In modern industry, quality is often discussed, but frequently misunderstood. The perception of quality—what it is and isn’t—varies widely from individual to individual and company to company. Oilfield service quality has received increased attention during the past decade as oil and gas operators strive to maximize hydrocarbon production and recovery at the lowest possible cost. This article illustrates how one drilling contractor, Sedco Forex, is infusing a quality culture and mindset in its organization to provide the best possible service.

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“We must define quality as ‘conformance to requirements’ if we are to manage it.”

What is your definition of quality? To some, it means fine craftsmanship, precision and attention to the smallest detail. For others, it’s consistency and reliability—something produced the same way time after time, something you can count on. For still others, it’s getting the best value for the money spent. Whatever your definition, you perceive a product or service to be of high quality—whether it’s a new automobile or how the waiter handles the orders and food delivery in the local restaurant—if it meets or exceeds your expectations. These expectations are often highly subjective. In the final analysis, quality is really obtaining what was promised by mutual agreement between provider and end user. For quality to be more than mere perception, however, requires established specifications—quantifiable standards or benchmarks against which the product or service can be measured objectively.

In the oil field, quality has taken on a new meaning and importance over the past decade. During the boom of the late 1970s, speed was all important. Wells were being drilled at a phenomenal pace; rigs were in short supply. How rapidly a contractor could move onto location, rig up, get the well drilled, rig down and move to the next site was, more often than not, the principal benchmark of a quality operation. However, the industry paid a premium price for this speedy delivery service, and the quality of the end product, the well, frequently suffered.

With the bust of the mid-1980s, the mentality of the industry changed drastically. Oil and gas operators were forced to look at ways to cut costs and squeeze the most out of every dollar spent. This was a prerequisite for survival and protection of the bottom line. Speed was no longer the prime determinant. It was replaced by a growing awareness that quality would be the single make or break factor in the future. Slowly at first, and then with increasing momentum, operators and service companies alike began to adopt the principles of quality that had, until then, been relegated to industries outside the oil patch. How the application of these principles by one particular drilling contractor provides dividends to its clients, its personnel and its operations is the focus of this article.

Have demonstrable results been achieved? Most assuredly they have been, as pointed out by the benefits gained in three diverse operating areas:
target reductions in operational lost and down time, Woodside Offshore Petroleum Pty. Ltd. and Sedco Forex recently completed a development program 20% under budget (see “A New Approach to Quality and Efficiency in Australia,” page 29).

To fully understand the route to these improvements, we begin with the fundamentals of a quality culture—what they are and how they are implemented—and then investigate how such a culture has been established within Sedco Forex.


Why the Emphasis on Quality?

“The customer deserves to receive exactly what we have promised to deliver.”

The drilling industry has evolved significantly in terms of work scope and the division of responsibilities between oil companies and service suppliers. Much of the change has been driven by the proactive initiatives in drilling contracting that emerged early in the 1990s. Instead of the drilling contractor simply executing the task of drilling a well according to the specifications of the operator, a new way of doing business emerged. Closer communication links were established, and a coordinated, joint decision-making process was adopted for well planning. This has led to a better understanding of client needs and expectations than ever before, creation of benchmarks, and an improved image and credibility for the contractor who has become a true partner in an operational team.

Today, the focus is on reorganizing the way tasks are performed and toward reengineering the management structure and

• Over a two-year period, working with Dubai Petroleum Company, Sedco Forex decreased operational time by 36% in 60 controllable rig activities (see “Middle East Offshore: Quality in Action,” page 23).
• In West Africa, Elf and Sedco Forex were able to improve field development economics significantly by reducing the time and costs of platform installation and well construction (see “Quality and Teamwork Pay Dividends in West Africa,” page 26).
• In Australia, using an innovative “technical limit” approach, which specifically

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interfaces. Safety and operational procedures are merging to bring suppliers together under a common system. New technology and communications methods are being applied universally, building greater rigsite efficiency. In short, much has changed and adapting to these changes has become a major challenge.

This evolution emphasizes client-oriented service and a commitment to do things right the first time and every time—the heart of a quality culture. It means eliminating unnecessary costs and losses that are the legacies of poor quality. Over time, a quality approach gains market share, increases profits and ensures competitiveness.

The Quality Evolution

“It is always cheaper to do the job right the first time.”

Quality has evolved over four distinct stages (above left). When materials and manpower were cheap, engineers designed products not to fail by overengineering them with large safety margins. As materials became increasingly expensive, but manpower remained comparatively cheap, engineers designed products that met specifications without these extra margins of safety. While the probability of failure increased, intense inspection became the safeguard against delivering inferior products.

Then, when both materials and manpower became expensive, there was a reorientation toward understanding the processes to determine the causes of defects. Process control became the basis for minimizing the probability of failures. Finally, process control evolved into a more proactive approach in which planning for conformance from the start was the fundamental principle; analyzing contingencies and avoiding pitfalls at the design stage eliminated the need for corrective action later.

The last three stages of this evolution in quality are analogous to Quality Control, in which inspection was the order of the day; Quality Assurance, in which in-depth process analysis ruled; and finally, Quality Management, the current industry focus (left).

Putting a quality-oriented management structure and culture in place is a major, long-term task, but one that reaps tremendous rewards.

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The Sedco Forex Trident III (above left), a jackup rig, has been working for Dubai Petroleum Company (DPC), a subsidiary of Conoco, since the early 1980s. But, operations today are far different than they were over a decade ago.

In 1995, the Trident 18 (above right) joined the Trident III as the only other jackup rig working for DPC. The quality program implemented on the Trident III was one of the primary reasons the contract was awarded to the Trident 18, even though another drilling contractor had submitted a competitive bid. Also, instead of rebidding the Trident III contract in 1994, DPC and Sedco Forex worked together to renegotiate and extend the contract for two more years.

The Trident III and Trident 18, each typically drill eight to ten wells per year for DPC offshore Dubai in water depths ranging up to 200 ft [61 m] with well depths of 9000 to 18,000 ft [2750 to 5500 m]. Today, these wells are almost exclusively extended-reach and horizontal.

Recent experience on the Trident III and Trident 18 demonstrates how an oil company, working closely with the drilling contractor and other service suppliers on the rig, can bring an effective team approach to well planning and construction. It also points out the benefits to clients of having a comprehensive quality program as part of the drilling contractor’s culture.

Early on, Sedco Forex implemented a number of quality practices in the interest of continuous improvement, such as improved methods for handling towing lines during rig moves and for securing rigs, as well as installing test stumps for blowout preventers (BOPs). By pretesting BOPs on the stumps, there is a 4-hour savings in the time needed to install BOPs.

Starting in 1992, Sedco Forex began to track 60 distinct rig procedures under its control, such as the amount of time for tripping drillpipe and for running casing, to establish a series of benchmarks. After a quality improvement program based on this assessment was established, the time spent on these operations was reduced by 22% in 1993 compared to 1992, with a further 14% decrease in 1994 from 1993. In total, this adds up to a savings of over 120 hours per well, which is equivalent to drilling eleven wells in the same time previously needed for ten wells.

When problems arise on the rig, they are solved jointly through participation by all members of the team—from initial discussion to follow-up action. For example, new handling methods were put in place to avert the potential of discharging oily cuttings while drilling the pay zone. Also, the jacks were having difficulties with close alignments to the platforms. Analysis showed that revised operational procedures would increase their proximity and permit better access. This has allowed DPC to add more drilling slots to the platforms.

“When problems arise, there is teamwork in solving them,” says Hal Schlindler, District Manager for Sedco Forex. “No one is pointing the finger or trying to determine who’s at fault. Instead, the philosophy is ‘what does the team need to do to fix it’.”

Close communication and analysis between DPC, Sedco Forex and other service companies overcame difficult problems while drilling a troublesome shale section. During drilling of the shale, the well angle is typically built from 30 degrees to nearly horizontal. Problems were
encountered while running the 7-in. [17.8-cm] liner through this drilled section. Often, the liner could not be run to bottom and had to be pulled, and the section was then redrilled or sidetracked. Recommendations to overcome this problem included higher mud weights and drilling speed, and increased frequency of wiper trips. Since these modifications were implemented, all liners have been successfully run and landed without remedial operations.

According to Schindler, “Every manager from every company on the rig meets with DPC management each morning to review the morning report and the three-day forecast. We define and analyze problems on the spot, and by the end of the meeting, everyone leaves knowing exactly what their responsibilities are.”

Service Quality Appraisals are conducted on a quarterly basis, and the Trident III and Trident 18 averaged a remarkable 98% rating from DPC for 1995 (see “Service Quality at the Wellsite,” page 33). “Performance tracking is invaluable,” says Schindler. “Looking at every aspect of the operation, in every possible way, pays dividends.”

In addition, the combined drilling team, made up of Sedco Forex and the other service providers on the rig, received Conoco Drilling Safety Excellence Awards for outstanding safety performance for the periods 1993-1994 and 1994-1995.

DPC Drilling Manager Ed Nordquist says, “One of the keys to the successful operation is the cooperation between DPC and Sedco Forex. However, this is becoming the norm today between operator and contractor. More important is the fact that Sedco Forex has been involved with DPC operations for a long time, and rig personnel know what we expect from them and are ready to deliver it.”

Quality Doesn’t Just Happen

“If quality isn’t ingrained in the organization, it will never happen.”

How does one go about changing a culture and infusing a new way of thinking and doing business in an industry that historically accepts change slowly, and often reluctantly? Change can be a daunting challenge and requires a concerted approach, nurtured by the top echelons of the organization and effectively transmitted through the rank and file. Specific, measurable objectives are prerequisites, and the task takes much time, patience and persistence.

Quality gurus, like W. Edwards Deming, Philip Crosby and Joseph Juran, have proposed a number of procedures for bringing a quality outlook to an organization. No single approach is necessarily superior, for they all have many fundamentals in common. Whatever route is chosen, the basic principles of quality will apply, adapted, of necessity, to fit the particular industry and company structure. To be successful though, a cultural change must evolve through three distinct phases (below).7

• Conviction—deciding something needs changing
• Commitment—demonstrating a serious desire to change
• Conversion—embracing the change.

All three elements are critical. Without conviction, the effort will never get off the ground. Without commitment, once the process has started, it will dwindle and fall short of its aims. But once conversion has been achieved, the converted stay converted, and there is no return to the shortcuts or deficiencies of the past. Achieving the ultimate goal requires the implementation of a Quality Management System (QMS), one that is grounded in a number of key principles (above).

For a QMS to be successful, it must be simple and well-defined so that it can be understood and effectively communicated to all participants through a comprehensive awareness program and, as a result, become all-pervasive within the organization. The QMS must focus both inwardly and outwardly and be simultaneously employee- and client-oriented. Internal procedures need to be systematic, and application must be consistent. Actions should be proactive, not reactive, constantly seizing the initiative rather than waiting for events to happen. It must foster an environment of cooperation, mutual goal-setting and teamwork where all employees are empowered not only to participate in the system but also to contribute in demonstrable ways to achieve established goals. Above all, there must be a
commitment to continuous improvement in all areas.

The basis for continuous improvement is the belief that within any situation or any activity there is room to improve. The goal is perfection or “zero defects,” nothing less. The road to achieving this passes through three specific stages (right). In the first stage, the Present Situation, the status quo is investigated to fully understand where an opportunity exists for improvement, defining the driving forces for change and whether change is really worthwhile.

In the second stage, the Preferred Situation, potential solutions to the improvement opportunity are analyzed and the optimal one chosen. This stage focuses on defining factors that could inhibit successful implementation of the change and, therefore, require selection of an alternate strategy.

In the third stage, Action, proof of the validity of the investigation and the planning of the two previous stages are confirmed. The solution is implemented, and its success is monitored to ensure that what is achieved is what was expected. The cycle then repeats, focusing on additional opportunities for further improvement. The overall process increases efficiency and competitiveness, reveals opportunities that might otherwise be overlooked and promotes teamwork and proactive problem solving. This leads to the ultimate goal of Total Quality Management (TQM) in which every person and every activity in an organization contribute to the achievement of overall quality objectives. This open and honest culture includes standard systems for recording, investigating, implementing and monitoring improvement opportunities. The goal, again, is to get things right the first time, every time.

“Quality management is needed because nothing is simple anymore, if indeed it ever was.”

Today’s complex world has led many to seek ways to safeguard quality through set procedures and controls. The main body that assists industry in doing so is the International Organization for Standardization, based in Geneva, Switzerland, with its ISO 9000 family of programs—the recognized standard for a quality system.

ISO 9000 is concerned with process (what is supposed to happen, how it is supposed to be done, who is supposed to do it, where it is to occur and when) rather than the product itself. ISO certification assures that a business does what it claims to, that this can be documented, and that problems will be resolved, not ignored. It has nothing to do with approving a product or service. Implementation of an ISO 9000 system is based on identifying and understanding customers’ requirements and systematizing the methods and procedures necessary for meeting their needs, even as these needs change. These procedures are then documented in a reference quality manual.

Standards, in general, imply specification (against which a product can be measured to establish if it meets the standard), commonality, and some recognized method of assessment. Achieving ISO certification involves (1) design and implementation of a quality system that meets the requirements of the standard, and (2) a successful assessment completed by a suitable assessor body.

The benefits of having a quality system in place, which include improved efficiency and assuring a constant level of quality, can result in reduced production and inspection costs. Furthermore, by providing assurance that a business will correctly meet customer requirements in a timely manner, compliance with an internationally recognized quality standard can increase confidence in a supplier, particularly when it may be located in another country.

As will be seen in the next section, ISO certification has become an integral part of the Sedco Forex drive to develop a corporate quality culture.

(continued on page 28)
Offshore field development economics are influenced significantly by the size and weight of the platforms deployed and their installation times. In the N’Kossa field, West Africa, where water depths range to 590 ft [180 m], Elf and Sedco Forex have worked jointly to improve economics by reducing the time and costs involved in, and by increasing the efficiency of, platform installation and well construction.

The N’Kossa field was to be developed with two platforms. Elf wanted several wells drilled in advance, so that as soon as platform jackets, deck equipment and production facilities—in this case, a barge as the main gathering center, offloading to a tanker—were in place, production could commence from both platforms at near maximum rates. The field would, thereby, generate significant revenue while the remaining wells were drilled and placed on stream. To achieve this objective, Elf and Sedco Forex tackled the project with a coordinated team approach.

From start to finish, the emphasis was on quality and communication. Beginning in the spring of 1994, both companies appointed special project teams to work together on all phases of development. Communication channels were established, and formal and informal group meetings were held at regular intervals.

The development plan for the N’Kossa field consisted of four phases:

- First, prior to mobilizing the rigs to West Africa, the modifications and upgrades that were required for both drilling campaigns were carried out while the rigs underwent shipyard refurbishments in Rotterdam.
- Second, two subsea templates were preset and several wells predrilled through them using the semisubmersibles Sedco 700 and Sedneth 701, after which the platform jackets were installed.
- Third, the aft sections of the two semis were modified to accommodate heavy-lift cranes for use in installing derrick sets on the platforms.
- Fourth, two specially designed, modular derrick sets were constructed and transported to location for placement on the platforms using the reconfigured semis.

In addition to the crane installations, modifications to the semis included changing power and fluid lines to permit tender-assisted operations during the subsequent drilling phase of the project, when umbilicals would connect the semis to the derrick sets; reconfiguring the subsea BOP stacks to a surface stack arrangement; and repositioning the lifeboats so that the aft sections of the semisubmersibles could face the platforms directly during derrick set placement and during operation in the tender-assisted mode.

The Elf and Sedco Forex teams devoted much of their time and effort to the design and logistics associated with the derrick sets, covering the entire spectrum from conceptual design to detailed engineering, construction, movement to location.
and, finally, installation on the platforms. During the construction phase, procedures were defined to ensure compliance with specifications of all components received from vendors and for quality control and inspection. Detailed acceptance test procedures were issued in conformance with ISO 9001 guidelines. Elf had a representative present at all times overseeing construction and witnessing inspections and component testing.

Problems or discrepancies were resolved via direct communications between Elf, Sedco Forex, other service companies and parts vendors. A final debriefing and quality check was held with all service companies involved prior to shipment of the derrick sets to West Africa.

The 700-ton, self-erecting, modular derrick sets were designed to be as integrated and compact as possible to 1) minimize the number of crane lifts during installation, thereby eliminating as many peripheral small lifts as possible, 2) limit the number of connections and tie-ins to reduce lost time and potential problems due to dynamic motion of the semis, and 3) minimize dead time during the loading from the semis to the platforms. Placement would include a total of 14 lifts each, with the heaviest being 93 tons.

Several special features were included. The derrick sets were designed to adapt to the jacket configuration used in West Africa—with jacket rails perpendicular to the tender-support vessel—or to jackets with rails parallel to the tender and to be drip-proof, with all runoff collected at a central point and then pumped to the tender-support vessel for separation and disposal. On the tender-support vessel, the shale-shaker cuttings are deoiled using a cuttings dryer installation based on centrifugation of a mixture of base oil and cuttings.

Stainless steel was used for low-pressure piping and the drilling shelter to minimize corrosion. Drilling controls were ergonomically designed for comfort and efficiency, with a 180-degree view of the rig floor and derrick provided for the driller. BOPs could be repositioned without breaking out well-control lines, and handling facilities for the BOPs allowed the wellhead to be lifted and installed preassembled. Fast-connect couplings were used throughout to minimize downtime in the nippling up of the BOP stack to the wellhead, and quick-disconnect couplings were used on hydraulic control circuits to minimize both oil spillage and downtime.

Construction began in France in October 1994, with both derrick sets fabricated simultaneously (previous page). Construction was completed in May 1995, and the units were shipped by river barges to the French coast and offloaded onto an ocean-going barge for the trip to West Africa. Transit time was 24 days. The barges were anchored alongside the semisubmersibles, and the derrick sets were offloaded onto the decks of the semis with the heavy-lift cranes. The two semis were then towed to the N’Kossa field, anchored on location, and the derrick sets were offloaded and rigged up. The process, from derrick set arrival to final installation, took 25 days. At present, the predrilled wells are being tied-back to surface wellheads on the platforms and completed, while awaiting the arrival of the production barge and final preparations for drilling additional wells.

As a result of the coordinated team approach and an overriding commitment to quality in all aspects of the project by both operator and drilling contractor, the following economic benefits were realized:

- The decision to contract two rigs at the same time with almost identical features allowed Elf to optimize the field development plan for both predrilling (stand-alone mode) and tender-assisted drilling mode.
- The decision to modify the semis saved significant rig-up and installation time, and cost compared to the option of securing an expensive crane barge.
- Use of a tender-assisted configuration, with key support and accommodation facilities on the semis, enabled Elf to minimize the size, weight and cost of the platforms.
- The modular and flexible design features of the derrick sets provide enhanced capabilities, as well as lower maintenance and operating costs.

How Have Things Evolved in Sedco Forex?

"Improvement comes with each step of the overall program." ¹¹

Sedco Forex is one of the largest drilling contractors in the world, employing 5100 people of 50 nationalities and operating 42 offshore and 34 land rigs in 26 countries. With such a far-flung organization and cultural diversity, implementing a universal quality program represented a formidable task.

As with any company committed to installing a quality program, Sedco Forex began with the tools at hand. The starting point was the company’s health, safety and environment (HSE) system, which was recognized as a model within the drilling contractor industry.¹²

Over the years, Sedco Forex had developed a comprehensive HSE Management System that included policies, procedures, tracking mechanisms and compliance assessment methods (above right). This system had its origins in a Safety Management System (SMS) which had received considerable attention from industry peers in the late 1980s.

In 1986, Schlumberger management committed to a 50% reduction, over a five-year period, in the drilling lost-time injury (LTI) frequency rate—as defined and reported by the International Association of Drilling Contractors (IADC)—as a show of the corporation’s dedication to safer drilling operations in the industry.¹³ This commitment motivated the staff and paved the way for a revitalized safety awareness program in which safety activities grew more focused, professional and proactive. Results improved and the target was achieved (right).

The safety system proved to be a good starting point, first for HSE and then for quality efforts. Much of what was needed was already in place. Over time, managers recognized that every aspect of operations could profit from the quality drive. Analysis of accidents and operating failures pointed out the need for better tracking and for closing the loop with specific solutions. Still lacking, however, was a mechanism for identifying the cost of quality nonconformance and quantitative measurements of real losses.

In general, other than IADC statistics, there are few internationally recognized benchmarks for the drilling industry. This meant that Sedco Forex had to define and implement its own set of benchmarks. This has been done. Each year, targets are set for key indicators, and these targets become integral to the company’s objectives, on a par with financial goals.

The system is simple and focused. Fatalities, LTIs and major losses, as well as compliance with HSE training, identification of risks and service quality appraisals are tracked and analyzed at headquarters. Results are regularly summarized and communicated to the field. Deeper into the field organization, the number of benchmarks increases accordingly, finally reaching rig-specific needs. For the first time, a systematic and coordinated effort is being used to quantify and understand losses in real financial terms.

ISO certification of selected locations has helped further emphasize the drive toward a quality culture. Operations in Aberdeen, Scotland and Brazil, the Engineering Department in Montrouge, France, and the logistics and supply center in Channelview, Texas, USA, have been awarded ISO certification (see “The Road to ISO Certification,” page 32).

¹³. A lost-time injury is any work-related injury resulting from an accident that prevents the person from continuing, in the next following shift, the same job that he or she was performing before the injury. The frequency rate is expressed as the number of incidents per million person-hours worked.
In 1993, Woodside Offshore Petroleum Pty. Ltd. committed to improve its offshore well construction performance on the Northwest Shelf of Australia. The company's analysis of operations conducted from 1986 to 1992 showed erratic results, with high average drilling times compared to published benchmarks.

For the upcoming Wanaea and Cossack developments in 270 ft [82 m] of water, which would include directional wells and the first-ever subsea completions for the company, Woodside instituted an aggressive target-setting and planning methodology, based on asking the question “What is possible?” instead of “How can we improve?” The approach had a central philosophy: targeting the “technical limit,” a level of performance judged as the best possible for a given set of parameters (right). Implementation of such a radical change in thinking required an extraordinary effort and commitment, and the building of new relationships with the drilling contractor and other service suppliers, founded on teamwork and effective communications.

Studies by Woodside had pointed out the critical importance of the drilling rig's specifications. The cost of higher level rig specifications could easily be justified if the added capabilities translated into significant efficiency gains toward the goal of achieving the theoretical minimum well time, the technical limit. This permitted “fit-for-purpose” rig selection and sole source negotiation of the selected rig, eliminating the need for a low-bid tendering process. Working with Woodside, Sedco Forex assessed rig options that would deliver the tendering process. Working with Woodside, Sedco Forex District Manager, Ted Pittman, selected a rig, eliminating the need for a low-bid selection and sole source negotiation of the technical limit. This permitted “fit-for-purpose” rig achieving the theoretical minimum well time, the significant efficiency gains toward the goal of being justified if the added capabilities translated into the cost of higher level rig specifications could easily.

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Sedco Forex was involved from the outset in the extensive planning phase that spanned a period of nine months. The company placed a former rig superintendent in the Woodside office to liaise directly with Woodside's engineers and design team. The emphasis was on developing benchmarks—the technical limits—optimizing the operational process and communicating the plan and process to everyone involved, including roustabouts on the rig, to enlist their commitment and ownership. Start-up seminars and regular, joint management visits and presentations helped facilitate and underscore the communication process. Throughout, a “no-blame” culture was adopted by Woodside in all its dealings with service suppliers, a culture that encouraged problem solving rather than finger pointing.

Critical path thinking was adopted during the assessment phase. All activities that could affect the critical path, either positively or negatively, were identified and analyzed. Much of the effort focused on areas normally defined as conventional down time and lost time. But, studies went further to concentrate on what became known as “invisi ble lost time,” inefficiencies targeted for the first time using the technical limit approach.

The process resulted in improved procedures and techniques that speeded operations. For example, subsea trees were normally assembled and pressure tested in the moonpool of the semisubmersible, inhibiting other activities. Tree and tree-handling operations were removed from the moonpool area for improved efficiency. During drilling, running of the drilling riser and BOPs was streamlined with better make up of lifting subs and pickup procedures. Where possible, bottomhole assembly (BHA) components were made up off-line, allowing pickup and mounting of the BHA in one piece using a specially designed roller system.

Applying this methodology, Woodside drilled three new wells and installed six subsea completions 20% under budget. By successfully reducing lost and down time and increasing the percentage of effective time, they were able to drill the third well in the project in 20 fewer days than the first.

“Everything we did targeted process optimization and control. It has been enormously satisfying to see our team of people from different companies pull together—and in the same direction—to achieve top-class results,” says Phil Scott, Well Construction Manager for Woodside. According to Ted Pittman, Sedco Forex District Manager, “The way the team worked together can best be summed up in the project motto: ‘Pride in Performance.’ From the start, it motivated all members of the team and kept us continually focused on quality and efficiency.”

Uniting all aspects of the QMS is the recently issued Quality Manual, which defines a consistent methodology for the pursuit, tracking and structure of the quality effort and emphasizes measurement, communication and continuous improvement (above). The HSE and quality functions have been merged into a universal Q-HSE function for coordinating and managing the quality system. The focus is constantly on the three prime elements, or dimensions, that must be considered in every quality activity—product, process and people (below). These elements provide the foundation for the new quality culture.

A corporate definition of quality has emerged: “Giving the client what he wants, when he wants it, at a mutually agreed cost.” This entails defining and meeting the client’s specifications and expectations; keeping to schedules, programs and project plans; and satisfying the financial requirements of both parties. Specifications must be agreed to in advance, must be backed up by an effective delivery system and must never be less stringent than the internal Q-HSE guidelines established within Sedco Forex. The remainder of this article focuses on the implementation of specific Sedco Forex quality programs in training, engineering and field operations.

Changing the Training Focus

“Think of change as skill-building and concentrate on training as part of the change process.”

Thanks to new technology and greater rig automation, drilling today is less demanding physically than a decade ago. But, it still remains a dangerous business. This is why comprehensive training has always received top priority. Within Sedco Forex, four training centers (see “The French (Training) Connection,” page 34) provide formal courses for new and experienced personnel. A follow-up system ensures proper application of new skills. Roving instructors visit rigs and check for safe work practices. Each rig has safety committees that set standards, hold regular information and problem-solving meetings, and track compliance. Data bases have been developed and are constantly updated to communicate risk information and profile critical risk areas. Health and safety campaigns are mounted to target areas where improvement is needed. Initiatives, like the Dupont STOP program, a systematic approach to recognizing potential problems and addressing them before they turn into incidents, provide quality focal points for rig personnel.

Within the training effort, benchmarking has been critical. Monthly measurements of compliance in areas such as HSE and well-control training, providing feedback, and developing action plans to rectify deficiencies have been at the heart of the program.

Without a focused training effort in quality from the top to the bottom of the organization, there can be no change toward a quality culture. To this end, two initiatives have helped instill the quality mentality. Within Sedco Forex, training had historically been technical and geared to career development needs for engineers, rig supervisors and rig workers. This formed the basis for loss control and service quality instruction. As the quality thrust gained momentum, however, it became apparent that training had to be broadened and, at the same time, more sharply focused.

The first initiative was a shift to a competency-based approach—where assessment and measurement of proficiency levels and a step-by-step methodology to correct noted deficiencies was implemented and tracked for compliance. In essence, this transformed the training function directly into a total quality support function.

The second initiative focused on communicating the quality goals of the company through the development and application of a training matrix for line management (next page). In all facets of this initiative, the ultimate clients of the program—both employees and customers—were consulted on scope and content. In some instances, training tools and courses were identified and added to fill gaps.

To deliver the message, a train-the-trainer methodology was employed. Supporting materials were prepared and presented to management via a Quality Awareness course. Supervisors, in turn, were given the training necessary, as well as a comprehensive presentation package, to transmit the quality message throughout their organizations.

In training and follow-up, the emphasis has evolved from strictly technical training to a broader view: how to better manage, how to better recognize problems and issues, how to empower and facilitate, and how to communicate. At the same time, training became more focused—focused on quality as the end goal.

Reengineering Engineering

“There is absolutely no reason for having errors or defects in any product or service.”

While some aspects of drilling operations have changed little over the past 50 years, technological advances, such as top drives, improved downhole motors, and logging- and measurements-while-drilling techniques, have had a pronounced influence on efficiency and cost. Ensuring rapid and effective development of new technology and its transfer to the rigsite requires a quality approach within the engineering organization of the drilling contractor.
The matrix outlines priority courses and essential supplemental programs for training rig personnel and regional management in quality, providing instruction on improving supervision, problem identification and communications.

For Sedco Forex, the engineering department is one of the sites that has achieved ISO recognition. But here the approach was initially directed at analyzing existing practices and developing innovative approaches to improve the quality and deliverability of new products and techniques. The goal was to have a practical, workable system in place, rather than to achieve ISO certification. However, in the drive to set up a quality system, ISO became viewed as the most effective means to this end. Certification was a natural outcome of the process.

Examples, ranging from electronic documentation to improved field support and shipyard construction and repair, highlight how recently introduced products and procedures are helping achieve more for the client.

If you’ve ever been on a drilling rig, you’ve seen the overwhelming number of printed technical and procedural manuals needed to support day-to-day operations. One engineering project focused on replacing these bulky, hard-copy manuals with electronic documentation on CD-ROM—saving storage space and streamlining the massive effort to keep them updated.

The first corporate documentation CD-ROM was sent to all rigs in December 1995 after pilot testing in four field locations in the Middle East and Far East. Each rig has been equipped with CD-ROM readers. A single CD contains 11 operations, Q-HSE and training manuals; 20 marine operations manuals; maintenance policies and procedures; and other location- and discipline-specific documents, for a total of 1664 files. Documents are linked; searches by key word and topic can be conducted; and a variety of navigation tools make finding key information straightforward and efficient. The contents of the CD will be updated and expanded regularly.

This approach to documentation ensures access to the most current information and improves the productivity and efficiency of rig workers by providing the data they require to perform their jobs, thus reducing errors, downtime and losses.

A second area of quality improvement has been in field support. Historically, when a problem arose on a rig, an engineer would ask for help from a contact in the engineering department. There were many potential pitfalls with this approach: the person might not be the right one to contact; descriptions of the problem might be incorrect or incomplete; similarly, the recommended solution might be incorrect or incomplete; or, finally, no action might be taken—the request simply being ignored.

To correct these deficiencies, new procedures were established, including a complete set of specifications and communication channels known as the Request for Engineering Action (REA) system. When help is needed, rig personnel describe the nature of the problem to the regional organization. The region then relays the request to an engineering point contact who determines the expert or group of experts best equipped to answer the question. If the problem can be solved faster and more efficiently outside the engineering organization, for example by using a consultant, the point contact will funnel the project accordingly.

Since at any one time there might be 60 to 80 such requests in process, priority setting is important, particularly with costly drilling times at stake. The REA system allows much tighter control over priorities and assignment of the proper sense of urgency—all features lacking in the previous system. The region and rig are both kept informed of progress toward, and the deadline for, a solution.

With the checks and balances involved, how rapidly are results delivered? The formalized procedures bypass many of the previous pinch points, and deliverability is as good or better. The key benefit is enhanced quality management of the solutions.

The quality system is also reaping benefits in shipyard construction and repair. Typically, shipyard activities were treated as one-off projects. Each time a new project came along, there was a tendency to reinvent the wheel. Today, a retrievable data base captures project information, allowing prior experience to be drawn on. Also, there is a formalized approach to project management and coordination, as well as document control.

Task force managers are appointed, and the scope of work is defined up-front. New communication channels facilitate early exchange of ideas. Staff and facilities benefit from better organization, which specifies

Courses run by Sedco Forex • Courses shared with sister Schlumberger companies • Outside courses

<table>
<thead>
<tr>
<th>Priority 1: High priority training and highly recommended</th>
<th>Priority 2: Lower priority training but also recommended</th>
<th>As needed: Where either the job or the development plan indicates the need</th>
<th>Best: Better Exempt Schlumberger Training</th>
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(continued on page 33)
In today’s marketplace, identifying and understanding a customer’s requirements and meeting those needs are critical for maintaining a competitive advantage and serve as underlying factors in the movement toward total quality management and implementation of quality systems. An effective system is one that has commitment to quality and continuous improvement at all levels of the company. Learning from mistakes and ensuring that problems do not recur are accomplished through problem identification (auditing), investigation (corrective action) and long-term rectification (controlled procedural change).

Sedco Forex prides itself on being close to its clients and providing innovative approaches to better meet their needs and reduce costs in drilling operations. Following the general movement of many businesses to comply with ISO 9000 standards and the specific desires of several customers to deal with ISO 9000-certified vendors and service providers, certain Sedco Forex facilities have sought and achieved ISO 9000 certification.

In particular, in 1993, the Materials Logistics Center (International Chandlers, Jacintoport Facility) in Channelview, Texas, USA, outside of Houston, was the first within Sedco Forex, and the first distribution center of any kind in the USA, to achieve ISO 9000 certification. Specifically, the center has been certified by Det Norske Veritas (DNV), the foremost certifying body, to conform to ISO 9002 quality system standards for “procurement and logistic services for oilfield equipment, spare parts, and consumables.” As the procurement center for the purchase and resupply of critical parts and materials for Sedco Forex rigs operating worldwide, this group plays a central role in minimizing drilling rig downtime. Rig time lost by errors in procuring or shipping replacement parts can significantly impact operational efficiency, profits, customer relations and company image.

The motivating factors behind the effort to seek ISO certification were threefold. “We felt that we could create a good quality system for our operation,” says Ellis Duncan, Materials Manager at the Jacintoport facility, that it “would be advantageous to our clients,” and that it would also “satisfy the needs of our North Sea operation.” On the first point, Ira Gervais, Jacintoport Quality Manager, points out that ISO certification is the facility’s first effort in developing a quality system. “We thought we were doing great,” he comments, but he also notes that there was no mechanism to identify what they were doing wrong when problems did arise. Discussing the advantages to their clients, Duncan says, “We wanted to be sure that if there was any question concerning the quality of our fleet in the North Sea, we could say that we are buying from suppliers through an ISO quality system.” Regarding the last factor, Duncan says that the need to stay competitive played a major role in the decision to seek ISO certification. “Major clients started pushing this in the North Sea.”

Although the Channelview facility went into ISO certification as a trial, taking a wait-and-see attitude, the experience and positive results paved the way for subsequent ISO certification of other Sedco Forex locations.

It’s difficult to compute exact dollars saved due to improvements resulting from the ISO-related changes. “How do you put a figure on accidentally purchasing the wrong part or an inferior product, or sending a part to the wrong place or...
the wrong rig, and ending up having to repurchase or reship a product,” Gervais points out.

ISO 9002 uses the combination of internal audits and periodic audits by an external organization to review procedures, documentation and corrective actions in purchasing, contracts, purchaser-supplier product control and process control.¹ DNV, the auditing body for the Jacintoport facility, focuses on one of these areas during its semi-annual audits. The DNV auditors review paperwork to verify that the documented procedures are being followed and make spot checks of portions of the operation. “For example,” Gervais says, “to avoid mistakes in shipping, we must specify how we handle noncompliant products when they come in. If they can’t be identified, we place them in a special location, properly tagged. DNV checks that on a regular basis. If something does go wrong, we must specify how we will correct the problem and isolate the nonconforming material in the future.” A full recertification is performed every three years—with the next due in 1996 for the Jacintoport facility.

The quality manual, containing the documentation of procedures required for ISO certification, must describe what’s actually done in the business process, while at the same time not be overly burdensome to employees. The liberal use of flow charts and organizational charts has kept the Channelview quality manual to a concise and readable 35 pages, in comparison to other companies where such manuals may be several volumes in length. According to Gervais, “A side benefit of having all procedures documented in a manual is that new employees now have a reference and learn the proper procedures from the onset.” The quality manual must be updated, and all employees must have access to the most current version. Depending on the size of a facility, maintaining and updating documentation can be complicated and cumbersome. In this area, the Channelview group has taken an innovative approach: their manual is accessible to employees through the Sedco Forex home page on the World Wide Web. “What we’ve done is put the current copy on our network,” says Gervais. “It’s the official copy for downloading and printing.”

Duncan indicates that the primary benefits of ISO certification for the Jacintoport facility are awareness, discipline and accountability. These are derived from the ISO 9000 requirements for establishing formal procedures for recognizing and handling problems, both internally and in the field, for accurate documentation and control of that documentation, and for taking corrective action. He says that prior to ISO certification, “There were no established procedures for making sure things were actually handled correctly. Now, when the field has any type of problem with something we handled, they fill out a procurement incident report and send it to us, and we have to correct it.” One example involved changes in receiving and packing procedures to address complaints that supplies were arriving in the field wet or damaged. To ensure accountability and corrective action, the Jacintoport facility now sends out a semi-annual service quality analysis questionnaire to the field to learn how customers feel about their service. Documentation produced by this communication must be addressed and acted on; problems cannot be ignored. “Without a doubt, a key area is speed” says Duncan. “They want us to react quicker. We weren’t as accountable before. But you are with this system. It’s all documented. It’s all there. It’s all auditable.”

Since ISO certification, Jacintoport has received additional business from sister companies like Dowell for procuring, packing and shipping goods to the field. These companies could use anyone, but, Gervais says, ISO certification has allowed the Jacintoport facility to improve its systems and to demonstrate that “we’re very professional in what we do” and that mechanisms for redressing complaints are in place.— SP

Service Quality at the Wellsite

“Think where your company could be if you completely eliminated failure costs.”¹⁷

Closing the feedback loop with the oil and gas operator is one key to ensuring a climate of continuous improvement. To aid in this goal, Sedco Forex implemented a Service Quality Appraisal (SQA) system three years ago. The system is based on a comprehensive set of guidelines. The first level, the SQA form, is filled out by the client (below). It provides a quantitative assessment of how the rig and its personnel stack up in several categories, including HSE, overall drilling performance, organization and skills of personnel, condition and utility of the equipment, and quality of rigsite communications. The bottom line is an overall performance rating, or index, with a maximum score of 100%.

The SQA covers a particular time period and is used by the rig manager to assess the operation and for discussion with clients in quarterly meetings. These sessions review the strengths and deficiencies of the service

The Pyrenees mountains form a spectacular backdrop to the Sedco Forex training center in a picturesque suburb of Pau, France. It is the largest, best-equipped and busiest of the four training centers the company operates worldwide. Sister facilities are located in Aberdeen, Scotland; Warri, Nigeria; and Singapore.

Today, with even greater emphasis on the health and safety of employees, protection of the environment, and quality, the center is fulfilling an expanded role that reflects the Sedco Forex commitment to training as a core element of the company’s culture.

The Pau site was originally established in 1949 as a base for North African and European drilling operations. Training courses were first conducted in 1972 and, during the nearly two and a half decades since, the training mandate has evolved and the course list has grown considerably, in line with the changing needs of the drilling industry and the profile of the company’s workforce.

Today, the extensive complex includes 10,800 ft² [1000 m²] of classrooms, workshops and office buildings, supported by 80,700 ft² [7500 m²] of yard space. Eight instructors and support staff provided 4400 man-days of training in the latest drilling technology during 1995. For 1996, that figure is expected to increase to 7000 man-days. There are four principal classrooms, one equipped with a state-of-the-art drilling simulator. This simulator, used primarily for instruction on well-control procedures, also models stuck pipe situations and various techniques for drilling optimization, and interfaces with an advanced computer system that allows trainees to access, and interact with, actual well data. Extensive computer and video facilities in the classrooms permit maximum use of new information technology tools and multimedia training aids.

The site’s most striking feature is also its principal piece of equipment—an ultraheavy, diesel-electric land rig with a rated drilling depth of 18,000 ft [5500 m] and a 600-ton capacity mast and substructure (above left). The size and capabilities provide a training tool unique in Europe. The rig is fully equipped with hoisting, rotating, circulating and well-control systems. It is positioned over a 4400 ft [1350 m] cased well, with casings ranging from conductor and surface strings to 9 5/8 in. [25 cm] at total depth. The rig and well combination permits realistic simulation of a wide range of drilling conditions encountered daily in field operations.

The rig is fitted with a high-pressure air compression, storage and injection system. Air can be introduced into the well through tubing run outside the casing to simulate a gas influx (kick) on a live well. Each Sedco Forex drilling crew receives mandatory well-control training every two years, carried out to the certification standards of the International Well Control Forum, an organization representing operators, contractors and drilling schools around the world. Sedco Forex is a founding member of the group. The crews must be able to resolve a variety of well-control problems and successfully shut in and circulate out gas kicks to pass the course and be recertified (left).
Today, induction training for newly recruited drilling engineers and technicians, initiated in 1980, is the principal business of the training center. In a 19-day course for engineers and a 10-day course for technicians, which combine theory, classroom lectures, homework and practical exercises, the rig and well provide a controlled environment for hands-on training in the latest technology and operational techniques. Knowledge and skills developed during the course form the foundation necessary to ensure that new recruits perform safely and effectively in their first actual rig assignments.

A complete mechanical workshop maintains all critical pieces of drilling gear and gives trainees the opportunity to witness and participate in disassembly and major overhauls of both surface equipment and downhole tools during hands-on training sessions.

In addition to new trainee induction and well-control schools, the center schedules a variety of other courses. These include drilling technology courses, covering both the fundamentals of casing and cementing, directional drilling, drill bits, drillstring design, hydraulics and solids control, as well as advanced work on formation evaluation and well design. In addition, there are marine courses on the stability of offshore rigs and procedures for moving and operating offshore rigs.

For many years, Sedco Forex has been a recognized industry leader in training field personnel. Never has this been more evident than today, as reflected in the dedication shown by the training staff at Pau.

The journey is only beginning. To develop and thrive, a corporate quality culture requires a never-ending journey along a route marked with road signs reading conviction, commitment and conversion. At times, the route is rough and winding, but every step forward brings substantive benefits for both clients and employees.

The words of Philip Crosby sum it up best. "Quality is an achievable, measurable, profitable entity that can be installed once you have commitment and understanding and are prepared for hard work." — DEO