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

SEMS (From SPE-166308)

- 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.

Audit Experience (From SPE-166308)

- 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**

Value of Assessment? (From SPE-166308)

- 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

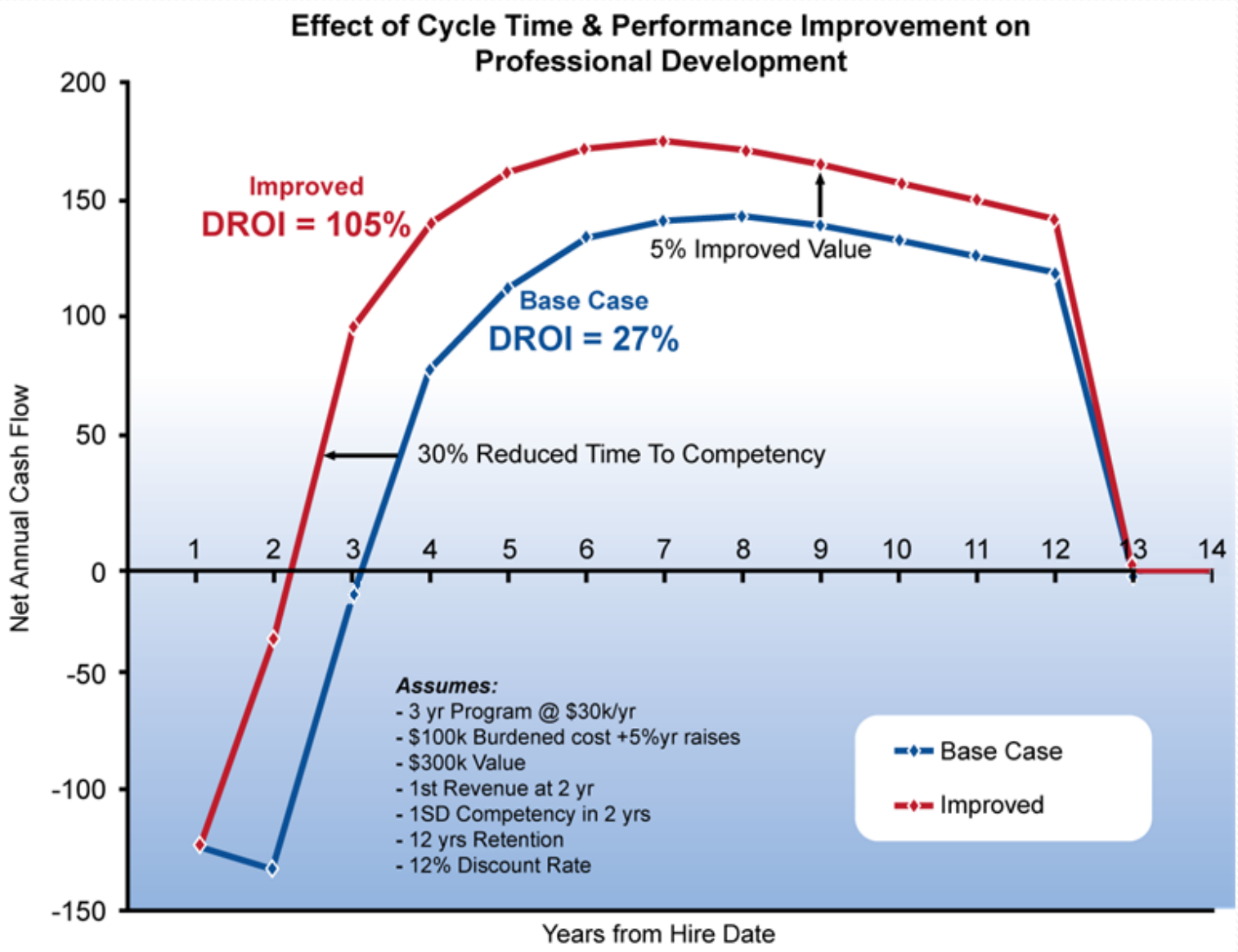
- Shell Graduate Program (SGP)
- Time to Autonomy – The time it takes a graduate employee from entry into the company until he/she can make nonstandard decisions autonomously.
- Time to autonomy 2-3 years vs. 4-5 years previously

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



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- “Performance Ready” Professional – Criteria & Approach
  - **Bruce Kitchel**
- Value Creation / Cost Avoidance - Well Integrity Scenario
  - **James Bobo**

Best Practices And What A Performance Ready Professional Needs To Know

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.

Best Practices And What A Performance Ready Professional Needs To Know

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.

Best Practices And What A Performance Ready Professional Needs To Know

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

Technical Considerations

- 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

Potential Risk

- 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.

Well Integrity Qualification Methodology

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/Assurance)

Competency Maps

Four Levels per Skill

Awareness | Basic Application | Skilled Application | Mastery

Skills

PetroSkills®

Geophysics Competency Map

Skill	Awareness	Basic Application	Skilled Application	Mastery
GENERAL SEISMIC INTERPRETATION	~ 45 min	~ 1.5 hrs	~ 3 hrs + OJT	OJT only
DATA MANAGEMENT	OBTAIN A BASIC KNOWLEDGE OF DIFFERENT PLATFORMS FOR DATA TRANSFER AND DATA MANAGEMENT	EXCHANGE SEISMIC DATA SETS BETWEEN MODELING, PROCESSING, PETROPHYSICAL, AND INTERPRETATIONAL PLATFORMS; LOAD WELL DATA INTO SEISMIC DATABASES	TROUBLE SHOOT PROBLEMS WITH DATA TRANSFER; CHECK FOR [illegible] PHASE OF WELL DATA	[illegible]
MAPPING	DESCRIBE BASIC MAPPING TERMINOLOGY OF CONTOURING AND INTERPRETING STRUCTURE, ISOCHRONS, FAULTS, VELOCITY, AMPLITUDE, FACIES, ETC	CONVERT TIME TO DEPTH, CONSTRUCT AND CONTOUR BASIC STRUCTURAL, ISOCHRON, FAULT, VELOCITY, AMPLITUDE, FACIES MAPS WITH WELL LOCATIONS	QC MAPS AND EVALUATE EFFECTS OF VERTICAL VS. HORIZONTAL RESOLUTION, FRESNEL ZONES; PROVIDE QUALITATIVE/QUANTITATIVE MEASURES OF MAPPING UNCERTAINTIES AND IMPLICATION IN VOLUMETRICS	2D, 3D, AND 4D MAP CONSTRUCTION AND DIFFERENCE SECTION GENERATION; FLUID REPLACEMENT MAPPING; DEFINE WELL TRAJECTORIES; ERROR ESTIMATION
STRUCTURAL MAPPING	DEFINE FAULT PLANE, DISCONTINUITY OF REFLECTORS, ATTRIBUTE PHASE DIFFERENCE, COHERENCY, ANTICLINES, SYNCLINES, SALT AND DIAPIRIC STRUCTURES, DIFFERING KINDS OF FAULTS	HAVE A BASIC COMPREHENSION OF RELATIONSHIP OF 3D AND 3D FAULT IMAGERY AND OF THEORETICAL STRAIN RESPONSE TO CHANGES IN STRESS; PURE VS. SIMPLE SHEAR FAULT STYLES; NONUNIQUENESS OF STRAIN PATH; GEOLOGIC RELATIONSHIP OF STRUCTURES TO ELASTIC AND VISCO-PLAST	MODEL AND INTERPRET STRUCTURAL FAULT PLANES USING STACKED, MIGRATED DATA WITH AND WITHOUT ATTRIBUTE PHASE DIFFERENCE AND COHERENCY ANALYSES; OBSERVATION OF ILLUMINATION DIFFERENCES, DIAPIRISM OF SALT AND SHALE; MAP ANISOTROPIC PROPERTIES	INTERPRET FAULT MECHANICAL STRATIGRAPHY; FAULTS AS PETROLEUM MIGRATION PATHWAYS, AS SEALS, AND AS FRACTURES RESERVOIRS; EFFECTIVELY USE PRE-STACK DEPTH MIGRATION FOR IMAGE IMPROVEMENT; COMPENSATE FOR ILLUMINATION DIFFERENCE+RMS; INTEGRATION WITH GRAVITY
ATTRIBUTE APPLICATIONS	DESCRIBE SEISMIC ATTRIBUTES AND GENERAL OF ATTRIBUTES IN DISCERNING RESERVOIR PROPERTIES	DESCRIBE HILBERT TRANSFORM BASED ATTRIBUTES; AMPLITUDE AND FREQUENCY RELATED ATTRIBUTES; MAP DISTRIBUTION OF ATTRIBUTES TO IDENTIFY RESERVOIR PROPERTIES	CONSTRUCT ATTRIBUTE MAP WHICH ILLUSTRATES UNCERTAINTIES IN DISTRIBUTION; APPLY BASIC GEOSTATISTICAL METHODS TO CORRELATE WITH WELL/RESERVOIR PROPERTIES; INCORPORATE GEOLOGICAL CONSTRAINTS; AND USE MULTIPLE ATTRIBUTES TO DISCERN RESERVOIR PROPERTIES	MODEL TUNING AND NOISE EFFECTS UPON ATTRIBUTES; DISCRIMINATE FLUID TYPES; CONSTRAIN BY INTEGRATION WITH OTHER SEISMIC TOOLS (E.G. VELOCITIES, ETC.); 4DAC INTERPRETATION+RM
INVERSION	CONTRAST GENERAL MATHEMATIC INVERSION VS. SEISMIC REFLECTIVITY INVERSION	OBTAIN A THEORETICAL UNDERSTANDING OF RECURSIVE, MAXIMUM-LIKELIHOOD, MODEL BASED INVERSION AND BASIC ASSUMPTIONS OF EACH	MAKE APPROPRIATE PARAMETERIZATION OF SUBSURFACE MODEL; APPLY INVERSION METHODS; SEISMIC LITHOLOGIC MODELING; INVERSION PROBLEMS WITH THIN BEDS, LITHOFACIES HETEROGENEITY, NOISE	DETERMINE UNCERTAINTY ESTIMATES OF RESERVOIR PARAMETERS; KNOW WHICH INVERSION METHOD BEST SUITED AND WHEN INAPPROPRIATE TO APPLY
AVO – VPVS	DEFINE BASIC PRINCIPLES AND PURPOSE OF AVO AND VPVS	MAKE ELEMENTARY USE OF SHUEY'S EQUATION AND AVO CROSS-PLOTTING TECHNIQUES AND TRANSLATE TO RESERVOIR PROPERTIES	EVALUATE SHUEY'S APPROXIMATION TO THE ZOEPPRITZ EQUATION; NON-LINEAR EFFECTS OF TUNING; ETC.; DETERMINE PROPER PROCESSING FLOW OR SUGGEST SELECTIVE REPROCESSING STEPS; TRANSLATE TO RESERVOIR PROPERTIES INCLUDING PORE FLUIDS	CONSTRUCT FORWARD AVO MODELS FROM LABORATORY DATA AND/OR FULL WAVE SONIC; PROCESS AND INTERPRET 3D AVO; QUALITY CONTROL AVO DISPLAYS AND ANALYSES

Detailed Skill Description

Activities that Build Skill: Courses and/or Work experiences

Competency Matrix – Well Construction