Bridging the Talent Gap

E&P companies are investing in the education of current employees as well as acquiring additional talent. A Schlumberger training program is helping companies manage such talent and accelerate employee training by assessing, developing and monitoring employees' skills and abilities. Geoscience and petroleum engineering courses, integrated training programs and competency assessment and development services are being used to bridge the gap for the next generation of petrotechnical professionals while sharpening the skills of current employees.

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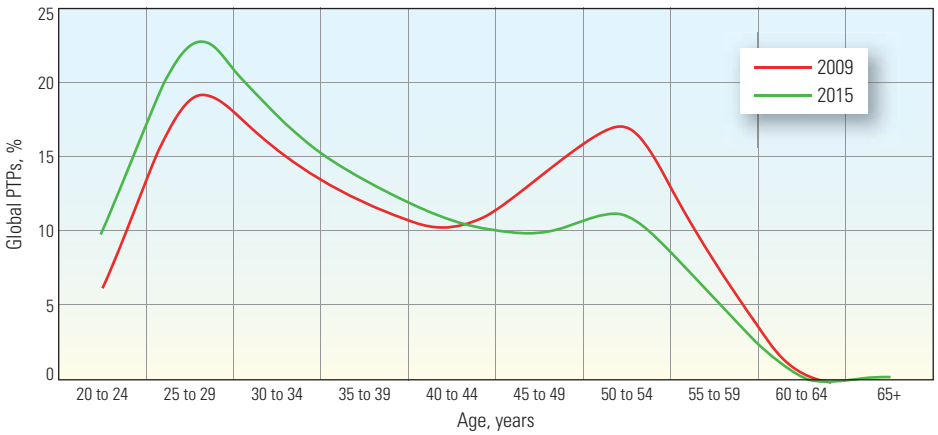
Every job requires certain skill sets and knowledge. In the oil and gas industry, skills and knowledge tend to be honed while on the job. However, because changes are constantly taking place, even experienced professionals may feel some degree of inadequacy. In today's fast-paced E&P world, operators need interdisciplinary approaches to exploration and production, an intense focus on new technologies and attention to the changes in tactics required to pursue new plays, often in settings that were previously deemed inaccessible. For E&P engineers and scientists, these are exciting times filled with innovations and changing paradigms. These circumstances require both new and existing employees to increase their knowledge and upgrade their skills.

In addition to the challenge of new technologies and new ways of accessing resources, E&P companies must also fill gaps in experience and workforce resulting from a demographic shift in petrotechnical professionals (PTPs), many of whom are leaving their jobs as part of the "great crew change."[1] Many experts who entered the industry during the boom days of the late 1970s and early 1980s are reaching retirement age. This situation is compounded by the baby boom generation in the US, a large number of births



^ Global staffing changes, present and future. The percentage of PTPs per age category illustrates the "great crew change" dilemma. The retirement rate is at 20% for 55- to 59-year-olds, 90% for 60- to 64-year-olds and 100% for those 65 and older. The E&P industry attrition rate is 1.4%. (Adapted from Rostand and Soupa, reference 1.)

recorded between 1946 and 1964. The first of these "baby boomers" reached age 65 in 2011, and the expectation is that up to 50% of the US energy workforce will retire within the next decade.[2] At the same time, the experienced mid-career population of 32- to 50-year-olds is underrepresented because of low hiring rates during the boom-and-bust cycles of the 1980s and 1990s.

Although companies are hiring young workers to replace retiring workers, many younger people typically have limited experience and inadequate training because companies, under restricted budgets, have cut training. The result is a loss of know-how leading to a talent gap (previous page). Companies are already reporting delays in some projects caused by this talent shortage.[3] Consequently, some operators ask relatively inexperienced PTPs to assume the responsibilities of their mentors and managers without allotting time for them to acquire the necessary skills. Young employees also have to take responsibility for complex engineering projects earlier in their careers than did their predecessors. The resulting situation necessitates intensified training and development programs.

Changing demographics, the accelerated introduction of new sciences and technologies and the experience gap are combining to compel E&P companies to reassess the strategic importance of their training and development programs. In addition, companies want to improve and accelerate the transfer of existing knowledge from senior experts to recent hires

1. The term *petrotechnical professionals* refers to geoscientists and petroleum engineers. Geoscientists include geologists, geophysicists and petrophysicists. Petroleum engineers include reservoir, drilling, completion and production engineers.

   For more on the great crew change: Coton S: "The Great Crew Change: A Challenge for Oil Company Profitability," *Journal of Petroleum Technology* 63, no. 4 (April 2011): 58–59.

   Rostand A and Soupa O: "The Strategic Importance of Talent," *SBC Energy Perspectives* (Summer 2011): 48–51.
2. Tennant J: "Making Informed Human Resources Decisions Based on Workforce Outlook," *World Oil* 233, no. 9 (September 2012): R127–R132.
3. Talent refers to a person or persons with ability or aptitude in a particular domain, field or area of knowledge or specialization.

   Rousset J-M, Bismuth P and Soupa O: "Technical Talent Shortage Could Begin to Limit Growth," *Journal of Petroleum Technology* 63, no. 6 (June 2011): 46–49.

   Olson B, Klump E and Kaskey J: "Dearth of Skilled Workers Imperils $100 Billion Projects," Bloomberg (March 7, 2013), http://www.bloomberg.com/news/2013-03-07/dearth-of-skilled-workers-imperils-100-billion-projects.html (accessed March 7, 2013).

   Huizer TJ and Portner F: "Building a Talent Engine," *SBC Energy Perspectives* (Semester 1, 2013): 4–9.

^ Geology field trip. At an outcrop of the Desert Member and Castlegate Sandstone in Thompson Canyon, Utah, USA, a field trip leader (second from left) shows trainees that what they see in the outcrop translates to a geologic cross section and a deterministic Petrel E&P software platform model. The outcrop relief here is about 100 ft [30 m].

while those experts are still available. Current training programs focus on accelerating the development and transfer of domain knowledge to novice PTPs but are often rooted in traditional classroom learning environments, a methodology that tends to neglect practice and learning using real data and workflow proficiencies. These proficiencies are essential for success in the rapidly changing E&P environment. To make immediate contributions, young PTPs must have a firm grasp of their subject matter and have practical knowledge of the data, tools and workflows important to their work groups and businesses.

The challenge for accelerating petrotechnical learning is to maximize its efficiency, practicality and effectiveness. NExT—Network of Excellence in Training—a Schlumberger company, uses blended learning-by-doing and competency management to meet these challenges. The approach consists of three components:

- subject matter learning
- technology exposure
- practice with real data.

These components are achieved through a combination of classroom-based, instructor-led coursework and workshops, case study learning, field trips, visits to laboratories and engineering and manufacturing facilities, mentoring and coaching programs and on-the-job training (left). The exact mixture of these training tools depends on each customer's needs and the competency levels to be achieved.

Learning-by-doing emphasizes analytical thinking and experience gained through a mixture of traditional teaching and hands-on training complemented by comprehensive technology and data exposure.[4] The goal is to shorten the time to autonomy, transforming a newly hired PTP into a competent, independent decision maker who contributes to a company's success.[5]

For fit-for-purpose training, NExT uses competency assessment and management to establish the curricula, benchmarks and milestones to ensure that training is efficient, targeted, effective and meets the needs of businesses to acquire talent and the needs of employees to acquire knowledge and skills to do their jobs. These competency programs are customized to the requirements of E&P disciplines and job functions of each business. Competency management uses a matrix of specific skill elements and levels of required proficiency for a job at each rank or progression level. Training and development staff use the matrix to assess proficiency, identify skill gaps, design curricula to fill gaps and verify training effectiveness.

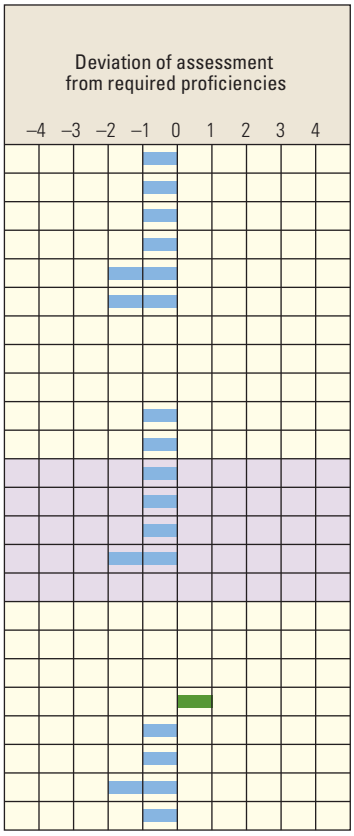
This article describes the NExT program, a training approach created to bridge the talent gap, and explains how training programs are tailored to meet specific customer needs while providing proficiency metrics to quantify success. Case studies of competency manage-

^ Training program. Trainees meet with a Schlumberger subject matter expert (*center*) to discuss drilling operations in a NExT training program.

4. Learning-by-doing is a form of problem-based learning. For more on problem-based learning: Galand B, Frenay M and Raucent B: "Effectiveness of Problem-Based Learning in Engineering Education: A Comparative Study on Three Levels of Knowledge Structure," *International Journal of Engineering Education* 28, no. 4 (July 2012): 939–947.
5. Soupa O: "Benchmarking Industry Talent Needs," *Journal of Petroleum Technology* 62, no. 7 (July 2010): 28–30.
6. Bowman C, Cotten WB, Gunter G, Johnson JD, Millheim K, North B, Smart B and Tuedor F: "The Next Step in Collaborative Training," *Oilfield Review* 12, no. 2 (Summer 2000): 30–41.
7. Some program participants may receive master's degrees from Heriot-Watt University if the programs are certified by that university for academic credit.

Reservoir Engineering Profiles

Skill unit	Skill element	Awareness	Knowledge	Skilled	Advanced	Expert
Reservoir engineering foundations	Reservoir production geology		✓X	●		
	Formation evaluation		✓X	●		
	Fluid flow through porous media		X	●✓		
	Properties of petroleum fluids		X	●✓		
	Well performance prediction		X	✓	●	
	Well test design and interpretation		✓X		●	
	Data management			●✓X		
	Geology		●✓X			
	Petrophysics		●X	✓		
	Decline curves			✓X	●	
	Unconventional reservoirs		X	●✓		
Basic reservoir engineering methods	Reserves determination			X	●✓	
	Gas reservoir engineering		X	●✓		
	Petroleum economics		X	●✓		
	Analytical techniques		X	✓	●	
	Reservoir management principles and practices			●X	✓	
Advanced reservoir engineering methods	Secondary recovery process			●X	✓	
	Immiscible and miscible gas injection			●X	✓	
	Subsurface integration			●✓X		
	Interactive real-time data transmission	●	✓X			
	Simulation-model construction and history matching		X	●✓		
	Simulation-model behavior forecast		✓X	●		
	Simulation compositional modeling	X	✓	●		
	Simulation of complex, dual-porosity systems	X	●✓			



^ Job profile. A job profile matrix is a collection of skill units, skill elements and proficiency levels; only a portion of a matrix is shown here. A skill unit is a collective job function such as reservoir engineering foundations. A skill element is a subset of a skill unit, such as reservoir production geology. Each skill element has a required proficiency (black dot) that depends on the job, required skill unit and a trainee's experience level. The matrix also includes specific definitions of each skill element (not shown) at each rank and proficiency level; including these specifics reduces assessment subjectivity. A participant performs a self-assessment (checkmark), which is adjusted (X) after an SME interviews selected participants. The deviation of the final adjusted assessed proficiency from the required proficiency shows gaps (blue) and strengths (green) in the individual's skills and abilities; where there is no deviation color, the individual has met the required proficiency level.

ment and integrated training programs illustrate the NExT approach to developing and executing training programs.

Background

In 2000, Schlumberger and three universities that offer curricula in petroleum studies created a limited liability company called NExT, a Network of Excellence in Training. The three universities with close links to the energy industry—Texas A&M University, College Station, USA; the University of Oklahoma, Norman, USA; and Heriot-Watt University, Edinburgh, Scotland—combined their educational capabilities with the operational experience of Schlumberger professionals to provide the NExT organization with training and development expertise.[6] This partnership continues today.

In 2010, Schlumberger purchased commercial rights from the three alliance universities but retained and maintained their instructor pool. In addition, NExT augmented its instructor staff with Schlumberger petrotechnical experts and industry-recognized experts from various consulting organizations.

NExT provides services to E&P companies in more than 50 countries. These services span three categories: oil and gas courses, competency management services and training programs (previous page, bottom).

The NExT course catalog contains more than 420 offerings that include technical and software courses, integrated training programs, software certification, and in some cases, credit toward master's degrees.[7] Competency management services include initial assessments, competency gap analysis, curriculum development and training to fill assessed gaps in employee competencies as well as follow-up verification to quantify improvements from training.

Competency and Gaps

NExT training programs are often tailored to meet a customer's business objectives and technical challenges. A NExT team begins the process by building a tailored, customer-specific competency catalog and matrices for each job function; then it executes competency assessments and gap analysis. The results provide the data necessary for NExT experts to propose priorities for training and development programs and recommend strategies to meet those priorities.

To define job functions, NExT subject matter experts (SMEs) work with a company to understand its business and technical needs. Then they draft discipline-based competency matrices for jobs within the company. The matrices consist of skill units, skill elements and required proficiencies for each domain—the field or area of knowledge or specialization (above). Each

Proficiency Levels

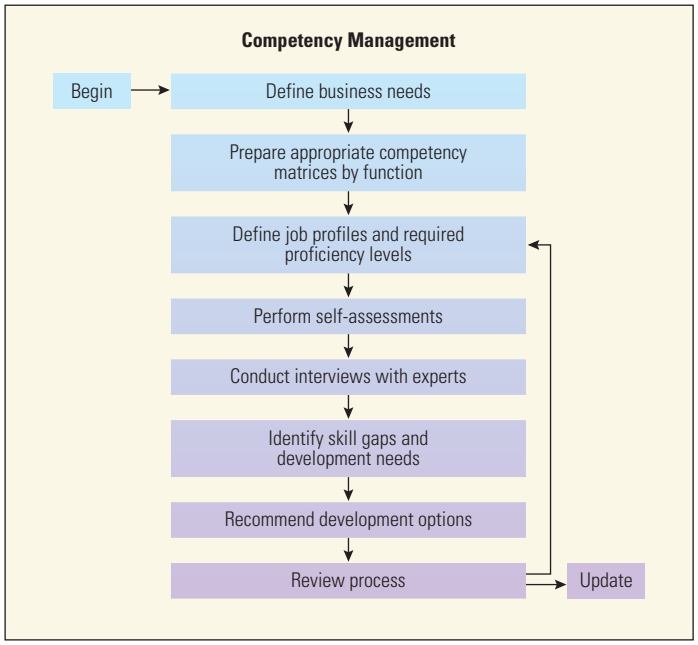
Expert	Advises the company on the strategic value and direction of the technology. Considered an authority on the technology by peers and company.
Advanced	Advises others engaged in applying the skill and can teach or mentor others. Has applied the technology on numerous projects in several diverse, complex areas.
Skilled	Applies the knowledge and skills, regularly and independently, in projects and can demonstrate their use.
Knowledge	Has attended a relevant course or training that covers principles and can explain and apply technology under supervision.
Awareness	Recognizes a technology or technique, knows its purpose, can describe it and understands its value and limitations.

^ Proficiency levels and their definitions.

skill element in the competency matrix has five proficiency levels: awareness, knowledge, skilled, advanced and expert (above). To reduce subjectivity in the assessment, the matrix includes specificity about each skill element, rank and proficiency level. A job profile maps the required proficiency level for the skill elements in that job within the domain. Core competencies are elements that are critically important in performing the job or meeting a business or technical challenge. The remaining elements are called complementary competencies.

SMEs then perform a competency assessment to determine an individual's actual level of knowledge and skills compared with the level of knowledge, skills, abilities and competencies required for the job.[8] The participants in the training program complete a self-assessment questionnaire by selecting the proficiency level they believe they possess for each of the skill elements. Following the self-assessments, the results are compiled and analyzed, and a sample of participants, who represent the distribution of responses to the questionnaire, is selected for interviews to validate and adjust the self-assessments.

Finally, gap analysis is performed to compare individuals' assessed proficiency level with the required proficiency level for job functions. When assessed proficiencies are less than required, curriculum planners target these skill gaps for training. When assessed proficiencies are greater than required, these are noted as technical strengths. Gap analysis results form the basis of recommendations for training priorities and programs that address skill gaps and raise the competency levels of trainees (below left).



^ Competency management. Competency management is a process that responds to customer company objectives and business needs. NExT SMEs and company representatives gather technical requirements, which are based on the current corporate and business objectives. They align the competency framework with the technical needs and then create processes and job profiles that represent the projects and position competency requirements. Working with NExT, the company assesses its staff and evaluates the gaps between required and actual proficiencies. Last, NExT and the company design a roadmap to close these gaps in the short term and provide a plan for long-term career development. As the company's business changes, the human resources department realigns the models.

Redefining Independent

Small, independent oil companies are often characterized by flat organizational structures with very little vertical hierarchy. Their business model is simple—to add more reserves through exploration, development and production. Typically, most employees are involved in looking for exploration plays, leads and prospects that may turn into successful discoveries; preparing and executing field development plans; and conducting production or reservoir analysis tasks to grow or maintain production from existing assets. These job tasks are focused on growing and exploiting reserves for a company. As a successful, small independent oil company grows, its staff increases, and the company eventually imposes some degree of vertical structure and hierarchy. To do so, it must understand what talent it has and how to use it to run the business most profitably and effectively.[9]

An independent oil company in the US recognized that it was facing a personnel development dilemma. The company was expanding rapidly; its workforce and proven reserves doubled in five years. To address this rapid growth, the company formed a talent and development division within

8. *Knowledge* is the set of facts, concepts, language and procedures needed for a job. *Skill* is the acquired experience and know-how needed to perform tasks in a job. *Ability* is the innate aptitude to carry out a job. *Competence* is the combination of knowledge, skill and ability to perform a job at some specified proficiency level.

9. Sanghi S: "Building Competencies," *Industrial Management* 51, no. 3 (May–June 2009): 14–17.

its human resources (HR) department to acquire, develop and manage talent.

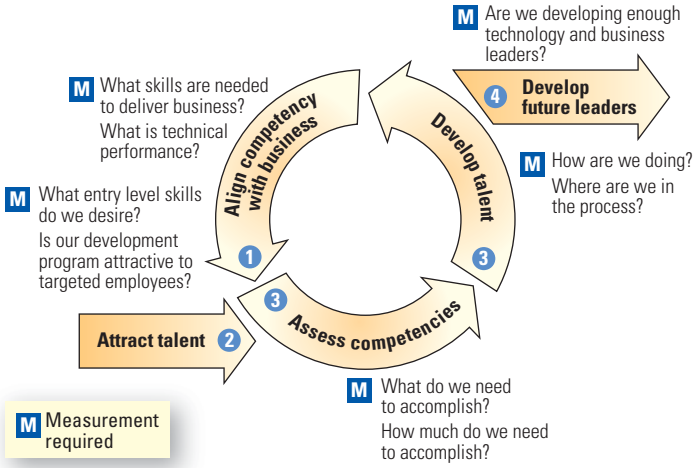
The first task for the HR department was to evaluate the current level of employee expertise, assess each employee's skill set and define specific job roles within the organization (right). The department also needed to understand the skill gaps that existed and to align and develop skill sets commensurate with business objectives; the HR department had to conduct this process to understand how to attract, develop, engage and retain talent for the company and cultivate future technical leaders within the organization. The HR department also needed to identify those with technical leadership and establish a structured system to transfer knowledge from senior to junior staff.

The HR department required quantifiable measurement points to determine the business value of this process. Business value may come in the form of direct and indirect benefits. Direct benefits include accelerating personnel development and improving retention of those with key skills in the company. Indirect benefits include engaged employees who are empowered to take control of their careers.

The company approached NExT to assist with talent management. NExT SMEs teamed with the company SMEs to define job profiles and competency matrices for each domain represented in the organization.

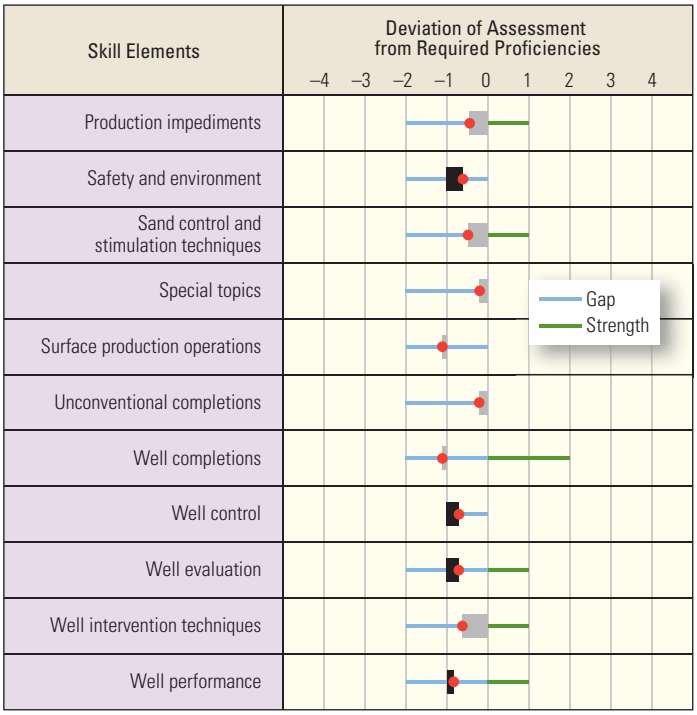
For the first step of the process, early career staff—those with one to seven years of experience—completed individual self-assessments, and the SMEs created skill assessment reports for each participant. The HR department provided the SME team with background information for each participant, including job assignment, years of experience, education level and place of education. This background information helped the team compare skill levels of participants with skill levels based on industry requirements. The team then conducted skill assessment interviews that enabled the team to validate each participant's self-assessment, and the results of the interviews allowed the team to update the self-assessment reports (right). The team of NExT and company SMEs then planned multiyear training actions for each participant. Plans included courses, workshops, learning-by-doing programs, self-study and on-the-job coached project work.

Through the competency assessment process, the company has aligned job functions with its business objectives, compiled required job profiles, defined proficiency requirements,



^Talent development steps. Counterclockwise from upper left, talent development starts with the development of competency models—a combination of competencies and job profiles that are aligned with the needs of the business (1). The company must attract the correct talent (2), which is a continual process and is influenced by business needs and the alignment of competency models with them to help with recruitment of both midcareer staff and new graduates. The keys to building talent are skills assessment and personnel career development (3). Using the competency models, a company assesses existing talent, establishes the gaps in proficiencies and uses the gaps to develop training options and plans for employees. Finally, through this process, the company identifies, develops and nurtures its future leaders (4). The measurement points (M) identify questions that must be quantified to determine the progress of development.

^Gap analysis of job trainee population. Every job has skills that an employee must perform at required proficiency levels (black dots). A group of job trainees undergoes competency assessment, and the trainees' final adjusted assessment scores are aggregated and averaged (X). Gaps (blue) and strengths (green) in the trainees' proficiencies provide the data to establish training targets for improving the group's skills and to identify talent within the company.



^ Gap analysis. This summary of gap analyses from a population of one company's production engineering employees revealed areas where training should be focused to eliminate gaps (blue) in proficiency. The analysis also showed some expertise within well completions, as this element showed the highest strength (green). For each production engineering skill, the bars summarize four statistics of the deviations of assessment from required proficiency—maximum, minimum, average (red dot) and median deviation. Zero deviation means that the assessed proficiency equals the required proficiency for the skill element. Positive deviations are strengths—when the assessed proficiency is greater than the required proficiency. Negative deviations are gaps—when the assessment is less than required. The boxes along the bars show the central tendency of the deviations; they are black when the median is less than the average and gray when the median is greater than the average. The spread of deviations results from the mix of backgrounds and experience in the sampled population.

completed roadmaps for training and development and established benchmarks for assessing talent and training. The company has learned what skill sets are required for individuals to do their jobs now and in the future. The company became cognizant of the baseline skills for their current staff, and as a result, established a training plan for closing the skill gaps (above).

As the independent oil company grows and redefines itself, the HR department has a roadmap for aligning and managing its talent to fit its business objectives. The competency matrices will facilitate the company's ability to foster and reward performance and optimize its ability to attract and retain talent. The employees should then have a complete understanding of the performance drivers within the organization, which will help them develop their careers.

Maximizing Software Proficiency

When companies experience rapid growth, they sometimes need to restructure to adapt to their expanded size and activity. A medium-sized North American independent oil company had to contend with growing pains as it sought to expand operational activities and add seasoned technical and managerial staff. The company also intended to adopt the latest field and software technologies. In doing so, it recognized the need for effective software training and thus provided generous training opportunities for its technical staff.

Embracing the most current software technologies is a tactic for increasing efficiency and productivity of PTPs on exploration, operations and asset teams. To benefit from changes in software technology, employees must have a good technical foundation in science and technology along with skills for using specific software products championed in the company. NExT was called in to assess the company's training environment, including the organization's structure, technologies used, types of training offered, current competencies of the staff and anticipated technology needs.

To begin its evaluation, NExT interviewed the company's management to understand the organization, its current business outlook and its expectations for technology in the future. NExT placed parameters on these expectations to develop metrics—standards of measurement—to assess experienced employees, defined as those with 10 years or more in the industry. Most respondents had been with the company for 10 years or less but had more than 10 years of industry experience. A sample group of these employees took a survey that measured their current proficiency with the company's software technologies and workflows. The company expected experienced PTPs to be proficient with technology, yet the survey revealed gaps in skills and abilities that provided NExT with the data necessary to establish targets for improvement.

Assessment results also revealed that the current technology training program was not providing desired benefits to the company (next page, top right). The self-assessment surveys showed that few people were highly proficient in software usage. Follow-up interviews confirmed these findings. Some PTPs used only basic functions provided by the software and, because they lacked awareness and knowledge of software capabilities, these PTPs did not use other software applications.

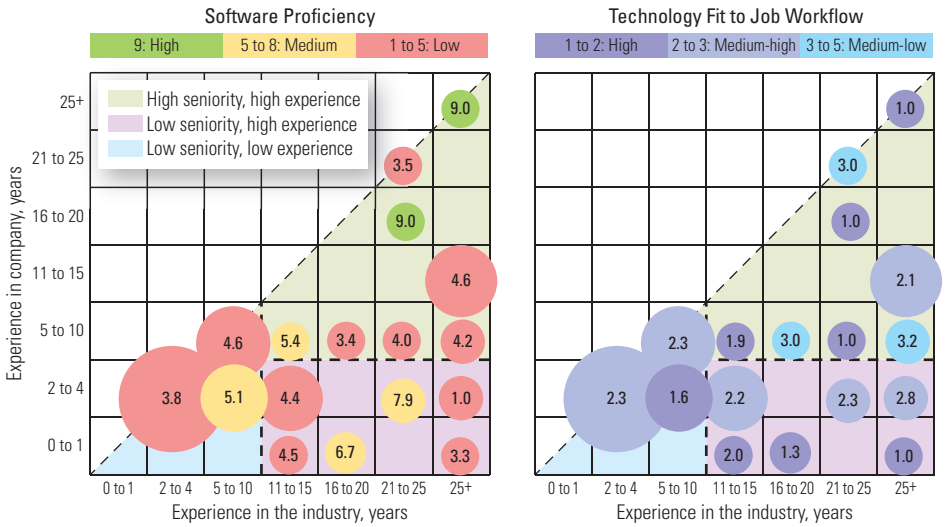
Survey results suggested that, with few exceptions, the company software training program was not meeting the technical requirements of employees. Employees' software proficiency needed to be aligned with domain experience, and targeted training had to be designed to fill gaps between assessed and expected software proficiency. Knowledge transfer could also be facilitated by fostering a climate in which junior staff members feel comfortable asking for help and expert staff are expected to mentor, coach and transfer knowledge to junior staff.

The surveys and interviews identified employees' concerns regarding the current state of the organization; their own learning, competency and software usage; and standard practices surrounding software technology. The survey and interview results suggested that the company's

lack of a software vision and strategy had led to haphazard adoption of software. NExT recommended the following strategic solutions to address these concerns:

- rationalize workflows to align with company strategies and industry best practices
- provide more hands-on courses using software critical to the company mission as well as software recognized to be E&P industry standards
- establish transparent guidelines for pairing software with asset types and workflows
- establish benchmarks for skills with recommended software, organized by workflow and discipline
- promote and develop technology champions within asset teams to transfer knowledge of assets, facilitate peer-to-peer training and foster a sense of technical achievement.

After implementing various recommendations, the company saw measurably positive returns on its training investment.



^ Self-assessed software proficiency and technology fit. Fifty geoscientists at one company participated in self-assessment surveys about their software proficiency and understanding of how the software fit with their job workflow. The bubble size corresponds to the number of respondents. The bubble colors and numbers represent average scores on software proficiency (*left*) and fit to job workflow (*right*). Software proficiency is low across the experience spectrum. However, the respondents rated the software as being appropriate for their jobs. These findings suggest that low software proficiency results from inadequate training rather than from inappropriate software.

Accelerated Learning

Aramco Gulf Operations Company and Kuwait Gulf Oil Company formed Al-Khafji Joint Operations (KJO) in 2000 to operate jointly and share equally in hydrocarbon production from the Saudi–Kuwaiti neutral zone between the borders of Saudi Arabia and Kuwait. KJO wanted to expand its exploration activities. However, it faced an acute shortage of trained PTPs. To accelerate its training of exploration PTPs, KJO contracted with NExT to develop a blended training program for new hires and midcareer engineers and geologists.

NExT developed two training programs, one designed to train 20 new hires over three years and the other to train 20 midcareer PTPs over two years. Both programs started with a trainee competency analysis followed by gap analysis. These data formed the bases of blended learning curricula featuring theory and software courses, on-the-job training (OJT), workshops, field trips, mentoring sessions, projects and project management training. The programs included verification of training effectiveness to gauge competency growth and individual participation.

The new-hire program focused on training seven engineers and five geoscientists in subsurface geology and eight engineers in surface facility operations. The goal was to develop semiautonomous professionals who were able to operate at a skilled proficiency level. The three-year curriculum evolved from 100% classroom training at the start of the first year to 90% OJT by the end of the third year. Building a foundation of core competencies in each subject domain was the purpose of Year 1. Training included a blend of instructor-led and self-directed learning and field trips. During Year 2, the focus moved to strengthening core competencies in each trainee's primary discipline through advanced coursework, mentoring by peers and experts and starting OJT projects. By the end of Year 3, trainees were expected to achieve proficiency and autonomy in their job function, to be fully engaged in OJT under structured mentoring by experts and to be responsible for project assignments.

The new-hire program started in October 2010. After the first year devoted primarily to coursework, the trainees' competency rose from an awareness level of 1.55 to a knowledge level of 2.04 (below).[10] After three years, trainees were expected to be at the skilled level of 3.

Domain	Initial Assessment	End of Year 1
Subsurface geology	1.61	1.90
Subsurface engineering	1.55	2.01
Surface engineering	1.50	2.21
Overall	1.55	2.04

^ Return on KJO investment in training. Competency models and measurements provide a standard for assessing skill levels and ensuring that training is fit for purpose. The range of improvement in the trainees' competency since their initial assessments was 18% to 47%. This result gives the company confidence that the training program is working.

10. The competency proficiency scale levels are the following: not aware 0, awareness 1, knowledge 2, skilled 3, advanced 4 and expert 5.

Based on lessons learned during the first year of training, NExT and KJO will modify the new-hire program. The ability to modify such training programs illustrates the flexibility of the NExT system. Rather than starting the program with a year of classroom coursework and ending with principally OJT, the new program will include a richer mix of classroom and hands-on training from the outset—from 60% classroom training at the start to 80% OJT by the end. Program participants indicated that staggering the courses and mixing in hands-on training would be more effective and would also facilitate learning and retention of course material. During 2013, KJO expects to hire 30 recent graduates; these new employees will follow the modified training regimen.

The program for midcareer hires focused on training seven geoscientists and nine engineers in geology and reservoir engineering and four engineers in drilling engineering. The goal was to develop participants into autonomous professionals, able to operate at an advanced to expert level and be responsible for conducting a full field development plan. NExT training professionals designed a two-year curriculum that began with 100% classroom learning and concluded with 100% onsite mentoring. During the first year, the trainees took preliminary courses to fill in gaps in the group's knowledge and combined their disciplines to collaborate on fully integrated multidisciplinary projects. In addition, individualized courses resolved gaps in trainee education and functional knowledge.

During the second year, each trainee was assigned to one of three integrated field development training projects following consultation with mentors and KJO management. NExT SMEs designed each integrated field development training project to last approximately four months. In the first two weeks, the trainees conducted an initial project assessment and took part in a project management course. During the following seven weeks, participants attended courses on the theory and workflows related to field development plans, including subsurface reservoir geology and geophysics, surface facilities, predictions of production and field operations and maintenance. In the final eight weeks, the trainees planned a field development project and worked on a subset of data from a general development plan. The trainees concluded the program with a final project and a presentation to KJO management. After these training projects, each midcareer trainee is expected to capitalize on knowledge gained and become a contributing member of an asset team.

The midcareer hire program was completed in 2012. The successor to this program is the KJO Specialist Talent Development Program (STDP), which is open to high-potential national employees with at least seven years of industry experience. STDP is a competency-based development program with the goal of transforming employees skilled in a discipline into specialists or experts. For the new program, each participant is evaluated for acceptance into the program based on competency level, then each phase of that person's individualized development plan will be evaluated by KJO SMEs.

The new hire and STDP programs are important to KJO because these programs eliminate the knowledge and skill gaps created as experienced employees depart KJO through retirement and attrition. For KJO, the programs help to build PTP leaders, develop young qualified PTPs into skilled PTPs who can work independently and enable the company to become less reliant on external specialists.

Unconventional Talent for Shale Plays

Saudi Aramco collaborated with NExT to train and develop expert PTPs in unconventional gas resource (UGR) exploitation. The company made a commitment to an accelerated training program to train asset teams of engineers and geoscientists for the UGR group. The training program emphasized integrating trainees into coherent asset teams, in which each team member has a core discipline competency and also has familiarity with the other team members' disciplines.

A typical training program begins with competency assessments of trainees. However, in this case, candidate trainees received general overview coursework on shale gas geoscience and engineering. Based on their coursework evaluations, the candidate teams of geoscientists and engineers were selected for UGR training.

The trainees then underwent baseline competency assessments evaluating their knowledge of the geoscience and petroleum engineering of shale gas resources. Following assessment, they began their UGR training, a blend of 20% learning, 20% technology exposure and 60% on-the-job training.

The program began with a focus on the fundamentals of UGR technology. This curriculum consisted of instructor-led coursework covering shale play geology, geophysics, petrophysics, geomechanics, reservoir engineering, well engineering, completions and stimulation, production engineering and water management.

Following the classroom component, the geoscience and petroleum engineering trainees focused on their core technologies, although each group was exposed to the technologies of the other group through cross-disciplinary training. Such training ensured that all participants understood the role of each technical discipline since interdisciplinary teamwork is vital for UGR exploitation and reservoir management.

The heart of the training program was an extended period of practical OJT. Trainees were expected to conduct tasks on actual shale play datasets and apply knowledge gained from classroom and software training. The trainees, separated into their geoscience and engineering groups, were rotated through diverse parallel projects in various Schlumberger facilities.

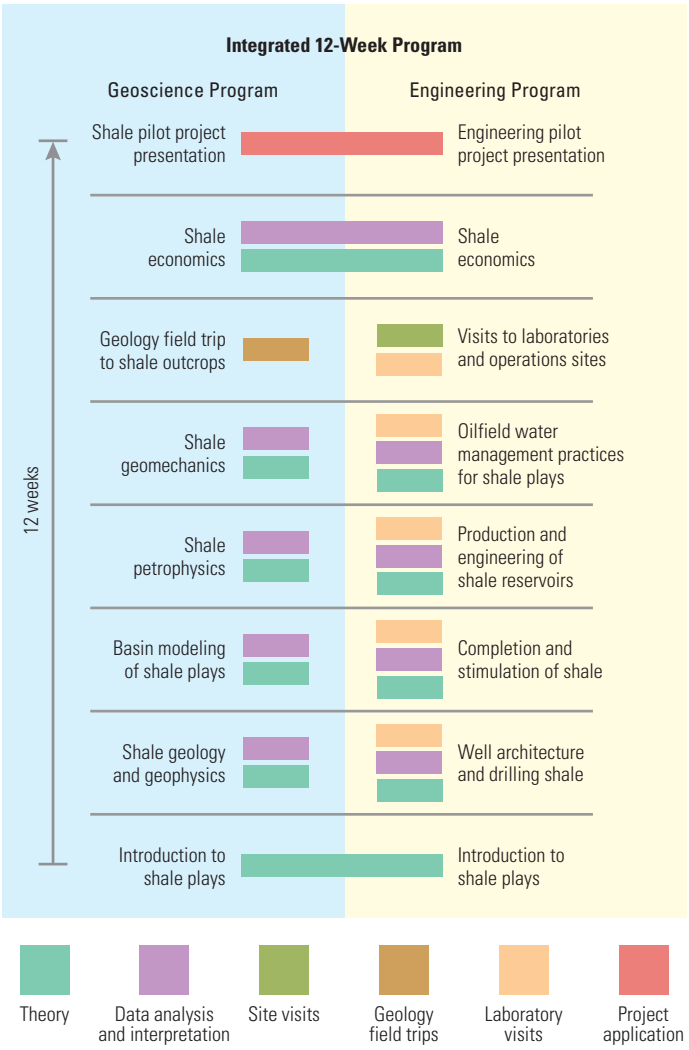
In conjunction with OJT, the trainees participated in the following:

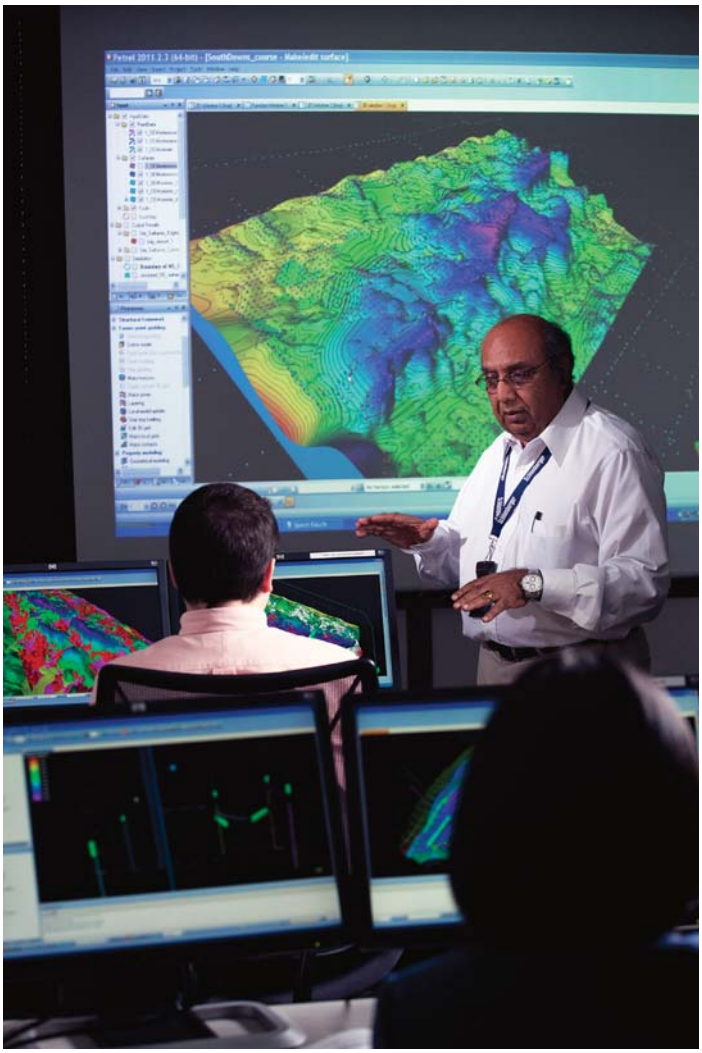
- project-based training using shale reservoir data under the supervision of industry shale experts
- site visits to manufacturing facilities to examine openhole logging tools, wellhead assemblies, drill bits and other technology
- geology field trips to observe shale outcrops and correlate them with software-based geology models
- observations of selected field operations
- specialized training on unconventional gas resource technology.

Following OJT, the groups came back together to work as asset teams on integrated facilities and shale play asset management projects. Each asset team member shared responsibility for the successes and failures of projects and learned the economics of unconventional gas resources using a mixture of theory and software to analyze datasets.

At the end of the program, each asset team evaluated an integrated project and produced a report detailing how it would manage the asset. Each team presented its report to a panel of industry SMEs, who graded the team.

Each trainee underwent a closing competency reassessment to measure and verify improvement in proficiency in shale play geoscience and engineering. The improvement in the trainees' skill proficiencies, which was quantified by the reassessments, demonstrated the return on investment from the UGR training program.





^ Multidomain shale training program. This 12-week training program (*left*) consists of parallel geoscience and engineering tracks. The training is a blend of theory, data analysis and interpretation (*right*), site visits to operations, geology field trips, laboratory visits and projects. The order of training proceeds from bottom to top. Geoscientists and engineers begin together learning the fundamentals of shale plays. Their tracks diverge for several weeks. At the end of the program, the trainees come back together to learn the economics of shale plays, form asset teams and work on common pilot projects. Finally, the teams give presentations to industry SMEs, who grade the trainees on their evaluations and recommendations for the projects.

Multidisciplinary Learning

The Saudi Aramco training program focused on acquiring capabilities needed to develop shale plays. In addition to conventional instructor-led training, the program exposed trainees to enabling technologies, field operations and on-the-job practice, culminating in trainees working through a scenario from a real project. This particular program will enable Saudi Aramco to accelerate the capabilities of its PTPs to exploit UGR opportunities.

Unlike Saudi Aramco, many companies in North America have mature shale play businesses. Even so, some companies may still need to expand their employees' capabilities in shale play technologies. Based on recommendations and feedback from participants and mentors of the Saudi Aramco program, in addition to discussions with SME advisors from US-based companies, NExT designed a 12-week multidisciplinary shale training program, which is expected to be available during the fourth quarter of 2013 (above). Each part of the 12-week program is a blended learning-by-doing module. In addition, customer companies may provide their employees with additional OJT in shale play resource exploitation and management.

The solution to development and acceleration of petrotechnical learning is to maximize its efficiency, practicality and effectiveness. NExT uses blended learning-by-doing and competency management to achieve these objectives and help bridge the talent gap in the E&P industry. Learning-by-doing combines learning modes based on customers' business objectives and technical challenges, while competency management ensures that the training is efficient, targeted and effective. Using these techniques puts E&P businesses of all sizes on the path to sustainable talent development and puts their PTPs on the road to proficiency. —RCNH