# The journey to deepwater operatorship

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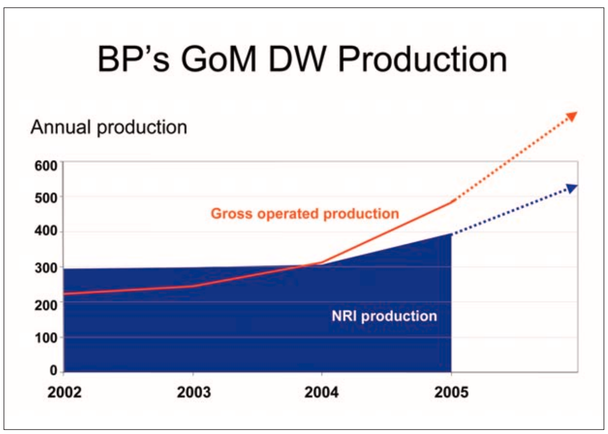
For the past 18 months I've been based here in Houston, where I lead BP's Deepwater Development Business. For those of you familiar with our deepwater Gulf of Mexico (GoM) portfolio, you will appreciate that this is a marvelous time to occupy my position. Indeed one might question whether in the company's long history, there has ever been such an exciting period of concentrated production growth, with no fewer than five multibillion dollar, technologically demanding projects starting up over a period of 18 months. It is both an awesome responsibility and a privilege to be leading that effort.

I would like to share with you some reflections on what I have learned in the role—about what it takes to be an operator in the deepwater—and in particular, what I have learned about the critical role technology plays in achieving that.




Over the last 20 years, BP has invested around US$15 billion in the deepwater GoM. The most recent manifestations of that are a series of seven BP-operated deepwater floaters, only two of which, Thunder Horse and Atlantis, have yet to start up.

That investment is not only important from the point of view of addressing this nation's energy supply—it also has global significance. It is a feature of these developments that they contain an extensive amount of new technology—quite simply they wouldn't exist without it. And that technology will go on to be used elsewhere.

It is interesting for a moment to review the growth that has taken place in our deepwater GoM portfolio over the last five years.

The graph highlights not just the growth in our net production, but the extent to which we are increasingly operating it—and this trend will continue.

And being an operator in this deepwater basin is a challenging role. You're what you might call "the master baker" who brings together all the diverse elements that go into field development—the people and the hardware—in a way that both safeguards life and environment, and is rewarding to all stakeholders.

Before getting into lessons learned, I'd just like to describe some of what I think you need to have as a condition precedent to deepwater operatorship—the ingredients of the cake if you like.

First, clearly you need *resources*, an acreage position in the basin. In the deepwater Gulf this takes vision—a vision grounded in a knowledge of deepwater technology and what it can deliver. That then gives you the confidence to be a first mover. We saw that first with Shell in the 1980s when they were the first company to step out into deepwater and some would say BP did the same thing ten years later in the ultra-deep.

Next, companies are founded on *business processes*, which they follow—at every stage—from exploration, through to operations. These require clarity in decision-making criteria and reflect corporate goals and business strategy. And in an environment like the deepwater GoM, these processes need in particular to identify and manage technical risk.

Third, the process is nothing if it is not owned and executed by a *strong and motivated workforce*, a great team of people. In deepwater, that's about having access to deep technical specialization. It's about developing strong project management skills and operating capability. And in such a technologically complex environment, it's about creating a culture that rewards learning and the rapid transfer of best practice.

Fourth, *relationships*, because no operator works in isolation. We value the contribution of our partners. We need to earn our license to operate through working well with communities and regulators. And we need to work with contractors in whose delivery we can have confidence.

Finally, *scale*—and don't misunderstand me—I'm not seeking to suggest that only supermajors can operate in a deepwater environment. But if we've learned anything so far about the deepwater GoM, it is that it contains surprises. And that means an operator needs depth—depth in terms of resources and expertise—to create the capability to respond to the unexpected.

It's a substantial list. The deepwater GoM is a comparatively high-risk, high-reward arena, and not a place for the faint-hearted.

I've already touched more than once on technology and risk management. I'd like to share further thoughts with you on these two issues, because for me, they are especially important in the deepwater environment. And it's probably on these topics, more than any other, that I feel BP has learned the most.

Deepwater GoM may be one of the most prolific new basins in the world, but it is still a *frontier* province. And by that I mean it contains basins characterized by complex, subsalt formations, where we have few, if any, production analogs to guide us, and traditional geophysical techniques need to be rethought. And in addition, we have to cope with extreme natural environments, the "ultra-deep" in terms of both reservoir and water depths, complex seabed geotechnics and severe

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metocean conditions in the form of both loop currents and hurricanes.

These are new challenges for the industry, and challenges which are being addressed at an ever-increasing *pace*. We find ourselves designing floating systems for 10 000 ft of water depth before the lessons of working in 6000 ft have been fully identified. And these new challenges are not just depth-related. Failure mechanisms, such as fatigue, driven by vortex-induced vibration (VIV) and vessel motion, are time-dependent and may take years to become apparent. The same is true of equipment reliability. We know the premium associated with hardware reliability is high, but at this stage, operators still have a limited failure database for forecasting the required levels of intervention in ever-deeper and more remote environments.

New technology is essential in this new world; we can't execute our projects without it. And the pace of change can demand that the technology is developed within the project timeframe. It becomes both an enabler, while at the same time being itself a source of risk. *Deepwater operators* need to manage this tradeoff between risk and pace.

So what have we learned so far?

*Apply the principles of project management to technology development.* This means, first, treat the development of the new technology as a "mini" project within the context of the overall field development process. In particular, be rigorous in front-end loading, and very clear about the scale and nature of the "size of the step" you are seeking to take. Recognize that what may initially appear to be an incremental change can often turn out to be much more profound. Develop multiple contingency plans. And be prepared to work closely with suppliers to drive up reliability and reduce risk.

A good example of this in our current portfolio is Thunder Horse. Over the past four years, since operator BP and its development partner ExxonMobil embarked on the Thunder Horse project, an army of industry vendors and specialists has been involved in an unprecedented collaborative program of equipment development, testing and qualification, to come up with a new generation of engineering solutions to handle the field's unique combination of challenges.

*Transfer lessons learned.* Next, we've learned to share our experiences within BP and the industry. This not only applies from project to project, but lies at the heart of cost reduction when applied to repetitive activities such as drilling and running completions—activities which make up nearly two thirds of our deepwater cost base. At Thunder Horse, we've been able to drive down our rig operating days per 10 000 ft drilled throughout the project.

*Learn how to take an integrated view of risk.* We've found that to get the best overall solution in deepwater, it is important to be able to balance out the risks as they arise across the disciplines, for example to be able to reduce subsurface uncertainty at the expense of taking on more completion complexity, or to achieve simplification of hull fabrication at the expense of pushing the envelope on riser design. The ultimate example of this arises at the concept selection stage.

*Experiment at scale.* The cost of full-scale testing (in some cases in situ) at first sight may seem to be prohibitive. But when considered in the light of the risk reduction achieved, it can often be justified. A good example is the Mardi Gras Project, where we paid for a full-scale trial lay of several miles of pipe to test the capability of a brand new installation system.

The cost of that exercise was around US$17 million.

This raises wider issues for me, around both the scale of our investment in new technology and on the question of technology ownership. You only have to look at a project like Thunder Horse, where the expenditure on new product development and testing alone approached US$100 million, to realize that claims by certain members of the service sector that we are cutting back are simply not true. Because that expenditure forms part of the cost of a project, rather than a line item in a R&D budget, in no way alters its nature.

And we are quite clear about the primary benefit this investment generates for us—that benefit flows from the more rapid and efficient exploitation of hydrocarbons. Rarely do we invest in technology simply in order to own it.

*Extending the limits.* Finally, the creation of engineering design standards and codes is almost by definition a slow process. It represents the distillation of engineering wisdom gathered over many years, timescales which are incompatible with the current pace of deepwater exploration and development. Add to that the fact that statistical characterization of the natural environment—which is needed to predict extreme events such as the magnitude of the 100-year return period wave—relies on having an extensive data base gathered over many years, something which is rarely the case with frontier marine provinces. And so we find ourselves in a world of having to determine not only design rules, but to set design criteria.

This has profound consequences in a number of ways. I will draw your attention to two:

1) The need to employ generous safety factors to protect against the unknown. For example in the case of VIV driven fatigue damage to risers, we allow factors of safety on fatigue life of 20—a higher figure than traditional engineering practice demands, simply to address the maturity of our understanding of the hydrodynamics.
2) The use of online monitoring systems, to validate that response is in line with the design basis.

Again, a good example of this arises in the field of riser technology, where BP is an industry leader in deploying monitoring systems across a range of different riser types.

It is time to close and to wonder what all of this tells us about the future.

Certainly it doesn't feel as if the challenges are lessening. Quite the contrary. In the deepwater Gulf of Mexico, the easy targets may have been drilled. To continue to find giant fields, industry is drilling very deep targets in ever deeper water. Although wells deeper than 25 000 ft and water depths beyond 9000 ft are no longer remarkable, they will always be very challenging. Over one third of our prospect inventory is what we classify as HPHT—and inside BP we use that term "high temperature and high pressure" to mean conditions equal to or beyond what we faced on Thunder Horse—thus creating new design challenges, particularly in the fields of completions and subsea hardware. And, increasingly, we find ourselves having to explore and develop reservoirs which are either partly or totally obscured by a salt canopy, thus creating a demand for new techniques for gathering and processing geophysical data.

Having said that, I can't think of a better place in the world to be addressing these issues than here in Houston. As I said earlier it all comes down to people, and it is probably true that we have here the greatest concentration of oil industry talent in the world.

And yes, as I look back to where we were 10 years ago, it's probably true to say that we (and by "we" I mean both operators and contractors) did somewhat underestimate the full nature of the challenges we were taking on in the deep waters of the Gulf.

So what are we doing about it? What I think you would expect us to do—apply the lessons of the past to take us into the future. TLE