

FMECA and Commissioning

**Guidelines to effectively deliver
technology and systems for successful
Drilling Automation**

Authors:

- **John de Wardt, DE WARDT AND COMPANY**
- **Tom Moore, Southwest Research Institute**
- **Andy McKenzie, National Oilwell Varco**

**Special acknowledgement to Tony Beebe, SPE
DSATS**

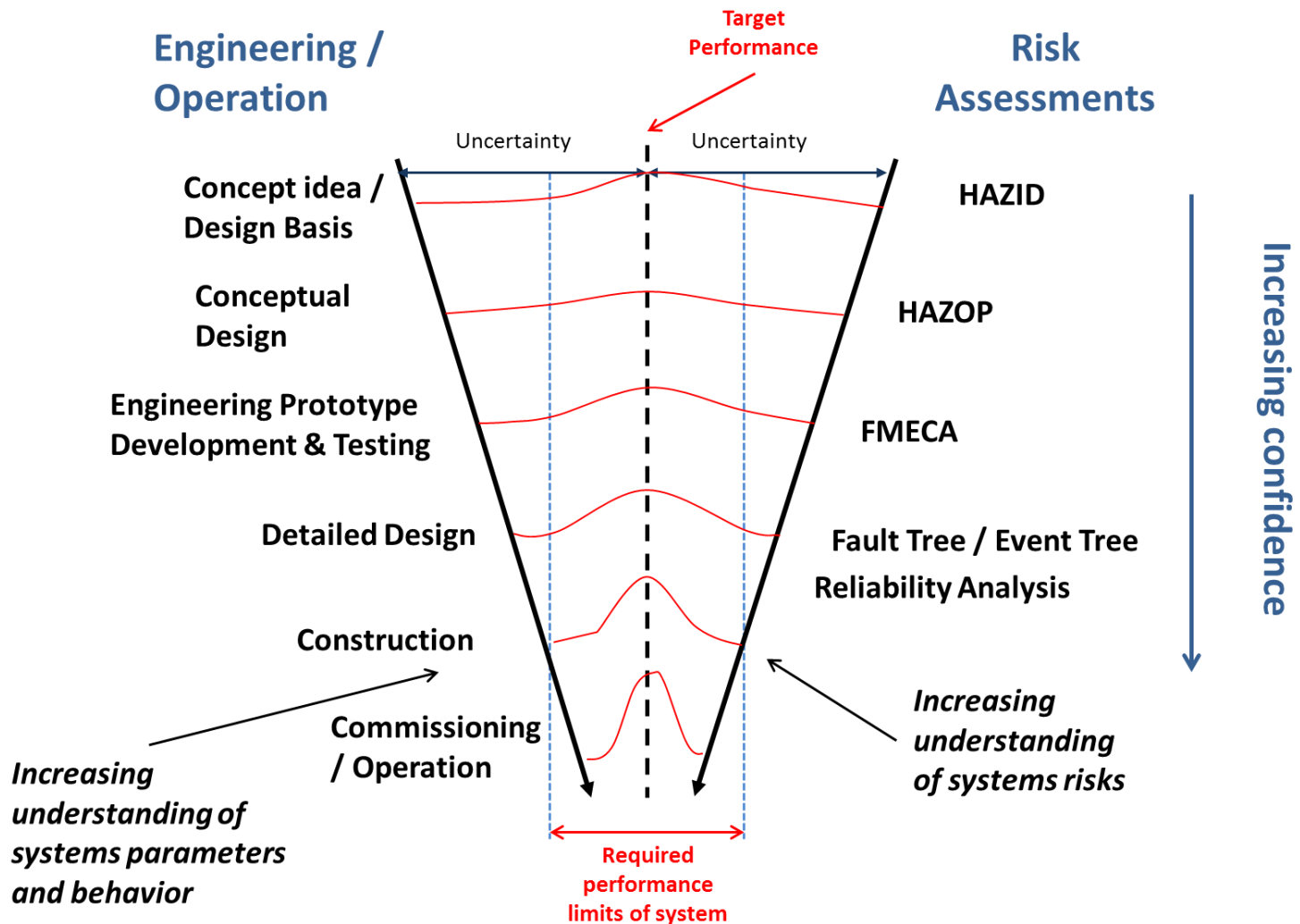
Our paper has key insights for drilling systems success

- Reliability for automation is an issue
- Failure Modes Effects and Criticality Analysis (FMECA) delivers in other industries
- Commissioning is a critical link from construction to operation

From here to there

- Generally there is a perception of lack of reliability in automated systems
 - Industry experience
 - Feedback at ATW Galveston April 2011
- We want a perception of reliability based on experience
 - DP systems has a achieved this

But the framework is large!



**Systems reliability
challenges surpass
component reliability**

**Systems involve multiple
sources of sensors and tools
and different (competing)
companies**

What is FMECA?

- Methodology to determine, characterize and document possible failure modes and effects on operations
- Systematic analysis of design through all stages
 - Concept through detailed design

Objective of FMECA

- Identify failure modes
 - Way can occur
- Identify failure effects
 - Consequences of failure modes
- Identify criticality
 - Severity in terms of safety, operability and well operations

How to apply FMECA

- Establish a team
 - Experience in FMECA
 - Knowledge of product
 - development, operation, control
- Data Gathering
 - Product functioning / operating environment
 - Functional block diagram
 - Design docs, drawings, past experience, component reliability

How to apply FMECA

- System Diagrams
 - Determine critical functions
 - Remove secondary / non critical
- Graphical illustrations
 - Functional block diagrams
 - Process diagrams
 - Flow charts
 - Inputs / outputs

FMECA Process

- Team drills down into what is relevant
- Tabulate to capture observations
- Use tools appropriately to analyze failure modes and effects
 - Fault trees, FEA, CFD,

FMECA process output

- Functional requirements
- Detection and warning systems
- Interdependent hierarchy
 - System – including computer software
 - Subsystem
 - Component – including sensor error / failure
- Economic analysis of corrective action

What is commissioning

**Process by which equipment,
facility or plant is tested to
verify its functions according to
its design objectives or
specifications**

Commissioning value

- The stage where multiple systems and sub systems are brought together
 - First time
 - Specifically tailored to project

Commissioning current practice

- Equipment installed
- Equipment commissioned individually
 - Vendor and owner
- Sign off
 - Vendor and owner
- Process level testing
 - Owner and operator
- Repeated change orders to meet operator requirements

Issues with today's practice

- Disconnect between vendor and end user
 - Multiple intermediaries
- Delayed delivery of a machine impacts system commissioning
- No testing of downhole tools into the system

Improvements have been made

- Organization structures dedicated to installation and commissioning
- Dedicated resources addressed:
 - Improved documentation
 - Process wide commissioning
- Better testing processes
 - FAT
 - Hardware in Loop (HIL) simulation

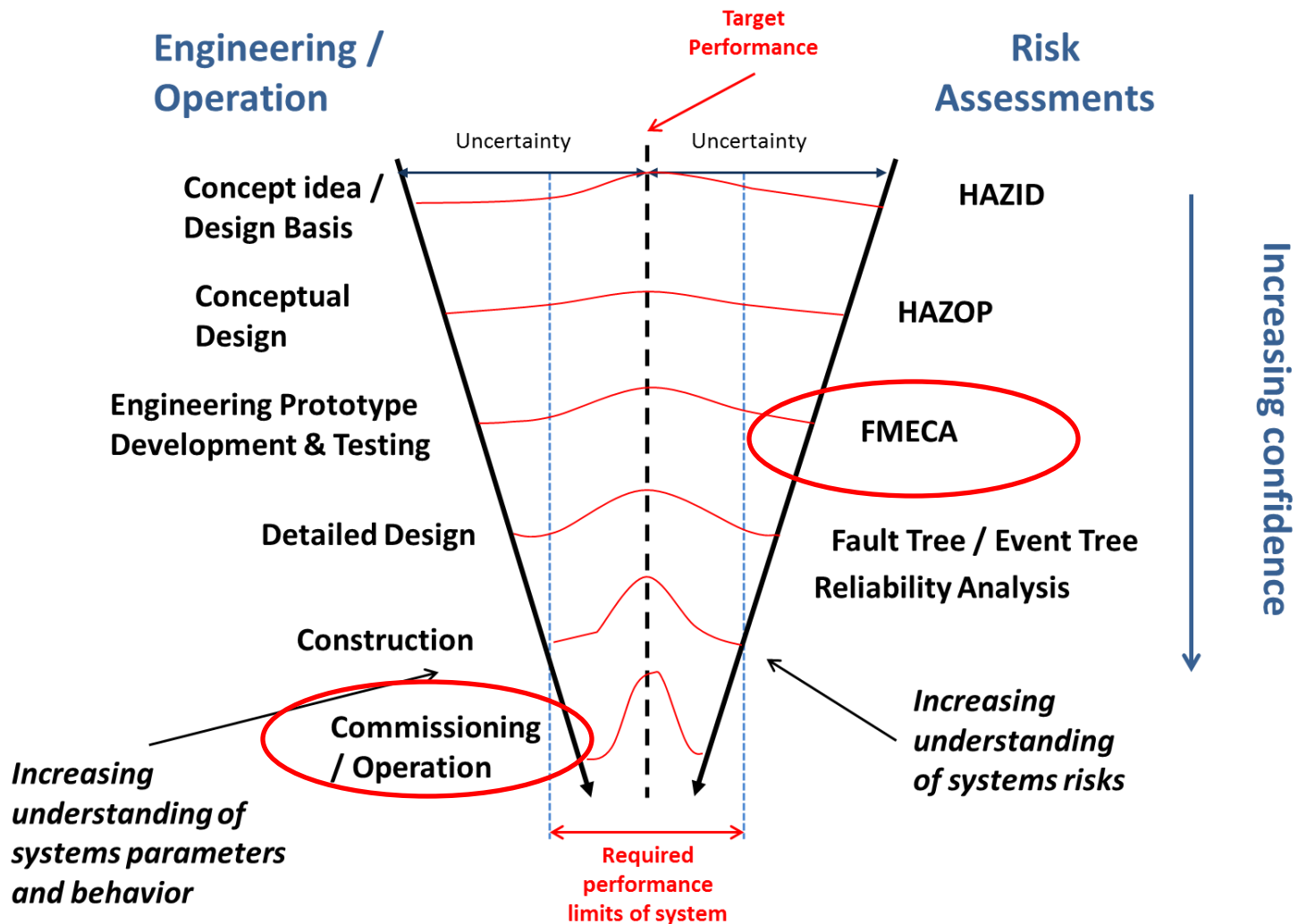
Commissioning future practice

- Enhanced relationships
 - Vendor, owner, operator
- Mesh tool level testing with systems integration testing
- Pre-plan commissioning
- Make time for commissioning
 - There is a benefit

Challenges to improve reliability of automated drilling systems

- Inter company commissioning
 - Especially downhole to surface
- Integrate and standardize methodologies
 - FMECA / Commissioning /
- Identify the integrator
 - Responsible to manage the integrated system

Need to coherently map the best methodologies



SPE DSATS and IADC ART

**Working groups
addressing these issues**

Thank You

Authors:

- **John de Wardt, DE WARDT AND COMPANY,**
- **Tom Moore, Southwest Research Institute;**
- **Andy McKenzie, National Oilwell Varco**

Special acknowledgement to Tony Beebe