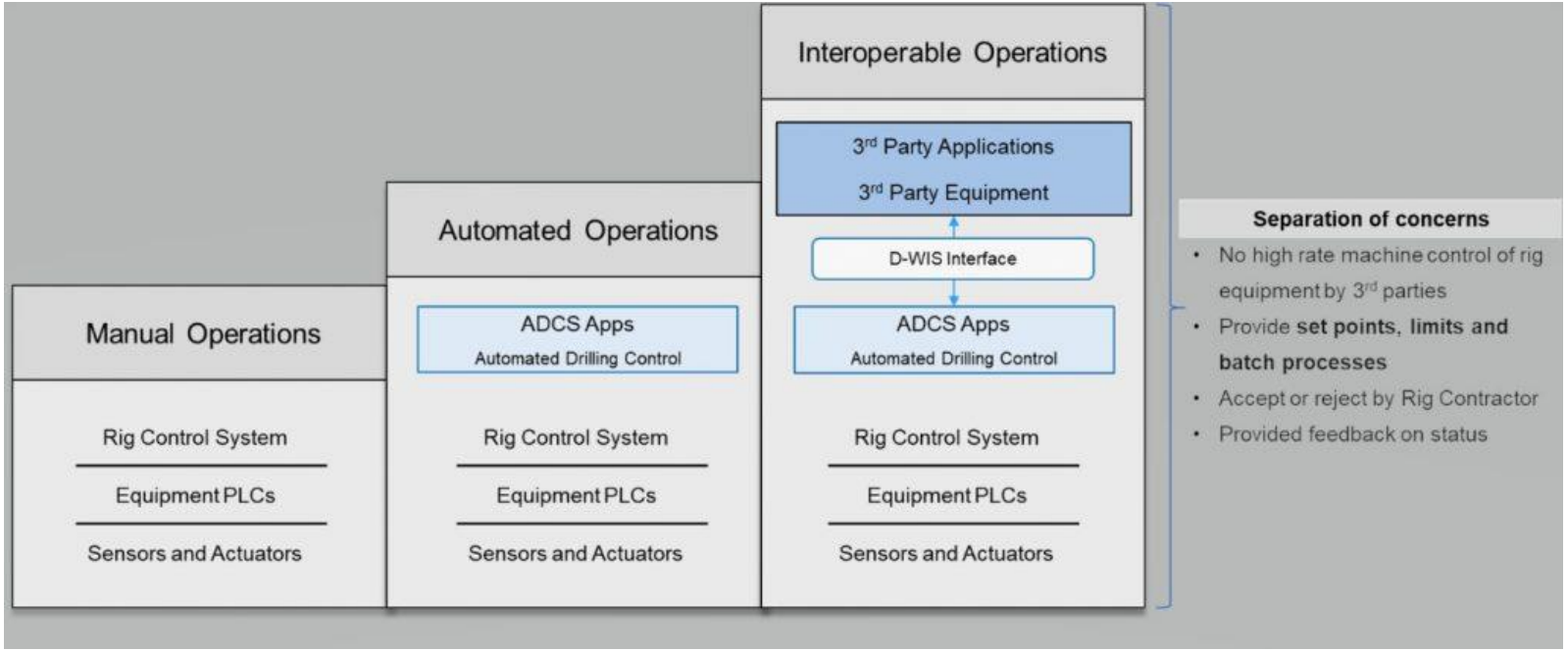
COLLABORATE

New Solutions

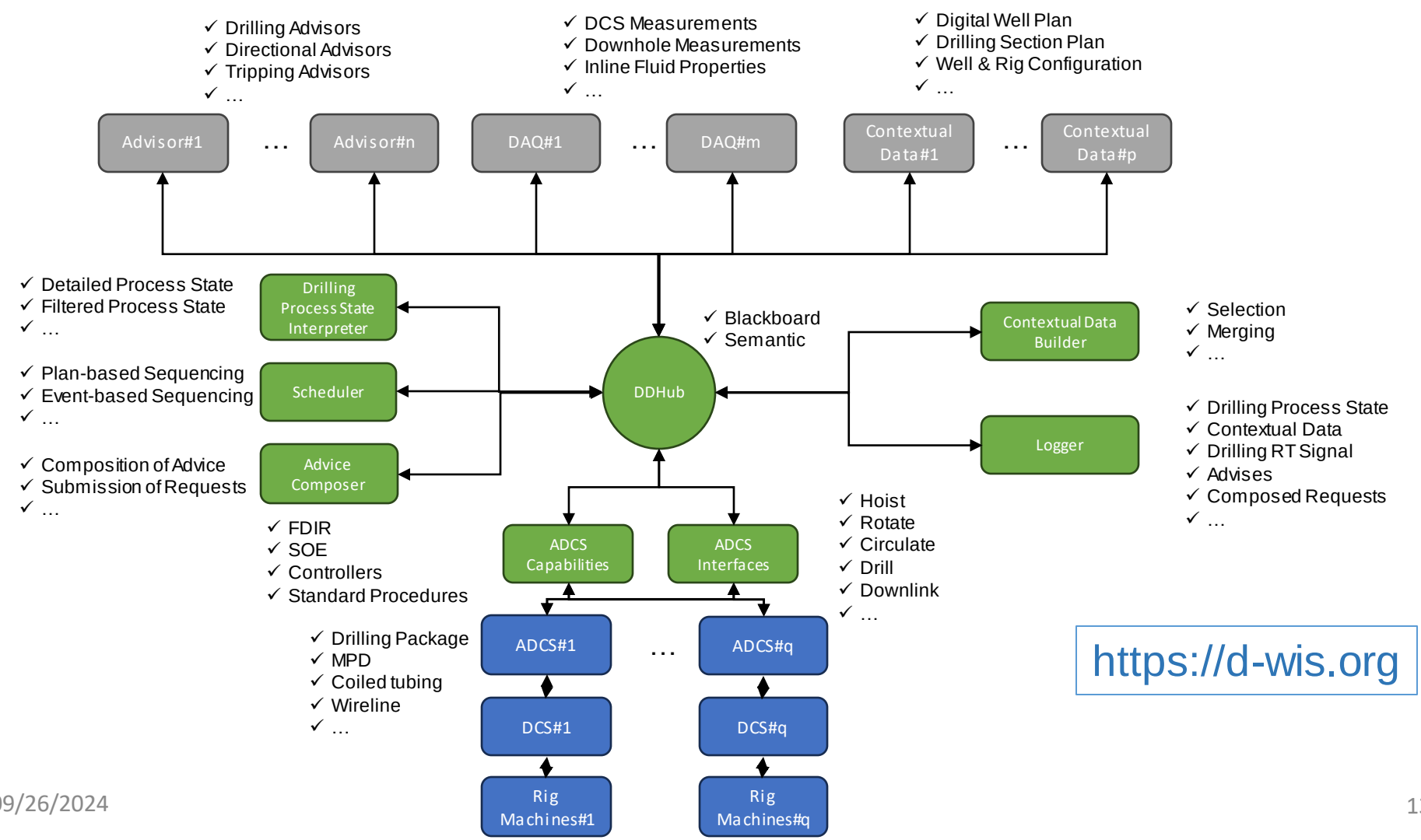
- Automation Agents
- Open-Source Models
- Connected Well Plan
- Connected Field Dev

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Graduation to interoperability thro DWIS (DSATS)



Copyright © John de Wardt, DE WARDT AND COMPANY 2024


✓ Drilling Advisors
✓ Directional Advisors
✓ Tripping Advisors
✓ …
✓ DCS Measurements
✓ Downhole Measurements
✓ Inline Fluid Properties
✓ …
✓ Digital Well Plan
✓ Drilling Section Plan
✓ Well & Rig Configuration
✓ …
Advisor#1
Advisor#n
DAQ#1
DAQ#m
Contextual Data#1
Contextual Data#p
✓ Detailed Process State
✓ Filtered Process State
✓ …
Drilling Process State Interpreter
✓ Plan-based Sequencing
✓ Event-based Sequencing
✓ …
Scheduler
✓ Composition of Advice
✓ Submission of Requests
✓ …
Advice Composer
✓ Blackboard
✓ Semantic
DDHub
Contextual Data Builder
✓ Selection
✓ Merging
✓ …
Logger
✓ Drilling Process State
✓ Contextual Data
✓ Drilling RT Signal
✓ Advises
✓ Composed Requests
✓ …
✓ FDIR
✓ SOE
✓ Controllers
✓ Standard Procedures
ADCS Capabilities
ADCS Interfaces
✓ Hoist
✓ Rotate
✓ Circulate
✓ Drill
✓ Downlink
✓ …
✓ Drilling Package
✓ MPD
✓ Coiled tubing
✓ Wireline
✓ …
ADCS#1
ADCS#q
DCS#1
DCS#q
Rig Machines#1
Rig Machines#q
https://d-wis.org

I have some questions

- How can subsurface geoscientists become educated such that they demand the uncertainty they require for good modelling?
- How can universities be upgraded to teach the real level of expertise and not a historic view?
- How will drilling engineers access resources that make them knowledgeable buyers of wellbore surveying?
- How can asset managers appreciate their loss of value from inadequate surveying?

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Comments and your questions

- john@dewardt.com
- www.dewardt.com
- http://www.linkedin.com/in/johndewardt
- WhatsApp +1 970 846 6571

Copyright © John de Wardt, DE WARDT AND COMPANY 2024

Copyright © John de Wardt, DE WARDT AND COMPANY 2024