Building A “Performance Ready” Drilling Engineer

IADC Webinar
October 2013

James Bobo, Ron Hinn, Bruce Kitchel
Overview

- Setting the Competency / Assurance Stage
  - Ron Hinn

- Best Practices And What A Performance Ready Professional Needs To Know
  - Bruce Kitchel

- Value Creation / Cost Avoidance - Well Integrity Scenario
  - James Bobo
Industry Realities

- Big crew change underway
- High level of industry activity and investment
- Increasingly challenging physical environments
- Intense industry scrutiny
Setting The Competency Assurance Stage

SPE-166308
Value of Competency and Value of Competency Assessment
Timothy L. Nieman, John Schuyler, and J. Ford Brett

- Competency in engineering design
- Value of information (VOI) approach
- Valuing competency assessment with a decision tree
- Well design process model using simulation
Recent increased emphasis on Safety and Environmental Management Systems (SEMS).

Is the system working as it should? How can we assure:

- A. That a system is working?
- B. That individuals have the necessary competencies?
- C. That individuals can perform their value-adding competencies (beyond HSE)?

BSEE’s new rules

- requires audits to develop answers to Question A
- requiring those audits to address Question B.
Assurances Desired (From SPE-166308)

- The SEMS will prevent incidents
- People can and will properly execute their responsibilities
- Hugely complicated systems
  - Number of possible interactions
  - Impossible to define all the cause-and-effect relationships
- An audit or capability assessment can test only a small subset of possible failure modes.
Accountants have a millennium of experience

- Identifying fraud
- Eliminating fraud

How have they done?

- 2012 study by Association of Certified Fraud Examiners
- Initial detection of occupational frauds
  - 3.3% detected by external auditors
  - 26.3% internal controls
  - 14.6% management review
  - 43.3% tip
  - 3.0% notified by police
It is the ratio of Failure Cost / Assessment Cost that is important to the decisions.

There are curves for judging how accurate the test must be as a function of the F / A ratio.

Sensitivity analysis indicates that under most reasonable input assumptions, competency assessments are often easily justified.

Competency testing is unneeded when:

- We’re already highly confident about a person’s competence.
- The available competency assessment method is unreliable.
How Errors and Poor Choices are Caught
(From SPE-166308)

- Review from colleagues on the design team
- Peer review (optional)

During construction
- Review of plans
- Problem surfaces as an incident

During operations / related activities
- Early detection before incident
- Incident occurs
Shell Case Study Reducing Time to Autonomy

- Shell Graduate Program (SGP)

- Time to Autonomy – The time it takes a graduate employee from entry into the company until he/she can make nonstandard decisions autonomously.

- Time to autonomy 2-3 years vs. 4-5 years previously

Source
IPTC 16394
Accelerating Time to Autonomy for Technical Staff – Developing the Industry’s Best Performers”, Michael Schaaf, Anu Garg-Buck - Royal Dutch Shell
Journal of Petroleum Technology, October 2013
Key Attributes of SGP

- Technical Disciplines "own" the program
- Focus on a small but critical set of competencies (e.g. 10) – remaining competencies are developed later as part of work role
- Baseline is established with individual assessment on entry (e.g. supervisor interview). Development is tailored to the "gap"
- Development linked to defined/assured job tasks
- Assurance
  - Direct Observation of task completion
  - Culminating competency assessment
Goal: Reduced Time to Competency

Effect of Cycle Time & Performance Improvement on Professional Development

- **Improved**: DROI = 105%
- **Base Case**: DROI = 27%

Assumes:
- 3 yr Program @ $30k/yr
- $100k Burdened cost +5%/yr raises
- $300k Value
- 1st Revenue at 2 yr
- 1SD Competency in 2 yrs
- 12 yrs Retention
- 12% Discount Rate
Overview

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- “Performance Ready” Professional – Criteria & Approach
  - Bruce Kitchel

- Value Creation / Cost Avoidance - Well Integrity Scenario
  - James Bobo
Vision

Like other operators in the Oil & Gas Industry we have identified an urgent need to develop drilling personnel equipped with the skills needed to properly plan and execute a drilling well plan that:

- Follows the Core Values of the company;
- Meets or exceeds the industry’s established best practices and government regulations;
- Meets or exceeds business and economic objectives; and
- Maintains a top quartile level of performance.
Objectives

Create a Drilling Skills Development Program that:

• Develops and trains a new group of drilling personnel, covering both engineering and operational skills;
• Establishes an ongoing format/process to train future drilling personnel from the ground up;
• Increases the global drilling resource base;
• Brings new ideas, skills and energy into the drilling function;
• Improves functional demographics and diversity metrics;
• Creates training and development opportunities for the entire global drilling staff;
• Creates and increases core competencies in the drilling function; and
• Focused primarily on less experienced personnel interested in being quickly immersed with skills to become a Drilling Engineer and/or a Drilling Rig Supervisor.
Learning Philosophy

The Training Program should be:
• Repeatable and dynamic to ensure relevancy to industry changes;
• Capable of measuring learning outcomes; and
• Progressive and globalized providing increased responsibilities and difficulties that lead the candidate to self-sufficiency

The Training Format should consist of:
• Class Room Training—Established set of core drilling courses usually 1 week per month;
• Hands-on Assignments—typically a rig assignment usually 2 weeks per month; and
• Mentor Coaching—Partner a trainee with an experienced staff member. and

The Training program should take no longer than 18-24 months
Best Practices And What A Performance Ready Professional Needs To Know

Core Competencies

• HSE & Standards
  • Internal and External Policies and Regulations
  • Managing Change
  • Emergency Preparedness

• Well Design
  • Subsurface and geophysical considerations
  • Wellbore design
  • Surface Equipment design

• Operations Planning
  • Rig Selection
  • Equipment Specifications
  • Barriers
Best Practices And What A Performance Ready Professional Needs To Know

Core Competencies

• Operations Execution
  • Wellsite Safety
  • Operations Execution-tripping, logging, cementing, testing procedures
  • Supervision and Leadership

• Production Well Integrity
  • Functional handovers
  • Well Operating guidelines
  • Well Interventions
  • Plug & Abandonment
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Maintaining Well Integrity

- Contain fluids, fluid rates and pressures for full-life cycle of well from spud to P&A

- One aspect is barriers following the primary cement job after running casing and before N/U BOPs

- Need to maintain well control

- Need to provide hydraulic isolation with cement

- Optimize plateau time
- Cement goes through a transition from being a fluid with a hydrostatic head to a gel with reduced hydrostatic head to being an impermeable solid that provides hydraulic isolation

- Static gel strength of 500 lbf/100 sq. ft. is typical threshold for prevent gas migration
Gas migration could comprise integrity of primary cement

Significant wellbore influx can lead to a well control event

Depending upon timing, well control event can become an underground or surface blowout
Value Creation / Cost Avoidance

- Misunderstanding/mishandling of this transition time still costs the industry tens of millions of dollars annually associated with well control incidents

- In addition, the invisible lost time of waiting too long also costs the industry tens of millions dollars annually
Methodology for Competency Assessment and Assurance for the Full Life-Cycle Well Integrity Role

There is a growing recognition across the oil industry of the need to assess and assure that the competencies are in place for full life-cycle well integrity from the initial concept through P&A. Well Integrity has not typically been owned by a single individual or even a single discipline within an organization. To assist in this area, a competency map, qualification and methodology is being piloted to provide a process for an organization to conduct and document the competency assessment and assurance for this key role in the life of a well. The methodology has been developed over the last 130+ years for numerous industries, disciplines and job roles. Vocationally related qualifications that are recognized internationally, accompanied by the appropriate award, certificate and/or diploma demonstrate the ability of the individual to actually “do the job”. These qualifications are delivered globally in 10,000+ training centers that operate in over 80 countries and provide learners with real-life, practical skills that are needed to succeed in the modern workplace.
Develop designs to ensure Well Integrity

Provide ongoing support and technical advice to maintain Well Integrity

Capture Learning

The competency map that describes the skill areas associated with life-cycle Well Integrity encompasses competencies from the following discipline areas:

• Design, Planning and Implementation, Drilling Operations
• Petrophysics, Completions Operations, Reservoir Engineering
• Production Operations, Petroleum Business, Geology/Geophysics
 Discipline Competency Inventories / Competency Map Components

- Skill group (12 related to Drilling)
  - Skill (levels of competency) (7-12 per group)
    - Task (tailored to job role)
      - Task Detail (Competency Assessment/Accuracy)
Four Levels per Skill

<table>
<thead>
<tr>
<th>Skill</th>
<th>Awareness</th>
<th>Basic Application</th>
<th>Skilled Application</th>
<th>Mastery</th>
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</thead>
<tbody>
<tr>
<td>GENERAL SEISMIC INTERPRETATION</td>
<td>~ 45 min</td>
<td>~ 1.5 hrs</td>
<td>~ 3 hrs + OJT</td>
<td>OJT only</td>
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<tr>
<td>DATA MANAGEMENT</td>
<td>describe basic knowledge of different platforms for data transfer and data management</td>
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<tr>
<td>MAPPING</td>
<td>describe basic mapping terminology of containing and interpreting structures, such as faults, fractures, structures, etc.</td>
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<tr>
<td>STRUCTURAL MAPPING</td>
<td>define blasts, planes, and fractures</td>
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<tr>
<td>ATTRIBUTE APPLICATIONS</td>
<td>describe seismic attributes and their relationships</td>
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<tr>
<td>INVESION</td>
<td>contrast general mathematical inversions and seismic reflectivity inversion</td>
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<tr>
<td>ADV - WAYS</td>
<td>define basic principles and purposes of advanced ways</td>
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Activities that Build Skill: Courses and/or Work experiences
# Competency Matrix – Well Construction

<table>
<thead>
<tr>
<th>Production &amp; Completions Engineering</th>
<th>G&amp;G Petrophysics / Reservoir</th>
<th>WELL CONSTRUCTION / DRILLING ENGINEERING</th>
<th>Petroleum Business &amp; Professional Development</th>
<th>Health, Safety, Environment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Applied Rock Mechanics</td>
<td>Horizontal and Multilateral Wells: Completions and Stimulation</td>
<td>Solids Control Systems</td>
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<td>Specialized</td>
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<td>Drill String Design and Optimization</td>
<td>Petroleum Project Management: Principles and Practices</td>
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<td>Formation Damage</td>
<td>Cementing Practices – Cementing II</td>
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<td>INTERMEDIATE</td>
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<td>Managing Wellsite Operations</td>
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<td>Practical Drilling Skills</td>
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<td>Directional, Horizontal and Multilateral Drilling</td>
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<td>Production Technology for Other Disciplines</td>
<td>Well Design and Engineering</td>
<td>Offshore Risk Management</td>
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<td>Foundations of Petrophysics</td>
<td>Stuck Pipe Prevention – Train Wreck Avoidance</td>
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<td>Fundamentals of Casing Design</td>
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<td>Primary Cementing – Cementing I</td>
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<td>Drilling Fluids Technology</td>
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<td>Drilling Practices</td>
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<td>Evaluating and Developing Shale Resources</td>
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<td>FOUNDATION</td>
<td>Completions and Workovers</td>
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<td>Petroleum Risk and Decision Analysis</td>
<td>Applied Environment</td>
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<td>Production Operations 1</td>
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<td>Applied Performance</td>
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<td>High Performance Petroleum Teams</td>
<td>Applied Safety</td>
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<tr>
<td>BASIC</td>
<td>Basic Petroleum Geology</td>
<td>Casing and Cementing</td>
<td>Essential Leadership Skills for Technical Professionals</td>
<td>Basics of Environment</td>
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<td></td>
<td>Basic Drilling, Completion and Workover Operations</td>
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<td>Basic Reservoir Engineering</td>
<td>Basic Drilling Technology</td>
<td>Professional Business and Technical Communication</td>
<td>Basics of HSE Management</td>
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<td>Basic Petroleum Engineering Practices</td>
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<td>Exploration and Production Process Basics: Understanding the Petroleum Industry Value Cycle (2 Weeks)</td>
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<td>Introduction to Data Management</td>
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<td>Basic Petroleum Technology (5 days)</td>
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<td>Basic Petroleum Economics</td>
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