Today’s business climate is encouraging oilfield operators and contractors to join forces. Alliances are one of the ways oilfield companies are cutting costs and making the most of their resources—and gaining on the competition.

In the oil field, two factors drive profits. The first, market price of oil or gas, is governed by many elements, such as political stability, economic growth and the weather, all of which are outside the control of operators. However, the second factor, production cost, can be controlled to some degree by the industry.

During the past decade, market price has stabilized—albeit at a moderate level—but production costs continue to increase. Wells cost more to drill and bring on stream because much of the easy oil is gone, leaving behind oil that defies production by conventional techniques and oil in deeper, more complex reservoirs in frontier areas. Total production costs remain high because productivity per well has declined and the techniques and materials required are generally more expensive (above).1

Striving to remain profitable, oil companies are taking action in two areas to control costs. First, they are redefining their business, identifying core competencies and outsourcing noncore activities. Second, they are changing the way they do business, gradually converting the arm’s-length relationship with contractors into more cooperative collaborations to eliminate redundancy and boost efficiency, exploiting new technologies to enhance productivity.2

Oilfield business relationships take many forms. Volume discounts, turnkeys, service bundling, integrated services, joint ventures, partnerships, alliances—each has a place in the continuum of business practices, each with different levels of cooperation and...
trust. Volume discounts and turnkeys are variations on the traditional way of doing business. Jobs are bid, whether by well or by project, and job specifications are set by the operator. The service company reacts, then executes the job on demand.

In a second category, service bundling and integrated services are new ways of doing business that are gaining acceptance, especially outside North America. Service bundling gathers several services under one contract and concentrates the points of contact between the operator and contractors. Here, the operator still provides all the specs, and the service supplier executes the job. Integrated services contracts span a wide range of activities, from service execution—performing bundled services—at the most basic end, to product delivery at the most sophisticated end (see “Integrated Services,” page 11). Product delivery, in which the product may be an offshore platform, a well or some other complicated project, entails conceptual design, process planning, service execution and evaluation.

Joint ventures tend to denote shared equity and sometimes result in acquisition of one party by the other.

The third category, and perhaps the newest in the oil industry—certainly the hardest to define—involves partnerships and alliances. Partnerships are defined by the *Journal of Petroleum Technology* as “short-term, project-specific relationships between supplier and client that seek to gain greater economic value for both parties.”

Alliances are similar to partnerships, except they are designed to persist beyond the scope of individual projects. Other definitions exist, but an alliance is defined here as a long-term relationship between two companies that furthers their common interests over a specific range of activities.

Although both are new business practices in the oil industry, alliances differ from integrated services contracts. Under an integrated services contract, the client assigns responsibility to the supplier to reduce the client’s costs. In an alliance, the supplier accepts responsibility to reduce client cost, and the client takes on responsibility to ensure the supplier’s profit, often by assuring future business to the supplier. The two sides work together to reduce costs and improve profitability for all involved. Trust and confidence in supplier commitment make bidding each service or per well a thing of the past.

However, integrated services and alliances are not mutually exclusive. An integrated services project may be offered to an alliance partner, or may evolve into an alliance. In fact, most alliances start out as tests for a certain period of time, then if successful, may become self-renewing, sometimes called evergreen. Not written as long contracts, the terms of an alliance often fit on a single page.

Alliances themselves take many shapes. An alliance may be an agreement between an operator and a service company for a single service, or it may embrace several companies or several product lines within a company to create what is called an integrated alliance.

Some alliances cover one geographic area or business unit; others encompass worldwide activities. The alliance between Texaco and Dowell, for example, covers all pumping services for Texaco’s North American operations (see “DESC in an Alliance: Texaco,” page 43). The alliance between Oryx Energy Company and Schlumberger spans wireline, testing and logging-while-drilling services worldwide.

Service companies can form a brand of alliance among themselves—more a consortium, or partnership, following the definitions in this article—to offer complementary services when the market is for integrated services. Oil companies forge similar partnerships to develop their assets.

“Strategic alliance” often describes alliances that are part of the partner companies’ strategies, and implies that the companies share their strategies openly. Few oilfield alliances so far have reached such a level of cooperation and openness, but that is the goal to which many aspire.

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Efficiency Improvements Through Alliances
The cooperative spirit of an alliance changes the way problems are approached. In the quest to cut costs, it means not dwelling on contractor profit, but cutting total project cost (next page, top). To uncover where cuts can be made, every process in the entire project must be analyzed and examined for inefficiencies. Alliance partners construct a description, called a process map, for each process. A process map may be a list of steps or a flow chart (next page, bottom left and right). The total project is analyzed and individual processes are retained only if they add value. Improvements are made to the remaining processes, or entirely new processes are developed, and the new processes are remapped, giving continuous improvement. Decisions on how to improve a process come from the alliance partners, and team members have the power make the necessary changes.

Where to start cutting costs? An economics professor would say, cut first where there are the easiest and biggest gains. In today’s development-oriented oil field, pumping services can often account for the majority of the cost of a well (below). These have become the early targets of companies trying to increase efficiency. Process mapping can show where redundant efforts are undermining efficiency. For example, before one alliance, stimulation engineers from both sides would spend time designing a frac job. Soon after the start of the alliance, the engineers from both companies completed the exercise of mapping their fracture design processes. The results showed the two processes to be duplicates.

Through the alliance, now a frac job is designed jointly, and then modeled by the service company engineer, freeing the oil company engineer to spend time on other projects that add more value—in some cases selection of other wells to be stimulated, called candidate recognition. In other cases, the optimal division of labor may assign candidate recognition and job design to the service company engineer, leaving the oil company engineer free to develop future growth opportunities. In a growing number of alliances, the oil company no longer requires a representative on site for the job. The streamlined process is more efficient, but trust in the alliance partner is crucial to the success of such a scheme (page 30).

Eliminating bidding is another example of increasing efficiency by slashing processes that add no value. Through process mapping, some oil companies have found that almost as much money is spent on the bidding process as on the job itself. An advantage of the alliance between Conoco Canada Ltd. and Schlumberger Wireline & Testing has been the time and money saved by not bidding. Conoco Canada Ltd. previously required at least three bids for every well. Specifying the logging program took a half day; getting the bids back took another two.

While this manner of association is relatively new to the oil business, it has been practiced by other industries, notably in manufacturing, for up to 15 years. Kodak, Apple Computer, Siemens, Ford Motor Company, Motorola, Toshiba and International Business Machines are just a few of the companies with experience in gaining efficiency through alliances. Alliance analysts have a rich selection of ongoing and past alliances from which to draw analogies, along with success and failure factors (see “The Alliance as a Relationship,” page 34).

5. For a review of oilfield applications of quality control, assurance and management:
6. This idea was quantified somewhat by Vilfredo Pareto, an Italian economist, and founder of the “80-20 rule”: 80% of the wealth is held by 20% of the people. Quality expert Joseph Juran extended this concept to the analysis of problems in general: 80% of the problems come from 20% of the possible causes.
Two fracture-design process maps streamlined to create one, more efficient process. Through continuous improvement, the operator (pink) and service company (light blue) processes become a new single process (purple). Further improvements yield a process with optimum efficiency (dark blue).

Analyzing a well stimulation process map. More than 6 ft [2 m] long, this typical process map comprises more than 100 steps.

New focus on cost-effectiveness for product-based and service-based systems. The traditional approach reduces costs by cutting supplier profit. Alliances achieve increased efficiency by cutting total system costs.
An example of an integrated alliance designed to increase drilling and completion efficiency is the multiservice, single-project alliance between Marathon Oil Company and the Schlumberger companies of Anadrill, Dowell and Wireline & Testing. Diamond Offshore Drilling was the drilling contractor, and mud was provided by M-I Drilling Fluids Company.

The challenge was to drill and complete nine directional offshore wells in the Vermilion Block 331 field of the Gulf of Mexico. Marathon fielded an interdisciplinary team that interfaced with the contractor team, and all decisions were approved by the new collaboration.

An idealistic example of process streamlining through trust is the story of tubulars—drillpipe, casing and tubing. Mapping the many processes from steel manufacturing and tubular construction through deployment and finally recycling shows that tubulars are picked up, put down, inventoried and inspected anywhere from three to eight times each (next page). Cutting out redundant steps and checks yields the seamless circle of the ideally efficient process. Most of the process lies outside the realm of the operating company alone, but through supply chain management—alliances with other links in the supply chain—total process efficiency can be optimized.

Some alliances initially formed to address drilling and pumping costs later expand to enfold other services. Examples from three North American oil companies show how such alliances are increasing productivity and cutting costs.

Offshore Integrated Alliance
Preperforating

Amoco/Dowell engineers select perfs.

Forward to local Dowell coordinator.

Copy to Amoco

Amoco installs frac valve; coordinates w/Dowell
to test casing.

Dowell notifies Amoco of total depth (TD)
and Amoco OKs TD or cleanout.

Dowell coordinates for
pit/frac tank/lines
and coiled tubing unit.

Dowell coordinates with water supplier.

Run wash tool; wash to plugged-back
TD and test casing.

Well ready to perforate

Schlumberger coordinates
logging and perforation;
notifies Amoco of date.

Run gauge ring w/gamma
ray/casing collar locator.

TD not OK

TD OK

Log and perforate

Palestine coordinates
installing frac stack,
pit/limes separator and
washmen.

Frac well; shut in for 36 to 48 hours.

Palestine coordinates
hauling flowback fluid.

Well cleaned up and ready
to run production tubing

Turn over to production;
ready for sales.

Amoco coordinates
w/Schlumberger to
set wireline packer.

Amoco coordinates
w/packer company.

Amoco coordinates
for rig.

Rig pusher coordinates
tools, water/packer
fluid, tubing and tree.

Run tubing and
land tree.

Rig pusher coordinates
rig-down and pick-up tools.

S

30 Oilfield Review
Process maps describing the use cycle of tubulars. Traditional processes allow tubulars to be handled, inventoried and inspected a number of times (top). Alliances between links in the chain permit elimination of redundant steps, yielding the ideally efficient process (bottom). (Adapted from Amoco ASAP 2000 program, with permission.)
Benchmarks were set in three areas: better-than-market financial compensation was offered if drilling time, health, safety and environment compliance, and well performance exceeded expectations. The joint team worked to anticipate time-consuming steps and solve problems rapidly. Drilling time was minimized with topdrive to speed tripping and connections, and with the help of the SPIN Sticking Pipe Indicator program, which requires downhole weight-on-bit and downhole torque as inputs. Before the alliance, Marathon normally wouldn’t acquire these measurements while drilling because of the high cost, but Anadrill drilling engineers pushed for them, certain the measurements would make drilling safer, would create a more stable hole and ultimately save money. Compared with other recent similar drilling projects conducted via “business as usual,” or outside the alliance, the Vermilion 331 team increased the average drilling rate by 56% and decreased drilling costs by 14% (below).

The completion phase also benefited from the team organization and the risk-reward financial structure. By focusing attention on both productivity enhancement and process cost reduction for the 15 zones completed, the team was able to reduce average rig time by 1.8 days and shave nonrig completion costs by 10%.

These savings were achieved while implementing the relatively new HyPerSTIM fracturing and sand control technique. The HyPerSTIM technology, combined with Marathon’s emphasis on sound completion practices and the team’s attention to detail, resulted in flow capabilities that averaged at least 30% more than in the prealliance completions (next page, top left).

While the overall project met or exceeded expectations, it took time and effort to step out of the comfort of long-standing roles, responsibilities and communication lines. A financial structure that gave all parties a vested interest in achieving project goals and an environment that promoted open communication and risk taking was key to the success of the project.

PanCanadian Stimulation Alliance

Unlike the integrated alliance that drilled Marathon’s Vermilion wells, most oilfield alliances begin with a single service. An example is the alliance between PanCanadian Petroleum and Dowell, the goals of which are to assure high-quality stimulation and to control treatment costs. In 1992, top management at PanCanadian urged business managers to search worldwide for more efficient production methods. Out of that came the motivation to forge alliances to optimize production and speed payout (next page, bottom). The alliance with Dowell emphasizes finding the best technology for the problems encountered in PanCanadian’s variety of assets, which span a multitude of environments in Canada, including shallow gas wells, deep foothill exploration wells and wells producing heavy oil.

A Dowell engineer—called a DESC engineer, for Design and Evaluation Services for Clients (see “The DESC Engineer Redefines

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8. For information on crosslinkers, breakers and other fluid additives:
work to the Pan-Canadian office to interact with field development teams and provide a link with Dowell research capabilities. Continuous improvement teams were formed to analyze the entire stimulation process. Prior to the alliance, PanCanadian had considered the shallow gas wells deserving of only low-technology fracture treatments. Stimulation engineers were pumping batches of premixed frac fluid. Premixed fluid is less expensive, but the quantity required is difficult to predict, and engineers tend to err on the side of surplus. A more efficient process was developed by switching to a more expensive PCM Precision Continuous Mixer system, giving higher quality fluid, and no waste.

Alliance engineers also examined the type of crosslinkers in the frac fluid. Previously, they had used titanate crosslinkers with covalent bonds. Then they tried borate, with ionic bonds, which are more flexible, so not affected by shearing during passage through perforations. Finally, they switched to an encapsulated breaker to improve the breaking of the link created by the crosslinkers to start fluid flowing out of the fracture. The combination of new technologies yielded improved fracture conductivity (right).

In the deeper oil and gas wells, the alliance team tested a new energy-assisted, or foam, fracture technique that gave higher productivity. "We did switch to more expensive products, but they have decreased our total cost and increased our productivity. The results of the alliance surprised us," says Steve Dole, coordinator for completions engineering at PanCanadian in Calgary, Alberta, Canada. "We thought we'd bottomed out on the cost per job by 1993. But we've learned we can keep cutting."

After two years, the alliance completed 1500 high-tech frac jobs, 700 cement jobs and 140 conventional fractures all with reasonable cost, excellent quality and no lost-time accidents—a perfect safety record. Jobs are now scheduled to avoid delays during periods of peak activity and to make better use of Dowell’s resources. This improved resource utilization has resulted in reduced costs for Dowell, thus benefiting both companies. The alliance is expanding to include coiled tubing services and cementing, and to plan longer-term actions. Through the alliance, PanCanadian is now influencing Dowell’s research in areas of special need, such as fracturing techniques for shallow gas wells and hydrocarbon frac fluid breakers.

Alongside the stimulation alliance is a parallel alliance to add value to open- and cased-hole logging and drillstem testing, initiated in 1993. PanCanadian has increased its drilling activity from 413 wells in 1992 to a budgeted 1250 in 1995, without increasing staff. To handle the increase in logging activity, two additional Schlumberger personnel have been dedicated to the PanCanadian office; an applications development engineer helps design logging programs, and an evaluation services technical representative coordinates all logging and testing.

In an atypical exchange of expertise, a third Schlumberger engineer has been seconded to the PanCanadian petrophysics

![Oil Well Performance Analysis](image)

** Improved well performance in wells stimulated with HyPerSTIM fracture treatment. **

![Stimulation Improvements](image)

** Continuous improvement in flow rates by changing stimulation fluid. Normalized absolute open hole flow rate has increased steadily as stimulation engineers optimize crosslinker and breaker technology. **

![Payout curves showing traditional and optimized drilling and production.](image)

** Payout curves showing traditional and optimized drilling and production. **
Supply chain evolution.

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Multiple Amoco Alliances

What makes an alliance successful? From those who’ve done it, one of the first answers is top-down commitment. The alliance must have champions at the highest level. An example is the case of Amoco Production Company. Early in 1992, Amoco launched the Vendor Asset Materials Management (VAMM) team as part of a company-wide business process reengineering effort. The VAMM team, led by US Operating Group Vice-President Jerry Brown, made a presentation to the seven North American business unit managers, urging alliances as a tool for lowering investment costs and reducing controllable operational expenditures. The Amoco Supplier Alliance Program, ASAP 2000, was set in motion throughout the company to bring a systems approach to managing supplier relationships (above).

The business unit managers were encouraged to create supplier alliances with the service companies of their choice. Five alliances have been built with Schlumberger companies, and three with Halliburton Energy Services. Each alliance is different, but share some common features. “We have a healthy concern for the profitability of our alliance partners,” says Harmon Heidt, Alliance Coordinator with Amoco in Denver, Colorado, USA. “Our focus is on eliminating costs deemed to be unnecessary—in all our operations, Amoco’s and our suppliers.” The following examples from three Amoco business units demonstrate some of the progress to date in increasing efficiency.

Early in 1992, John Morris, the operations manager of the Southeast Business Unit (SBU)—covering land operations in Louisiana, east Texas, south Texas, Arkansas, Mississippi, Alabama and Michigan—met with major service suppliers to discuss alliances. He anticipated a significant reduction in operating costs associated with reducing the number of suppliers. At

The Alliance as a Relationship

In French, alliance means marriage. And many alliances seem to resemble marriages more than they do other business relationships. After studying 37 alliances in different industries, Professor Rosabeth Moss Kanter of the Harvard Business School, Cambridge, Massachusetts, USA, has found that relationships between companies grow or fail much like relationships between people. She describes the four phases of an alliance as courtship, engagement, marriage and old marrieds.

During courtship each side checks out the other, and compares with others, looking for the most attractive, compatible partner. Compatibility is based on common values, principles, experiences, resources and hopes for the future.

After the engagement, plans are drawn and the wedding closes the deal. The agreement is given a name and made public. Executives from both sides are invited to “meet the family.”

The marriage phase begins as the partners set up housekeeping together and grow as a family. During this phase, differences are discovered—sometimes coming as a surprise to those who founded the alliance—and the partners must work out problems and develop techniques for getting along. Trust is crucial and individual sacrifices are made for the good of the relationship.

As partners enter the “old marrieds” phase, they can reflect back and recognize changes, changes not anticipated at the start of the relationship. Collaborating becomes more effortless and routine.

Kanter also outlines the eight essentials “I”s in an alliance that make for a strong “we”:
Midyear, a project was designed to test the abilities of the service companies to provide cost-effective stimulation solutions. By the beginning of 1993, the SBU had aligned all pumping and wireline business with the Schlumberger companies. The alliance operates with a steering committee comprising the Amoco operations manager, representatives from Dowell and Wireline & Testing and the alliance coordinators. The role of the steering committee is to set objectives and communicate results between upper management and the working committee.

Most alliances have two coordinators—one from the Amoco business unit and one from the Schlumberger companies. The coordinators are the facilitators for the alliance, and also responsible for scheduling, quality assessment, a newsletter for communicating results, interventions to solve specific technical problems and alliance scorecards—tools for measuring the success of the alliance.

The SBU alliance is organized into four alliance field teams, each composed of Amoco, Dowell, Wireline & Testing and GeoQuest people in the office and the field. The teams select and evaluate wells, and identify and modify processes for their local operations from recompletion and fracturing to plug and abandon.

Initially, there was redundancy in fracture and recompletion evaluation and design, with both sides performing the same tasks. A streamlined approach was approved by each side, and is now used in the alliance. Flexibility in job scheduling has resulted in better utilization of equipment and personnel.

Comparison of well completion and fracturing costs tracked before and after formation of the alliance shows that the cooperative approach has reduced costs by 20%. Accompanying the reduction in costs is an improvement in well performance relative to benchmark wells (left).

**Individual Excellence:** Each company is strong and has something of value to contribute. Motives for pursuing the relationship are positive—to pursue future opportunities, not mask weaknesses.

**Importance:** The alliance fits with major strategic objectives.

**Interdependence:** The partners need each other, have complementary skills and couldn’t achieve the same results alone.

**Investment:** Each side shows tangible signs of long-term commitment by devoting financial or other resources to the relationship.

**Information:** Partners share data required to make the alliance work. These include objectives, technical data, and knowledge of conflict, trouble spots or changes.

**Integration:** Partners develop linkages and shared ways of working together. They build broad connections between many people at different levels in the organization. They become both teachers and students.

**Institutionalization:** The alliance is given a formal status, and extends beyond the people who formed it.

**Integrity:** The partners behave honorably in ways that justify and enhance mutual trust. They do not abuse information, nor do they undermine each other.

operating in West Texas, officially began a pumping alliance with Dowell in 1992 covering cementing, acidizing and fracturing. “Substantial savings have been realized and pumping service quality has improved constantly,” reports alliance coordinator Fred Ray of Amoco, in a recent alliance newsletter. “We attribute the savings and improvements to our commodity planning and process reengineering.” Since the alliance began, the PBPU has documented a cost savings of $1.3 million.

Among the greatest challenges in any alliance effort are documenting and quantifying improvement, probably more difficult in a service industry than in manufacturing. One of the most powerful tools for recording progress is the scorecard, and the PBPU alliance team takes scorecards seriously—to the point of creating a team to evaluate scorecards. Scorecards have been devised to track all activities to understand problems, identify bottlenecks and recognize improvement. Examples are scoring workover cementing jobs in categories such as cost of job, cement left in pipe, job pumped on time and remedial cement required. Often the best scorecards are the ones that look bad, because problems can be tackled only if they are discovered. And some of the most successful scorecards are those that are no longer used—either they have helped identify other factors that should be tracked, or the problems they’ve exposed have been addressed.

The PBPU alliance operates through intervention teams to drive improvements to gain efficiency. “Joint intervention teams are highly focused to resolve issues in a timely manner,” says Amoco Resource Manager Ted Rolfvondenbaumen. “In other words, we involve the right people at the right time.” For example, in the past year, the fracture appraisal intervention team has identified other factors that should be tracked, creating artificial barriers in the drilling and completion process. The major objectives were to reduce total system costs for drilling and completion, reduce cycle time and continuously improve service quality.

The alliance steering committee set incentives for recognition of innovative and superior work at three levels: individual, team and company. To monitor progress, the committee established measures—well performance, well cost, service quality, timing and adherence to plan.

Total well costs in the first field dropped 49% compared to 1991 levels, an achievement made possible by numerous changes in the drilling and completion process. Amoco completely redesigned the wellhead assembly, facilities and casing size to save costs. The drilling contractor improved the drilling process to reduce average drilling time per well by six days. Alliance partners modified frac fluid and proppant, taking advantage of the BRACKETFRAC technique in which both buoyant and dense proppant are injected to create artificial barriers above and below the desired fracture interval, thereby controlling fracture height. Dowell engineers used the FracNPV application that examined the balance between fracture cost and anticipated production to identify the most cost-effective fracture treat-

Alliances in Research and Development
Not all alliances between oil and service companies revolve around field operations. Collaboration and optimization of resources are being taken a step further with research and development alliances. Through such alliances, the oil company benefits by obtaining the tools and products for their precise needs. In addition, the service company develops products that can be transferred to the market, and the companies exchange know-how.

An example of such an alliance is the collaboration between AGIP, the Italian oil company, and Wireline & Testing and GeoQuest. In 1992, Agip sought a working relationship with a service company to enhance the usefulness of dipmeter logs by automating more of the interpretation and integrating it with other log data. Agip wanted more than a typical operator-contractor arrangement, in which the contractor programmers would meet Agip’s specifications: working together, geologists and programmers from both sides created a product adapted to user needs.

The project was named DipFAN for dip facies analysis, and split into six modules. For three of the modules, Agip engineers are assuming the role of operator, taking the project lead with responsibility for specification and design documents, executable code and a user guide, while their Schlumberger counterparts take the role of partner. For the other three modules, the roles reverse. Four of the modules have developed to field-test stage, and work began on the remaining two early in 1995. All six modules will become part of the GeoFrame oilfield data interpretation system (see “Tapping the Dipmeter,” next page).

Another example of a development alliance is the agreement between Statoil, the Norwegian oil company, and Geco-
Tapping the Dipmeter

DipFAN facies analysis consists of software modules for faster, standardized interpretation of dipmeter data. By year end, six modules will be completed and running on the GeoFrame system. Three of the modules have been completed: the StatPack, FasTex and SediView applications.

The StatPack program is both a stand-alone module and a statistical library used by the other components of DipFAN. It performs basic processing such as principal component and cluster analyses.

FasTex processing conducts geology-driven pattern analysis of high-sampling rate resistivity data from the dipmeter to extract layering, heterogeneities and fractures. Texture curves are generated by cluster analysis to define a high-resolution electrofacies zonation. The program outputs a catalog of facies in the specified interval, and segments the interval into layers with those facies.

SediView analysis processes dip information to produce a sedimentological description of the logged interval. The method first requires making a link between lithological information and dip results. Then the structural dip is computed and subtracted, to rotate the sedimentary bodies to their initial position. The final step detects the boundaries and orientation of the sedimentary structures.

FasTex pattern analysis for clustering dipmeter data into a specified number of layers—five in this case. The geologist can cross-plot variables such as volume, apparent thickness or contrast of conductive events versus resistive events, to monitor the quality of clustering. The resulting vertical zonation is displayed with representative examples of each zone, identified by their eight dipmeter channels.

SediView analysis of dip information to produce a sedimentological description of the logged interval. Raw dip results (track 1) are processed to give local curvature axis (track 2). Structural dip is estimated from stereonet projection (center) and subtracted from raw dips to yield sedimentary dips (track 4). Dip dispersion analysis is reported (track 5) and the sedimentary structure is delineated (track 6).
the Norwegian oil company, and Geco-Prakla to commercialize the SUMIC subsea seismic acquisition and processing technique. The new system places four sensor components on the ocean floor and records signals from a conventional marine seismic source. This allows recording of shear waves, which have previously been recorded only on land (see “Why Subsea Seismics?” below). Shear wave analysis adds information about rock and fluid boundaries that eludes conventional compressional-wave seismic interpretation.

Statoil had already invested years to research the SUMIC technology, including three feasibility studies, scaled experiments and comparison of the sensors with reference sensors in controlled environments. It was time to find a contractor to help commercialize the system.

After considering several companies, Statoil selected Geco-Prakla to develop and improve the equipment and associated services, and promote marketing and sales. The agreement permits Statoil to retain ownership rights on the technique, while Schlumberger has exclusive user rights. The agreement is one of a collection of projects under a wider umbrella agreement with Statoil. In a separate project for processing and interpretation, new functionality will be added to the Charisma seismic workstation to handle the new type of data.

The Hard Road to Alliances

There are no short cuts to alliance success. Process mapping can be a tedious exercise. Meeting after meeting to explain total quality management and to ensure continuous improvement can make office life more demanding. The alliance approach requires learning a new way to work, and it raises some difficulties and questions. The foremost problem has been securing top-level commitment and top-to-bottom buy-in to the alliance concept. For alliances to work, they must be part of the business plan, not a passing fad.

An alliance is not a short-term fix. There may be early successes that are not repeatable. Large cost savings encountered in the first rounds of continuous improvement may have caught what alliance specialists call "no-brainers," or "low-hanging fruit"—the easy fixes that yield big savings. Later savings may be incremental, but still important, and not attainable if the alliance partners give up too quickly.

There is also a fear of change. People are going to be concerned about their careers, their power and their control. These very delicate, significant issues must be considered before an alliance is formed. Restructuring is not a necessary outcome of an alliance. According to Rick Adams, Operations Engineer for Mobil Exploration & Pro-

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Why Subsea Seismics?

Conventional marine seismic surveys record compressional (P) waves but no shear (S) waves. This is because the receivers are in seawater, and water supports only P waves, no S waves. The new SUMIC subsea seismic data acquisition technique plants four components of sensors—one hydrophone and three geophones—on the seafloor. Receivers coupled to the solid seafloor can acquire both P waves and S waves that have been converted from P waves upon reflection (right).

The acquisition of S-wave data may solve many problems encountered in conventional marine seismic surveys. Compressional waves are disrupted by changes in fluid content, especially the presence of gas, in subsurface layers. That makes detection of gas possible with P waves, but also renders lithological changes invisible. Shear waves ignore fluid changes and measure only rock properties. Hoping to harness shear waves in this way, Statoil conducted a feasibility study to illuminate the top of a reservoir through a gas chimney. In zones where gas had completely obliterated earlier P-wave signals, the seafloor sensor data showed reflections.

Shear-wave and P-wave data may also be combined to extract elastic properties such as lithology and fluid type from subsurface layers. This application requires calibration with log data—incorporating P-wave and S-wave velocities for known rocks and fluids—to extrapolate properties away from the well using seismic velocities as guides.

A third area of possible application of SUMIC technology is hard seafloor. Seismic wave energy
ducing, in Midland, Texas, “Alliances are a way of improving productivity without the negative side effect of downsizing.”

Another potential concern is the fear of being locked into an agreement and not getting the best technology. This must be taken into account when choosing a partner. The alliance partner that has offered the best technology in the past and who offers it today is likely to be the one who will be able to offer it in the future.

Oil companies may question how big they must be to have an alliance. According to industry experts, alliances can work for small independents as well as for majors. The goal is to optimize assets, maximize efficiency and lower total costs. An operator’s assets may be its infrastructure, or a large in-house staff. Or it may have a small in-house staff that needs to be augmented.

As more companies begin to make alliances, some are looking for ways to share their experience and to promote alliancing as a new technology. Others are beginning to view alliancing as a core competency, and are less inclined to share their expertise. They have worked hard to learn the skills, and are more reluctant to give away their new competitive advantage. But such an advantage may be temporary. New business relationships that control total costs and encourage constant change are healthy for the industry, and give a direction for more companies to follow.

Through alliances, operators and service companies are trying to achieve a common goal—lower the total cost per energy unit produced. As more companies gain experience with alliances, significant savings will continue to be made by both operators and suppliers, and more opportunities will be found for gaining efficiency and adding value.

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is greatly attenuated by reflection at large-contrast boundaries. In conventional surveys, waves reflect twice—going down, then up again—at the water-rock interface. Compressional- and shear-wave recordings both may benefit from the placement of receivers on the seafloor.

Finally, the new technology may facilitate repeat surveys designed to monitor changes in fluid saturation fronts. In the past, such surveys have suffered from difficulties associated with changes in acquisition geometry and equipment and in processing methods between one survey and the next. Permanently secured sensors may alleviate some of those difficulties.