

60th General Meeting
Main meeting 26th of September 2025
New Orleans, Louisiana USA



Wellbore Positioning Technical Section



The Industry Steering Committee on
Wellbore Survey Accuracy (ISCWSA)

MWD and Gyro Survey Tool Quality Management System



Speaker BIO

- Principal well engineer with Shell Kuwait
- Manage global borehole survey subject matter expert group
- Owner of borehole surveying and relief well planning standards
- Owner Shell Open University borehole surveying curriculum

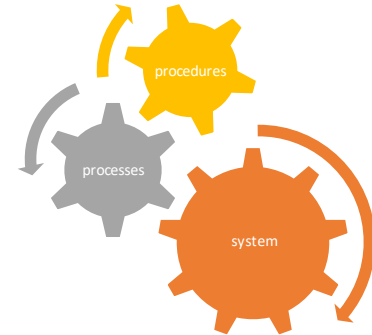
SPWLA topical conference on MWD 19 October 1995 in Kerrville, Texas



What organization was born at this conference?
Who led this successful initiative?
Who from the audience attended the conference?

GROUNDING

- Status: Multiple survey tool quality management systems
- What's new: Publish a quality management system
 1. To manage MWD and gyro survey tool quality
 2. With a systematic approach in survey data acceptance processes and procedures
 3. And with real time survey data quality representative for its theoretical wellbore position uncertainty estimate
- Goal: Long term Result
 - Ensure that Operator business needs are clearly understood, agreed and fulfilled by all stakeholders
 - Simplified ways of working in survey tool quality management



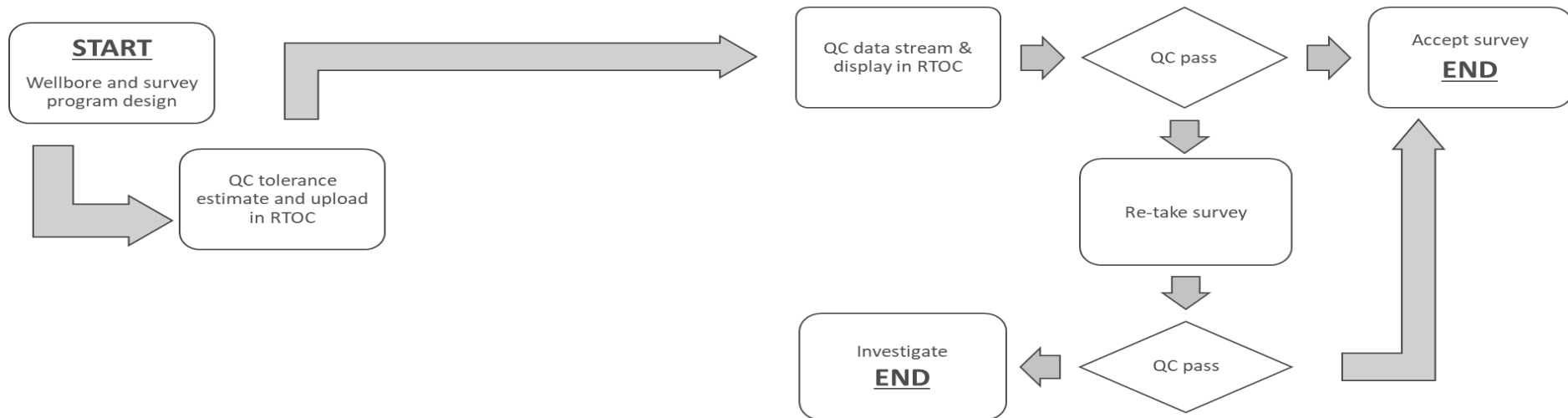


PROCESS

SURVEY DATA ACCEPTANCE

WELL DESIGN PHASE

WELL EXECUTION PHASE

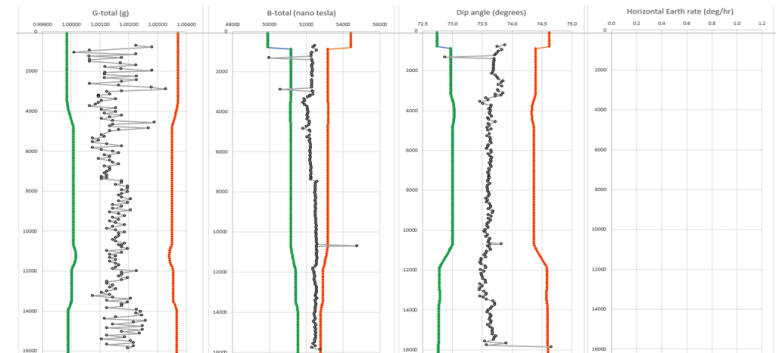
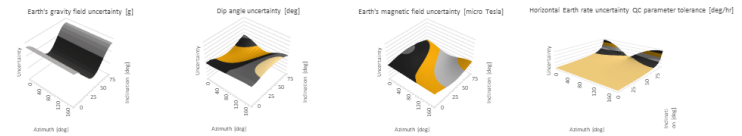


PROCEDURE

SURVEY DATA ACCEPTANCE

- What are QC parameters?
 - MWD survey tool
 - Gravity field/Magnetic field strength & variation
 - Gyro survey tool
 - Gravity field strength/Horizontal earth rate of rotation
- QC tolerance estimation
 - Estimated with MWD survey tool QC procedure
 - Estimated with Gyro survey tool QC procedure
- QC measurement acceptance
 - $QC_{tolmin} \leq QC_{measurment} \leq QC_{tolmax}$
 - Service company decide acceptance
 - RTOC validates decision

QC tolerances



QC measurements and QC tolerances



FOCUS AREAS

SURVEY DATA ACCEPTANCE

WELL DESIGN PHASE

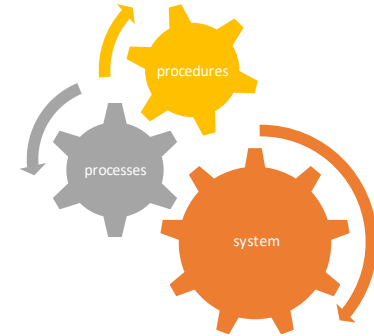
- MWD survey tool default in survey program design
 - One global geomagnetic model
- Standard BHA design type for NM space out
- Select BHA design to avoid sag correction

WELL EXECUTION PHASE

- Survey tool maintained to operate with specification
- Non-magnetic BHA's hot spot free
- Drilling fluid systems absent from magnetized materials

CONCLUSIONS

- Published quality management system
 - MWD and gyro survey tool QC procedures (*NEW*)
 - Survey data quality representative for its theoretical wellbore position uncertainty estimate
 - Manage stakeholders to ensure that Operator business needs are clearly understood, agreed and fulfilled by all service companies
- Value opportunity
 - Drive performance management on survey activities
 - Strong foundation for risk-based well collision avoidance management





“A high-accurate survey tool does not imply a high-quality survey. On the other hand, a low-accurate survey tool may indeed be a high-quality survey”

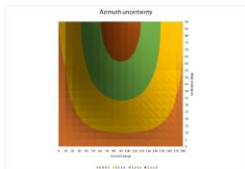
Q&A



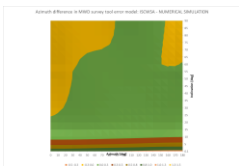
Back-up

One MWD and one Gyro Instrument Performance Model

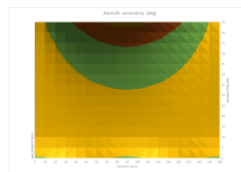
MWD - survey tool ERROR MODEL –ISCWSA



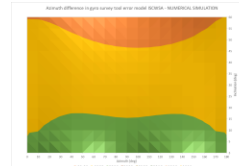
Error model differences
 ISCWSA– Numerical
 simulation



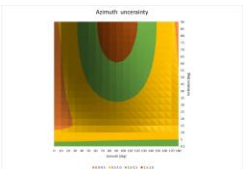
Gyro - survey tool ERROR MODEL –(ISCWSAformat)



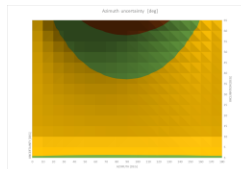
Error model differences
 ISCWSA– Numerical
 simulation



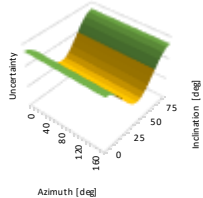
MWD - survey tool ERROR MODEL – NUMERICAL SIMULATION



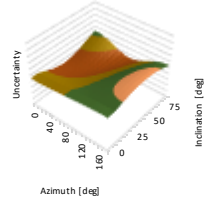
Gyro - survey tool ERROR MODEL – NUMERICAL SIMULATION



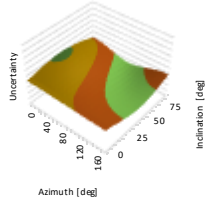
Earth's gravity field uncertainty [g]



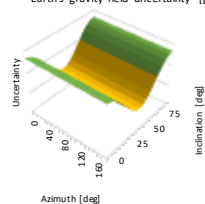
Dip angle uncertainty [deg]



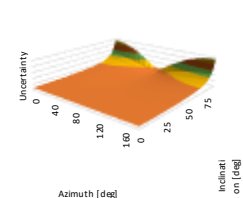
Earth's magnetic field uncertainty [micro Tesla]



Earth's gravity field uncertainty [g]



Horizontal Earth rate uncertainty QC parameter tolerance [deg/hr]



MWD – Quality Control tolerances

Gyro – Quality Control tolerances