# Going Deep

# HOW SIR JOHN BROWNE TURNED BP AMOCO INTO THE HOTTEST PROSPECT IN THE OIL PATCH.

## By Daniel Fisher

ON A NOTORIOUSLY VIOLENT patch of the Atlantic Ocean northof Scotland and 100 miles west of the Shetland Islands, where winds howl at 50 miles per hour and waves can run 100 feet high, a brutish red vessel rolls in a mounting breeze. The ship, named the *Schiehallion* after a mountain on the Scottish coast, is the only visible sign of what lies 1,200 feet below: a 500-million-barrel oilfield that BP Amoco has discovered and developed. Equipped with a turntable mechanism at its bow, the floating production platform can swivel a full 360 degrees in treacherous winds while pumping more than 100,000 barrels of oil a day. At current prices *Schiehallion* is dropping $1 billion a year into BP's bank account.

A decade ago this project would have been technologically and financially absurd. At a cost of $1.2 billion, it still exceeds the reach of all but the biggest oil companies. But for BP Amoco, such deepwater oilfields are the only chance of finding enough crude to replace declining reserves in less remote parts of the world. The company is in an urgent race to control the last giant sources of oil in the waning days of the petroleum era.

For BP Amoco's soft-spoken chief executive, Sir John Browne, deep water offers the prospect of the largest untapped reserves and the lowest-cost means of extraction. It could keep the

## TANDEM OPERATION: THE *SCHIEHALLION* TRAILED BY A SHUTTLE TANKER, WHICH DELIVERS OIL TO THE MAINLAND.

company safely afloat even if oil prices, currently $30 a barrel, fall by half.

London-based BP Amoco once confined its efforts to buying small stakes in the deepwater forays led by bigger rivals. But in recent years the company has quietly stolen the lead in this expensive game, moving ahead of ExxonMobil Corp. and Royal Dutch/Shell Group. BP Amoco (which will drop "Amoco" from its name later this year) has spent the past decade buying up exclusive drilling rights to undersea acreage in the world's most promising deepwater regions, setting up an assembly-line process to find new reserves, build rigs and get the oil out.

By 2005 BP expects to pull 1.3 million barrels of oil and their equivalent of gas a day from fields lying in waters more than 1,000 feet deep in places including offshore Trinidad, the North Sea and the Gulf of Mexico—25% of its worldwide production, up from only 6% now. The total could climb dramatically as BP completes similar projects in Brazil and Angola *(see map, p. 116)*. "This demonstrates what organic growth means," Browne says. "We found the resources ourselves, we're developing them ourselves and we have a lot of legs. It goes and goes and goes."

The deep-sea plunge is the crucial element to achieving Browne's promise of turning in earnings growth of 10% a year even as revenue grows only half as fast. Hitting that target requires trimming per-barrel costs by 3% a year, and the key to doing that is technology. And nowhere in the oil patch is technology as challenging as in the deep waters of the Atlantic, the Gulf of Mexico and elsewhere *(see diagram, p. 114)*.

If Browne is right, BP, now the world's third-largest oil company with $148 billion in sales and almost $12 billion in net income last year, could pass Shell to become the number two oil company and pose a more potent threat to number one ExxonMobil. BP needs some good news: Its stock is down 11% over the past eight months, compared with a 9.5% rise in the S&P Oil Index (BP trades as an ADR on the New York Stock Exchange). BP shares are valued at only 16.7 times trailing earnings, compared with ExxonMobil's multiple of 18.

But Browne's deepwater push carries big risks, ranging from steep upfront costs to devastating human error and corrupt foreign governments. Drilling a deepwater well costs $50 million or more, compared with only $1 million onshore. At the sea floor, ice plugs can form in pipelines exposed to the near-freezing temperatures, forcing the owner to rent a drilling rig at $200,000 a day to fix the clog. Mistakes can be brutally expensive. Poorly engineered wells can get clogged with sand, requiring intervention at $5 million a pop. In 1998 contractors on Texaco's Petronius project accidentally dropped a 3,600-ton deck module into the Gulf of Mexico. Today the $70 million platform still languishes under 1,700 feet of water, too deep to be recovered.

In some regions the challenge is complicated by politics. After BP and two rivals paid $870 million in "signature bonuses" to Angola's government to win deepwater concessions in 1999, human-rights activists complained that the cash went to fund the long war against UNITA rebels. And some doubters wonder whether BP can really deliver. Investors should be wary until Browne proves his deepwater gamble has paid off, says Merrill Lynch analyst Jonathan Wright, who questions whether BP deepwater results will come in time to replace diminishing production of existing fields.

Exploiting the deep was a typically bold move by Browne, a lifelong BP employee whose father was a BP engineer, as well. Named chief executive in 1995, Sir John kicked off a spate of oil mergers in 1998 with his $48 billion acquisition of Amoco, later cutting annual operating expenses by $5 billion. Exxon responded by acquiring Mobil. Browne next scooped up Arco for $27 billion, making BP the largest U.S. producer of natural gas—in time to see the price of its product triple. Smaller outfits like Chevron and Texaco are still playing catch-up.

Browne, 53, is a donnish, Cambridge-educated oil engineer who loves the opera, smokes Cuban cigars and collects Mapplethorpe photographs ("flowers," he is quick to point out) and 18th-century English furniture. His father, Edmund, worked at BP for ten years and died in 1980. His mother, Paula, was a Romanian survivor of the Auschwitz death camp in World War II; she lived with him until she died last year. (Browne has never married.)

While studying physics at Cambridge in 1966, Browne apprenticed at his dad's company. After graduating in 1969, the younger Browne joined BP full time as an engineer at Prudhoe Bay in Alaska, where BP had just discovered a massive, 14-million-barrel oilfield.

Prudhoe Bay taught Browne the distinction between technical and financial success—and the value of blind luck.

JONATHAN OLLEY / NETWORK / SABA FOR FORBES (PREVIOUS PAGE)

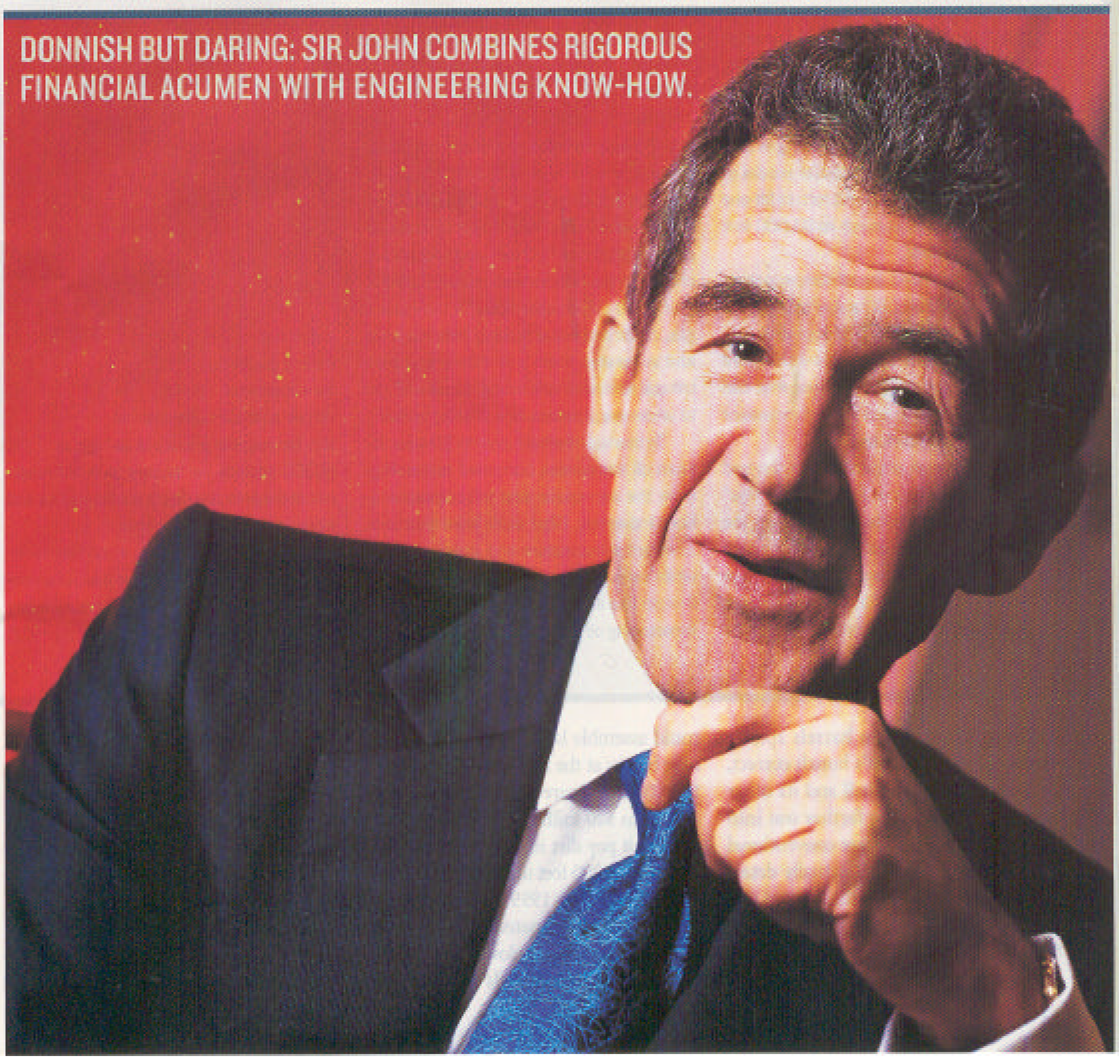
When BP and its partners built a pipeline to carry the crude 800 miles overland to a tanker depot in Valdez, project costs rose tenfold to $9 billion. Fortunately, "the price of oil went up by a factor of five," Browne says. "Based on $1.95 oil, it would have been pretty tough."

By 1980 Browne had earned a master's in business at Stanford while working for BP in San Francisco. He moved back to the company's base in London and held a series of finance jobs, welding his knowledge of petroleum engineering to the discipline of return on investment. In 1986 he became chief financial officer of BP's 55%-owned Sohio unit (which it later acquired outright). There, Browne began to take a harder look at the promise of deepwater drilling, largely out of necessity: He took charge of exploration and determined that Sohio's oil projects outside of Alaska were a mishmash of expensive properties that would never yield a proper profit.

At the time Jack E. Golden, then a staff geologist and now head of deepwater exploration for BP, had a theory that massive oil deposits lay just beyond the Continental Shelf in the Gulf of Mexico, in waters 1,000 feet deep or more. That was beyond the reach of conventional drilling platforms, which stand on steel legs anchored to the sea floor. But engineers were fast developing new floating platforms and undersea equipment to exploit these deeper reserves.

Intrigued, Browne diverted Sohio's entire $50-million-a-year exploration budget to the unproven deep, even though other oil companies were still making good money on the Shelf. "The key was to take a position in advance of the then-fashionable theory," says Browne. "It wasn't a 'bet-the-company' strategy, but it was clear that if it didn't work, our position in North America would be limited to Alaska."

The gamble worked. Rather than punching in wells immediately, BP bought a share of two Shell projects, Ursa and Mars, which turned out to



DONNISH BUT DARING: SIR JOHN COMBINES RIGOROUS FINANCIAL ACUMEN WITH ENGINEERING KNOW-HOW.

# The Delicate Art of Sucking Up

Extracting crude oil from deposits under 6,000 feet of water is one of the most complex projects around, on a par with building a jet airliner. Hardly surprising that oil executives are looking to the high-tech Boeing 777 as the model for doing things cheaper, faster and better.

In both cases engineers rely on computer-aided design, intricate planning and layers of digital controls to make everything work. To develop a deepwater oil field, geologists first sift through terabytes of data collected by undersea seismic devices. Only the U.S. Navy uses more sophisticated computer techniques.

Next, geologists and petroleum engineers huddle in a "hive," or 3-D imaging room, to identify promising geological formations and plan the trajectory of the well. Using Linux-based servers working in parallel, they generate a computer model of how a drill bit must twist and turn to hit one or more formations as much as 30,000 feet below the sea floor.

With plan in hand the oil company rents a drill ship at $250,000 a day to punch in exploratory wells. The 700-foot drill ship is equipped with computer-controlled thrusters, or swiveling propellers, that can keep it in position in any kind of inclement weather, up to a hurricane.

To drill the well, engineers have devised an ingenious system of hollow "riser pipe" that creates a hermetic seal between the well opening on the sea floor and the ship swaying 6,000 feet above. Inside the riser pipe is a space about 18 inches in diameter, large enough to hold the spinning drill pipe and bit as well as to allow the return flow of drilling fluid. The whole construction is similar to an oil well on land, with the weight of the drilling fluid designed to contain the geological pressures deep in the ground. But to protect against uncontrolled releases, or blowouts, a valve assembly must be lowered to the sea floor.

Scuba divers can't work at 6,000 feet, where the water temperature is close to freezing and pressure exceeds 2,600 pounds per square inch. So everything must be done with remote-controlled robots—equipped with cameras and powerful lights—that install the blowout preventers, submersible pumps and other devices to manage the flow of oil and water on the sea floor.

Once the wells are completed, often over 50 square miles or more of the ocean bottom, they are connected by flexible hoses to a floating production platform on the surface. Some, called spars, resemble giant fishing bobs 700 feet long and are anchored to the bottom with massive chains. The $500 million spar takes in the natural gas, crude and water flowing from the wells and separates them with filters and centrifugal spinners, offloading the oil and gas to undersea pipelines or a waiting tanker.

To manage the field over its 20-year life span oil companies borrowed technology from the aerospace and telecommunications industries. Fiber-optic links feed back constant temperature and pressure data, while sensors the size of a dime determine if water has infiltrated the surrounding rock, threatening oil production. Technology borrowed from a satellite manufacturer yields valves that can operate reliably for years at pressures as high as 18,000 pounds per square inch, so reservoir managers can direct the flow of oil and water inside the formations.

The ultimate purpose of all this technology is to protect an asset that, at a cost of more than $1 billion, must produce every last drop of oil it can. —D.F.


## SUNK COSTS

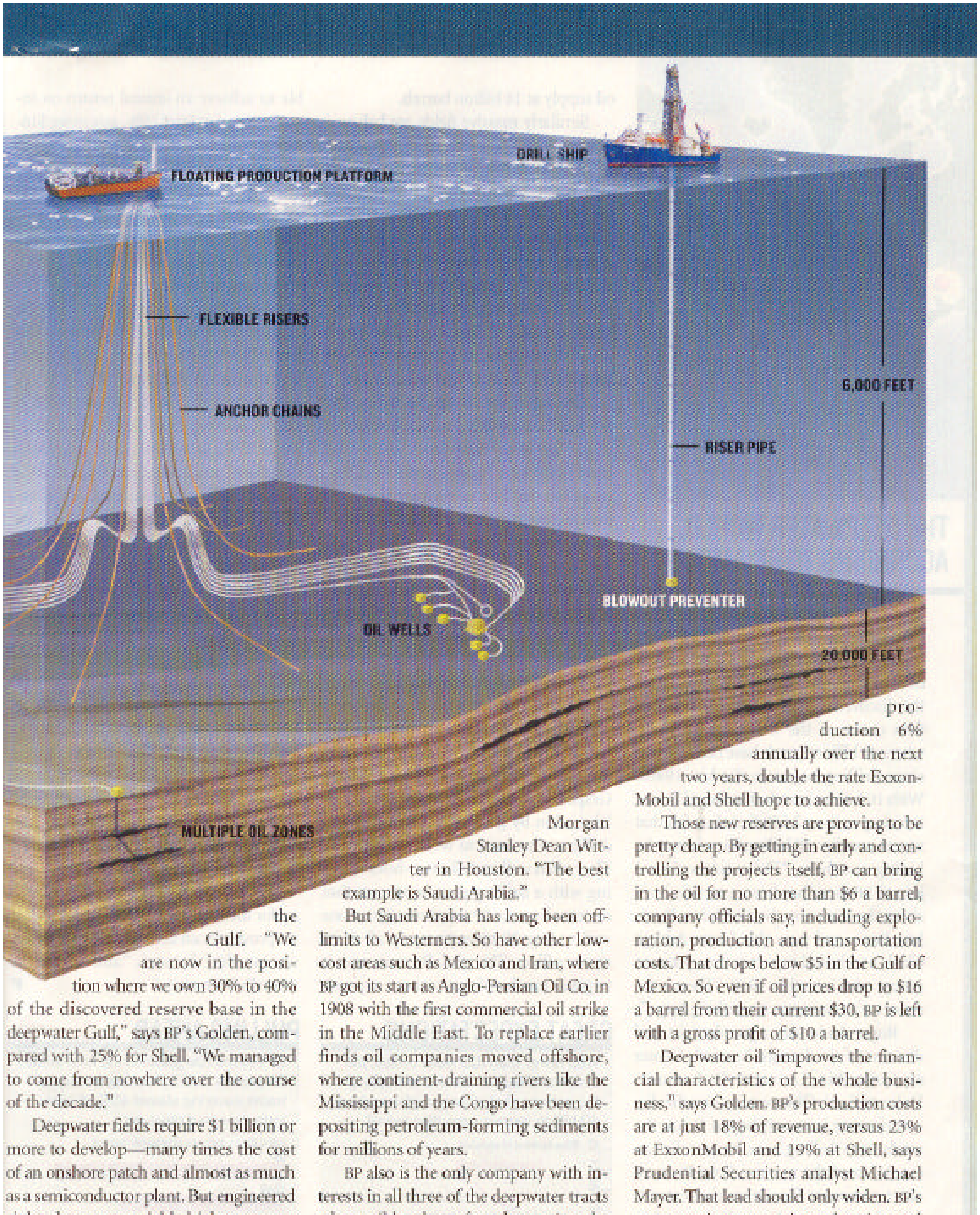
A single floating production platform can take in oil from wells scattered across miles of sea floor. High-tech monitoring devices keep everything flowing.

hold some 500 million barrels apiece. Having proved Golden's hunch correct, BP then leapfrogged Shell and its other competitors and went farther out into the Gulf, into zones where conventional seismic analysis couldn't actually detect whether there was oil in the ground.

The risk was higher, because only a $50 million well would determine success. But by going farther out, BP found it could assemble large tracts of 9-square-mile blocks at the minimum lease bid of $150,000, compared with current prices as high as $20 million.

BP hit pay dirt in 1995 with its Neptune well, 6,200 feet under in the Gulf of Mexico. Then in 1999 BP found Crazy Horse, with an estimated 1.5 billion barrels lying 6,000 feet below, a field that is expected to produce wells tapping more than 20,000 barrels a day by 2005, 20 times the average in shallower portions of the Gulf. Some analysts think BP's Mad Dog, Holstein and Atlantis fields hold another 2 billion barrels or more.

Now Shell is rapidly falling behind BP in water depths exceeding 2,000 feet. While Shell is widely believed to control more acreage worldwide, BP holds far more of the estimated future reserves in




the Gulf. "We are now in the position where we own 30% to 40% of the discovered reserve base in the deepwater Gulf," says BP's Golden, compared with 25% for Shell. "We managed to come from nowhere over the course of the decade."

Deepwater fields require $1 billion or more to develop—many times the cost of an onshore patch and almost as much as a semiconductor plant. But engineered right, deep water yields higher returns than many onshore projects because the fields are compact and easily drained. "Anytime you find a lot of oil in a small place, the economics are fantastic," says Douglas Terreson, managing director at Morgan Stanley Dean Witter in Houston. "The best example is Saudi Arabia."

But Saudi Arabia has long been off-limits to Westerners. So have other low-cost areas such as Mexico and Iran, where BP got its start as Anglo-Persian Oil Co. in 1908 with the first commercial oil strike in the Middle East. To replace earlier finds oil companies moved offshore, where continent-draining rivers like the Mississippi and the Congo have been depositing petroleum-forming sediments for millions of years.

BP also is the only company with interests in all three of the deepwater tracts where oil has been found near Angola. Off the coast of Brazil, it has leased 15,000 square miles—as much acreage as its vast holdings in the North Sea—and hopes to extract billions of barrels of crude. With the new fields, BP aims to boost production 6% annually over the next two years, double the rate ExxonMobil and Shell hope to achieve.

Those new reserves are proving to be pretty cheap. By getting in early and controlling the projects itself, BP can bring in the oil for no more than $6 a barrel, company officials say, including exploration, production and transportation costs. That drops below $5 in the Gulf of Mexico. So even if oil prices drop to $16 a barrel from their current $30, BP is left with a gross profit of $10 a barrel.

Deepwater oil "improves the financial characteristics of the whole business," says Golden. BP's production costs are at just 18% of revenue, versus 23% at ExxonMobil and 19% at Shell, says Prudential Securities analyst Michael Mayer. That lead should only widen. BP's return on investment in exploration and production could increase to 18.6% next year from 13.6% in 1999, mostly due to cheap reserves, says Morgan Stanley's Terreson. "One of the things BP hasn't gotten credit for is how successful they've


## THE DEEPWATER WORLD, ACCORDING TO BP AMOCO

been with the drill bit," he says.

No one knows how much oil is left to be found in the Gulf of Mexico. So far the discoveries are tracking the production curve of the Continental Shelf, where 40 billion barrels have been located since drilling began in the late 1940s. With 10 billion barrels discovered in waters deeper than 2,500 feet thus far, that means another 30 billion barrels may be hiding out there. "Three times since I joined BP there has been a terrific buzz about the company: the North Sea, Prudhoe Bay—and now this," says Adrian Clark, a technical expert in the upstream group, who joined in 1970. "There's the sense we're sitting on something huge."

Roger Anderson, a geophysicist and director of the Energy Research Center at Columbia University's Lamont-Doherty Earth Observatory, says the discoveries may have only begun. Below the sands BP is drilling now, he says, lies an extension of the massive Pozo Rico, an older carbonate formation that extends into the water and was discovered in Mexico at the turn of the century. "You want to know the size of it, look at Pemex's reserves, not BP's," he says. The state-owned Mexican oil company claims reserves of 25 billion barrels; BP pegs its oil supply at 14 billion barrels.

Similarly massive fields are believed to be waiting off the coasts of Brazil and Angola. As in the Gulf, the oil deposits were created during a period of flourishing plant life 80 million years ago, when rivers draining Africa and South America dumped sediments into the narrow and shallow sea then separating the two continents. Poor water circulation meant the organic material was covered before it could decompose, and it eventually was transformed into oil and natural gas.

Getting at the oil can be tricky, and not just because it lies under as much as 30,000 feet of water and rock. In the Gulf most of the oil is hidden under thick layers of salt that blur conventional seismic images, requiring fancy supercomputer-driven images to decipher what is present *(see box, p.114)*. Once oil is found, BP is extremely careful in planning how to extract it. It has set up an assembly line of rig builders, engineers and computer scientists to bring its deepwater projects online quickly and cheaply.

Before a major well is drilled or a platform is built, key employees gather in the "hive," a $500,000 room for viewing 3-D images generated by a Silicon Graphics computer. The hive allows collaboration by geologists, engineers and drillers, who used to work in isolation. They often walk out of a two-hour meeting with a drilling plan, a process that once took weeks. BP saved enough on one well to buy 20 hives to equip all of its major offices. The goal, Browne says, is to get as much upfront cost out as possible to achieve an annual return on investment of at least 15%, assuming $16-a-barrel oil.

"Every business is a margin business—you always have to balance unit production against unit costs," Browne lectures. "If you ever forget that, you will build the greatest projects, get the greatest production—and get no profit."

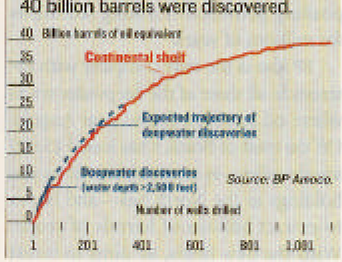
It was Browne's familiarity with the economics of billion-dollar projects that landed him on the board of Intel, where he reviews similar expenditures in the high-tech realm. Intel Chairman Andy Grove, who recruited Browne as a director in 1997, says the BP chief "asks solid questions" in daylong meetings Browne often attends via transatlantic videoconference from his office in London. "We understand each other well," Grove says. "True for him, true for us."

Browne is trying to keep BP a few paces ahead in the energy race, in part by developing nonpetroleum fuel sources such as hydrogen-powered fuel cells and solar panels for the day when the world finally runs out of fossil fuel. BP's new logo, a green sun, and its Web site, populated by what look like refugees from a Benetton ad, help reinforce the image of the company as the environment's best friend. But for the foreseeable future, Browne will be judged on how much oil he can find—and at what price.

Browne, who was knighted in 1998, is up for the challenge. "In the end, it's what we prove we can do and not what we say we can do," he says, "and so far the record's been okay." F

## GREAT EXPECTATIONS

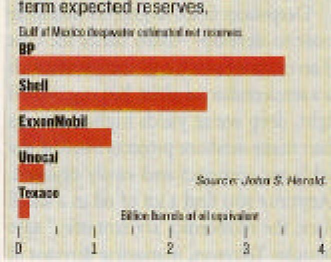
With fewer than 100 wells drilled, the deepwater Gulf of Mexico is tracking the pattern of shallower regions where 40 billion barrels were discovered.




Source: BP Amoco.

## PULLING AHEAD

BP Amoco has grabbed the lead in the deepwater Gulf by leasing undersea tracts covering almost 40% of near-term expected reserves.




Source: John S. Herold.