# Shell News

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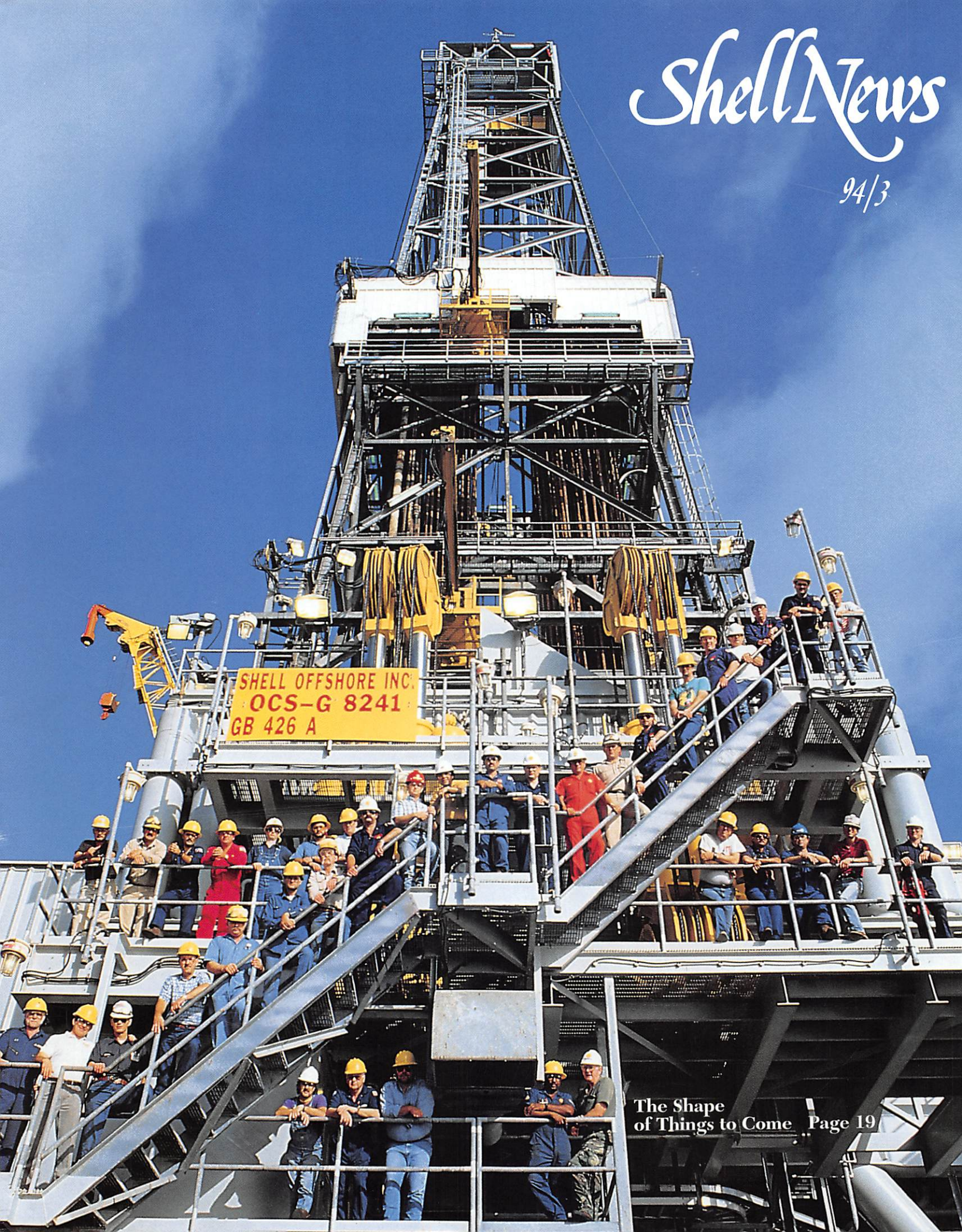



The Shape of Things to Come Page 19

# The Shape of Things to Come

*Auger, Shell Offshore Inc.'s innovative tension leg platform (TLP), sets new records for oil and gas production in the Gulf of Mexico.*

Representing a number of firsts for the industry, new Shell Offshore Inc. Auger platform portends the future in deepwater production of oil and gas

*Story by JOHN ABBOTT*
*Photography by RAVI ARYA*

Under the eyes of the world's petroleum industry, Shell Offshore Inc.'s (SOI) innovative Auger tension leg platform (TLP) has gone into production in the Gulf of Mexico, signaling a new era for offshore oil and gas development.

Auger's first production well initially flowed at a rate of about 2,200 barrels of oil and 5.8 million cubic feet of gas per day. This quickly rose to more than 10,000 barrels of oil and 9.2 million cubic feet of gas per day, with total field production reaching daily rates of 50,000 barrels of oil and about 100 million cubic feet of gas. When the field is depleted years from now, it is expected to have produced an estimated 220 million barrels of crude oil equivalent (COE).

As the world's deepest offshore drilling and production platform, Auger sits in water 2,860 feet deep. It is the first Shell platform to be located in water deeper than 1,500 feet, which is generally considered the threshold of the deepwater Gulf of Mexico. From the highest point on the platform to the ocean floor, it spans nearly 3,300 feet—more than twice the height of the world's tallest building.

Located almost 135 miles off shore—75 minutes by helicopter from dry land—Auger is situated on Garden Banks Block 426, about 255 miles southeast of Houston and 214 miles southwest of New Orleans. The other Auger leases, also 100 percent owned by Shell, encompass Garden Banks Blocks 427, 470 and 471.

The installation of Auger was completed in February 1994, following more than three years of fabrication and construction. The TLP more than doubled the water depth record previously held by SOI's Bullwinkle platform, which continues to hold the record as the world's tallest fixed platform in 1,353 feet of water (see related story, "A Leader in Deep Water").


*Members of the Green-Gold-Brown and (onshore) Plaid teams discuss drilling operations aboard the TLP, which has slots for 32 wells. From left are: Steve Terrebonne, Kaz Javanmardi and Danny Alviar.*

*With the Lateral Mooring System (LMS), the crew can move the massive platform as much as 200 feet laterally in any direction so that the fixed drilling rig is directly above the subsea location of any Auger well.*

Despite widely varying water depths, there are other significant differences between Auger and its predecessors. Instead of resting on the sea floor like a conventional platform, Auger floats on the surface. The TLP is made up of four large cylindrical columns that are connected to submerged pontoons, and is held in place vertically by a dozen tendons (three per column) connected to foundation templates secured with piles to the sea floor. These tendons, each 2,760 feet long and made of 26-inch diameter steel pipe, are secured under tension to keep the platform from bobbing like a fisherman's cork in rough seas.

A Lateral Mooring System (LMS) is used to position the platform and limit its lateral movement. With nearly a two-mile radius, the LMS consists of eight lines with 8,650 feet of five-inch wire rope and 1,800 feet of 3⅜ inch chain per line. Each line is connected to two submersible buoys, one with 70-ton buoyancy and the other with 45-ton buoyancy.

Still, mobility is an essential aspect for Auger. By pulling in or letting out cables from the LMS, the crew can move the platform 200 feet laterally in any direction so that the fixed drilling rig is directly above the subsea location of the well being worked on.

A $1.2 billion project, Auger represents the first TLP for SOI, for Shell Oil, and for the Royal Dutch/Shell Group of companies. (Auger, the fourth TLP installed in the world, is in the deepest water.) In the Gulf of Mexico, it's the first TLP to support both a drilling rig and a complete complement of production facilities. In fact, Auger has so many "firsts," it is difficult to put them in perspective:

- For starters, Auger's water depth set a world record for a drilling and production platform, beating the old mark in the Gulf by 1,100 feet.
- Auger's crew developed its own Incident Command System (ICS) for safety and emergencies.
- In an even greater departure from the past, the Auger crew is divided into multiskilled teams that claim responsibility and ownership for different parts of the operation. Multiskill teams have been used by Exploration and Production for years, but never on such a wide scale—or in such a remote location.

With so many innovations built into it, and so many challenges ahead of it, Auger could forever change the way the industry operates in deep water. And therein lies its true importance. By taking the plunge, so to speak, Auger has moved the entire industry within reach of an estimated 10 to 15 billion barrels of oil and gas equivalent that are believed to exist in the deepwater environment of the Gulf of Mexico.

"When this project first began in the late '80s, we had several concerns," says Asset

*Blue-Yellow team members Jim Kittoe (left) and Zack Smith inspect the Lateral Mooring System on platform Auger, located in water 2,860 feet deep.*

Manager Tom Bourgeois. "We asked ourselves, 'Is there a reservoir there? Do we have the technology to develop it? And can we make money?'."

Auger has already answered the first two questions, Bourgeois notes. "The predrilling, well completion and producing results have given us confidence about the reservoir," he says. "The TLP is installed and operating on time and under budget, so we feel we have the technology for continued success in deep water. The only outstanding issue is making money in deep water. Given the current price outlook for oil and gas, it will be very challenging—but doable."

Like everybody else, Bourgeois is understandably reluctant to predict the future, but he likes the odds. "The most reliable indicators of profit for deepwater wells come from high production rates per well and a high ratio of reserves per well," he says. "In other words, you want to get the maximum production you can from each well so you can reduce your capital expenditures. From what we've seen with Auger so far, it appears that's what we've got."

*Gene Baudoin, a member of the Blue-Yellow team, monitors a generator control panel aboard SOI's record-setting offshore drilling and production platform.*

Designed and engineered by Shell, the Auger platform was backed with strong research by Shell Development Company, complemented by the efforts of key consultants and contractors. The TLP dates back to December 1989, when SOI publicly announced its plans to develop the Garden Banks leases. Shell had acquired the deepwater tracts in 1984 and had drilled a discovery well in 1987. This favorable lease position, combined with a wealth of acquired three-dimensional (3-D) seismic data, provided an impetus for the Company to move ahead.

SOI's leap into deep water might be likened to the United States' exploration of the moon. Deep water, like outer space, symbolizes a new frontier, one that is not without risks.

"Auger combines a high concentration of people and a high concentration of assets with three very critical drilling, production and marine operations," Bourgeois says. "To do it safely and economically, you have to manage those operations very carefully. Individually, each piece is not that unique. But when we decided to put them all together in one package, we were faced with a real challenge."

Because of this, at the end of 1991 SOI formed an organizational design team that included a cross-section of managers, support groups, operators, craftsmen, technicians and contractors who determined how the TLP would operate.

The two top design considerations were risk management and making money.

Outside of Shell, the project took on epic proportions, energizing many local economies. More than 900 companies in the United States and 33 foreign companies were involved with Auger. That translates into nearly 3,000 people in the USA who were directly employed at one time or another on the project.

Auger's deck was fabricated by McDermott Inc. in Morgan City, Louisiana, and the 20,000-ton hull by the Italian firm of Belleli S.p.A. The two mammoth structures—the deck alone is the size of two football fields side by side—were mated at sea in October 1993.

The mating operation was another first of its kind for SOI. Perhaps the most critical element of the entire project, this effort was hindered by several delays—not the least of which kept the deck in the construction yard for an extra month and a half because of silting in the Atchafalaya River due to the Great Flood of '93 (*Shell News* 94:1).

Because of the delays, the mating operation could not be started until late September. Since this is the peak of the hurricane season, SOI kept a watchful eye on extended weather forecasts in the Gulf; indeed, a potential threat from Hurricane Gert postponed the operation for several days. Once the sea conditions were right, however, the crew pulled it off without leaving a single scratch on the fenders that were rigged between the hull columns and the transport barge.

Basically, here's how they did it:

The hull was ballasted down to a draft of 136 feet; the deck, carried on a McDermott barge, was then slowly pulled into position between the four hull columns. Once the deck was in place, the hull was deballasted by pumping water out the columns, making it lighter and lighter. As it slowly rose, it actually lifted the deck off the barge and completed the mating. Many observers thought that such a precise operation could not be done at that time of year, but the Auger crew showed that most anything is possible—with the right amount of patience and planning.

After the mating, the resulting superstructure was towed to Freeport, Texas for final hook-up and commissioning. Under tow, Auger rose above the water to the height of a 26-story building. "Standing on the derrick barge looking up at the deck, I was reminded of the spaceship in the movie 'Close Encounters of the Third Kind'," says Senior Construction Superintendent Pete Arnold. "It was so massive that it dwarfed everything else."

The installation of the platform began in November 1993 when McDermott laid the lateral mooring system that enables Auger to shift positions. The TLP was towed to the site in December and work crews began to connect the superstructure to the mooring system and to the tendons that hold it in place. Tied to


*Members of the Auger team survey wellhead operations on Well A-14, which is producing from the Blue reservoir. Clockwise from left, they are: Daniel Griffin, Ricky Upton, Paul Tucker and C.P. Rogers.*

## A LOOK AT TENSION LEG PLATFORMS

Auger is the first SOI tension leg platform in the Gulf of Mexico and only the fourth in the world. Here's a look at the components of these gigantic offshore structures, which can be installed in water depths of up to 7,000 feet.

- A floating hull comprising a deck on which is housed a drilling rig and a complete complement of production facilities.
- Vertical tendons, constructed of tubular steel pipe, which connect the hull to templates on the ocean floor. The tendons eliminate vertical movement but allow limited horizontal movement.
- Tubular production risers which connect the wellhead on the deck to the wells on the ocean floor.
- A lateral mooring system which provides the means to position and hold the structure directly over the wells on the ocean floor.

*Ernie Munn, a member of the Pink team, surveys a compressor on SOI's TLP, the world's deepest offshore drilling and production platform.*

foundations set in each corner, Auger is designed to simultaneously withstand hurricane force waves of 71 feet and winds of 140 miles per hour.

On February 12, McDermott officially turned the platform over to Shell. "The hand-off was quite an adventure," says Rick Fox, one of Auger's Superintendents (Auger has two crews, each of which works 14 days straight then is off for 14 days). "We were hustling to finish construction and complete the wells.

"The most pleasant surprise was how quickly everyone came together and put on the Auger hat. There's a level of cooperation and trust out here that I haven't seen before. There's sense of urgency in the air that brings people together, like in a battle."

Actually, the field of "battle," so to speak, proved to be a field of dreams—at least so far. Ten wells were predrilled before platform installation. The first four completed wells flowed at rates well beyond projections. The six other predrilled wells only awaited completion before coming on stream. At peak production, 14 wells will be in operation.

Even though Auger is loaded with the latest technology, the most impressive aspect of its operation may be its innovative organizational design structure, which emphasizes teamwork and calls for the participation and involvement of everybody.

Crew members were selected for their technical skills and their behavioral characteristics, with the nod given to team players who showed initiative, decision-making ability and good communications skills. "These kinds of talents have always been there," Fox adds. "The difference is the Company is now asking employees to use them."

The Auger organization is built around three teams—Blue-Yellow, Green-Gold-Brown, and Pink—each of which is named after the color-coded reservoir the team is responsible for managing. Within each team, the members are multiskilled in various tasks. For instance, mechanics who in the past would have only worked on compressors, now find themselves helping get oil wells ready to flow. That sense of shared responsibility not only contributes to camaraderie, but also gives the team members a feeling of ownership for the oil and gas they're producing—and by extension, for the entire platform. "The concepts and techniques we're using are unlike anything you'd find in a traditional operation," says Mike Woodward, a member of the Blue-Yellow team. "The new organization has changed things. We're expected to speak up if we see something we think we should be doing differently. Let me tell you, that's a big, big change for the oil patch."

With the help of Continuous Performance Improvement (CPI) techniques—such as prioritizing ideas and trying to understand different points of view—a production operator is now just as likely to chair a team meeting as a manager. This, of course, is no panacea. "There are still problems, but they are our problems," says team member John Blackwelder. "The sense of accomplishment we get from working them out makes up for the aggravation."

For some employees, working in the new environment on Auger has been a revelation. "I've worked for Shell for 15 years but I've never been in a place where people are more willing to work together than they are here," says Ricky Harrison.

When Harrison's team was on the verge of bringing on their second well, several members of the Blue-Yellow team—whose well was next in line for production—volunteered to help. "We improved the efficiency and they got a leg up on experience," says Harrison. "We're not competing against each other, we're competing

*Blue-Yellow team member Joe Whiddon checks a ballast pump on Auger, an innovative tension leg platform.*

## A LEADER IN DEEP WATER

Shell Offshore Inc. (SOI), headquartered in New Orleans, has been operating in the Gulf of Mexico for more than 40 years. Its exploration and production efforts have made it a leading producer of hydrocarbons in the Gulf and the largest leaseholder. In fact, few companies have made such an impact in the oil industry.

- SOI has an interest in 675 leases and is the net owner of 562 of them. Many of these leases are in deep water of more than 1,500 feet, where experts predict the future of offshore development is likely to occur.

- With Auger, SOI's first tension leg platform, the Company set a world record for a drilling and production platform at a water depth of 2,860 feet. Yet, SOI has been setting world platform records since 1965 and reached the 1,000 foot water depth milestone in 1978, when Cognac was installed in 1,025 feet of water.

- Ten years later, SOI set a new record with the installation of Bullwinkle, the world's tallest fixed platform, in 1,353 feet of water.

- In 1996, SOI plans to install a tension leg platform at Prospect Mars in 2,933 feet of water, setting yet another record for the Gulf. The Mars field, with an estimated recovery in excess of 700 million barrels of oil and gas, should solidify SOI's position as a leader in deep water for decades to come.

against efficiency; so we were glad to get the help. The sooner we get wells flowing, the quicker the cash register starts ringing."

The team spirit was vividly illustrated during a recent visit by a group of SOI senior managers. During a discussion with members of the crew, one senior manager asked: "If there was one thing that you could change on Auger, what would it be?"

The crew members gave each other a strange look, and after a moment of silence, one of them ventured: "If we knew there was something that needed to be changed, we'd change it."

One of the most visible signs of success for this new management system may be the platform's safety record, which reflects the attitudes, emotions and commitment of everyone on board. Through first production, there were no lost-time accidents or recordable incidents, an incredible feat considering the activity level and the large number of contractors involved. Safety signs, warnings and reminders are everywhere on the platform, and any non-routine work requires both a safe work plan and a work permit, which are reviewed at daily communications and coordination meetings attended by representatives from every team.

"We came up with our own Incident Command System and put our own emergency management system into place," says Chris Louviere, a member of the Green-Gold-Brown team. "We wrote most of the policies and procedures ourselves. Nothing came from town (i.e., SOI headquarters at One Shell Square in New Orleans) except guidance and resources."

The difference, Louviere maintains, is ownership. "When you develop something, you own it," he says. "And when you own it, you take a lot more pride in it."

Because Auger is so far from shore, its emergency safety procedures were designed on the presumption of fight rather than flight. On most conventional platforms, in the event of a major emergency, the crew would most likely abandon the structure and let specialists take over; but not at Auger. The crew is trained in both land and marine-based fire fighting techniques, as well as marine search and rescue operations.

In addition, the crew quarters building, a five-story structure that houses the control room, offices and emergency response center, was built of a special fireproof material engineered to withstand a hydrocarbon fire for up to four hours.

The platform is also staffed with on-board

medics who run what amounts to a mini-hospital. They are qualified to treat everything from minor injuries to major emergencies; in the most critical cases they have access to 24-hour hotlines to consulting physicians on shore and can also call for emergency medical transportation to shore-based facilities.

Besides drilling and producing wells in record water depths, one of the biggest challenges facing the Company may have been acquiring the expertise to handle the marine operations required of a TLP. Instead of hiring dozens of new employees who already possessed such skills, SOI chose to train its own people, launching a massive effort that is still underway.

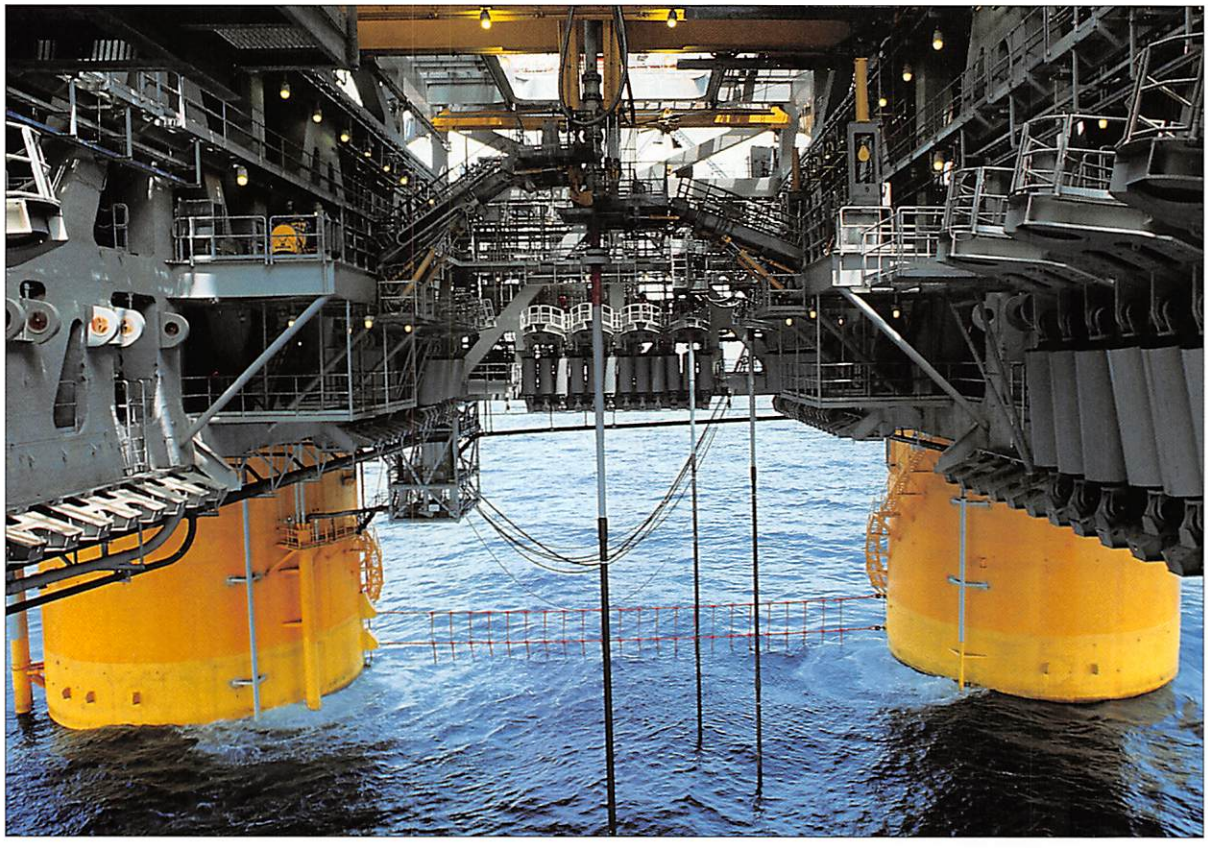
The training, which is mandated by the Coast Guard, requires all control room operators to be able to run the bilge and ballast system that keeps the TLP afloat and stable, and reposition it when new wells are completed. This is equivalent of keeping the Queen Mary on an even keel, sometimes in unpredictable seas and stormy weather.

"As Shell employees, we never had to deal with marine systems before," says Control Room Operator Tony Jolly. "But since we're a floating platform, everyone in the control room had to go to school to become licensed ballast control operators."

The heart of the action takes place in the well bay located in the center of the platform. There are 32 well-slots arranged around a 75-foot by 200-foot opening. The wells drop straight down into the seafloor, and then kick out in various directions—traveling laterally more than a mile in some cases. Since the drilling rig does not move, the entire TLP has to shift positions—through use of the lateral mooring system—when each well is completed.

Because the TLP is afloat, the crew has to maintain a constant tension on the risers to prevent the well conductors and casings from snarling or breaking. "The structure is designed to move laterally with the ocean without overstressing the wells," says team member Steve Terrebonne. "The load cells that keep the wells in place are similar to shock absorbers on a car; they can flex three to four degrees as the geometry of the rig changes."

Through the use of sophisticated computers, Mark Gatlin and his team members keep close watch on the wells. As an example, he calls up a program that shows the bottom hole pressure of a well at the very second he looks at it. "It tells us exactly what's happening with our wells downhole ... in real time," he says.



*Auger wells drop straight down into the seafloor, then kick out laterally in various directions.*

## AUGER'S CHRONOLOGY

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| **May 1987** | Discovery on Garden Banks Block 426 |
| **Dec. 1989** | Development decision announced |
| **Aug. 1990** | Deck and hull contracts awarded |
| **Feb. 1993** | Hull starts 100-day tow from Italy |
| **Oct. 1993** | Deck and hull mated off Freeport |
| **Dec. 1993** | Auger arrives at location, installation begins |
| **Feb. 1994** | Installation completed |
| **Apr. 1994** | Oil flows from first well |
| **Aug. 1994** | Oil rate reaches expected level |

"With this kind of information, we can make better decisions about how we manage the reserves, we can predict where obstructions in the tubing might occur, and we can prevent them."

Once produced, oil and gas are sent by pipeline to production platforms in shallower water. The oil is transported 72 miles to SOI's Eugene Island Block 331 in 243 feet of water; the gas is transported 38 miles to Mesa Oil Co.'s Vermillion Block 397 in 398 feet of water. Both the oil and gas pipelines are 12-inch diameter.

The control room is where all the teams intersect. Needless to say, it's equipped with high-tech computers that allow the operators to monitor as many as 3,000 process points on board. "We can get a total overview of the TLP down to which valves are open or closed," says Leo Rew. With a few quick keystrokes he can call up information on pressures, temperatures and flow rates. One of the computer screens actually gives a 3-D view of Auger's position relative to the wellheads 2,800 feet below. Even though the schematics seem too complex to read, the operators have no trouble—after all, they helped write the programs themselves.

If anything, being in the national spotlight seems to have brought out the best in the Auger crew. The first well they completed took 44 days; by the time they finished their fourth well, they had cut the completion time in half. Besides reducing the number of days that it took to get the wells flowing, they also increased production rates of each well through a variety of procedures.

"None of our competitors are in this environment," Bourgeois says. "That puts a lot of pressure on us, but it also means that we're gaining experience at a rapid rate ... experience that the rest of our competitors lack."

A point of pride within the Company is Shell's strong lease position. Most experts agree there are few new huge discoveries left to be made domestically—except in deep water. Considering that Shell holds 34 percent of the current deepwater leases in the Gulf of Mexico, it's not hard to understand why some competitors are scrambling to catch up.

The Company has already determined to push the frontiers of deepwater technology even further. Late last year SOI announced its plans to develop the giant Mars field in the Gulf of Mexico. With estimated reserves in excess of 700 million barrels of oil and gas equivalent, Mars is the largest discovery in the Gulf in the past 20 years. The first phase of development calls for the installation of a new TLP in 2,933 feet of water—yet another world record.

Like the sense of shared urgency that brought them together in the first place, members of the Auger crew seem to relish their destiny. "The way we look at it, we're in on the beginning of something," says Louviere. "That something happens to be the beginning of deep water."

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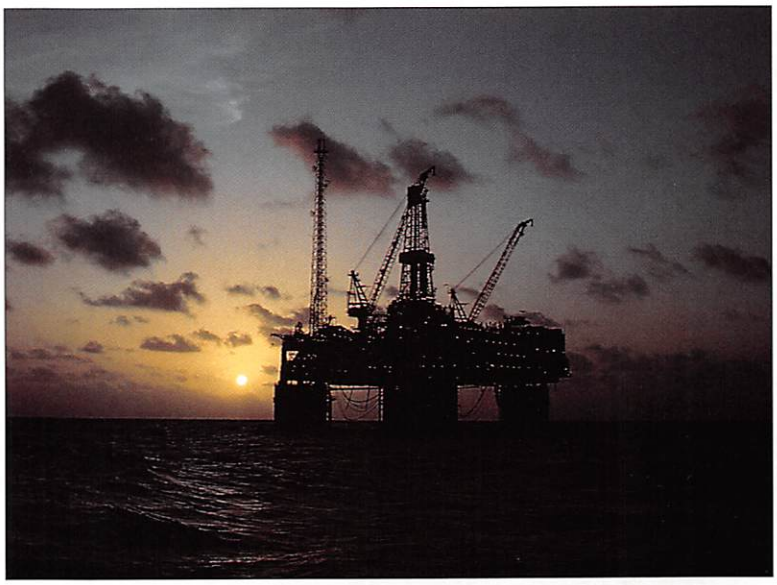

*Along with its many innovations, Shell Offshore Inc.'s TLP signals a new era for offshore oil and gas development.*


1994
The President's Award for Team Excellence
Phil Carroll