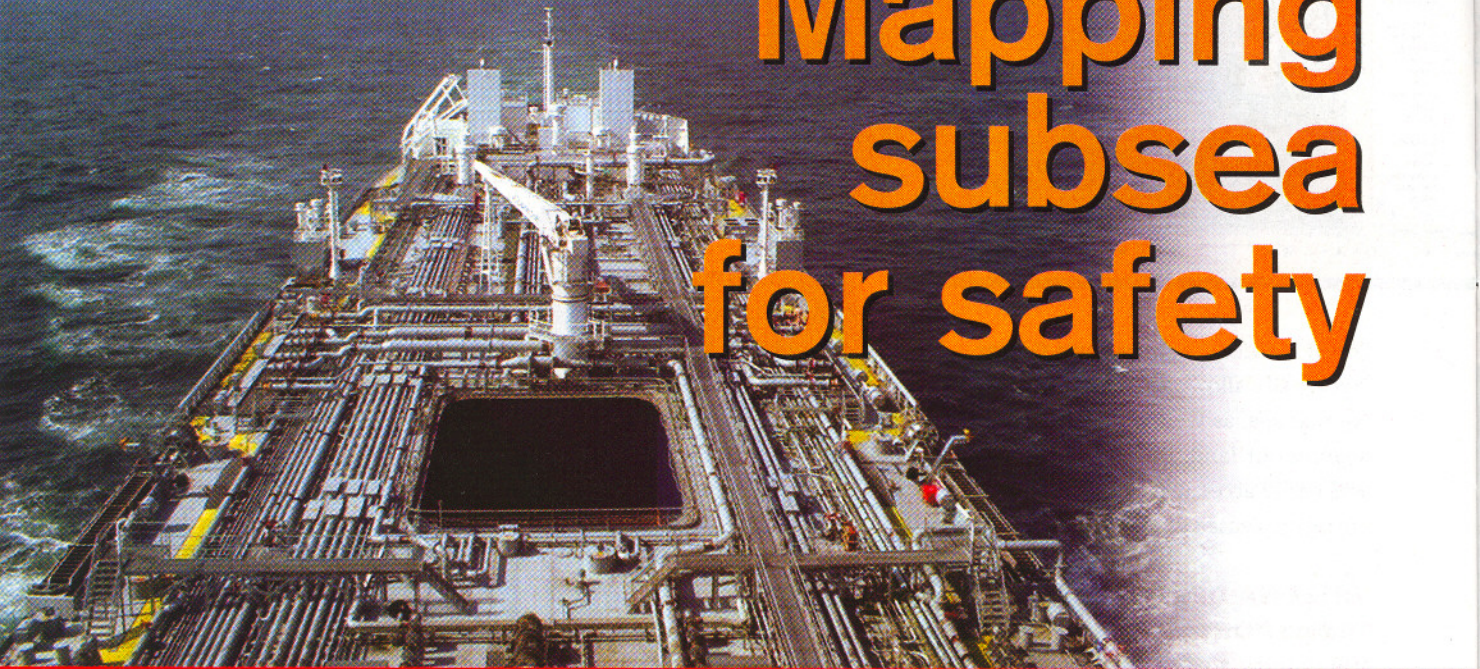


Mapping subsea for safety



Extending from Vitoria to Rio de Janeiro off the southern coast of Brazil, the Campos Basin covers 100,000 square kilometers of the continental shelf. Since 1977, the state-owned oil company Petrobras has developed more than 55 oil fields in this basin alone, helping Brazil achieve its oil self-sufficiency goals in April 2006.

As offshore activity has increased, however, subsea obstacles have multiplied, posing a hazard not only to offshore operations, but also to other ships navigating the basin. Petrobras SA has reduced the risk of accidents and oil spills by creating a continuously updated 3D map of the basin and all the pipes, platforms and oil wells it contains.

First developed in 1996 for the Campos Basin, the \$ 20 mn Sistema de

Gerenciamento de Obstáculos (SGO) Obstacles Management System has been systematically mapping surface and deep-sea obstacles for more than 10 years. It now has over 40,000 registered obstacles in the Campos Basin, as well as the Santos, Espirito Santo, and Rio Grande do Norte oil basins. Together, they total about 160,000 square kilometers.

More than 800 users in several Petrobras business segments -- as well as third-party companies -- access the system to locate and visualise subsea obstacles in their areas of operations. Applications include projects related to installing, managing and collecting pipe; positioning and managing platforms, floating production storage and off-loading facilities; conducting seismic surveys and environmental impact studies; and piloting tankers through the oil basins.

The SGO project has significantly

reduced environmental damage that resulted from accidents at marine installations. Without visibility into the subsea hazards, a ship could drop anchor on submarine pipes, or pipes could impinge on obstacles that cause leakage. Now any authorised user who needs to research what obstacles are in a specific area can access SGO, select the area in the system, and visualise the surface and deep-sea obstacles in a scaled 3D model.

The system has also reduced the total time required to install and manage pipes. Before SGO was created, all piping operations began with a survey of the target region. This costly operation required a survey ship to launch a remotely-operated vehicle (ROV), which then took several days to create and deliver accurate maps. SGO eliminated this step by providing a continuously updated map of the region. As a result, piping operations take 40 per-



cent less time, saving as much as \$100,000 per day.

"SGO enables the planning and safe execution of all activities that depend on geo-referencing, making possible the high-precision visualisation and identification of all obstacles," said Ruy Santos Cova, SGO project lead. "All offshore operations have been optimised in this way."

PATENTED TECHNOLOGY

Technological innovations such as SGO have helped to make Petrobras the 14th largest oil company in the world. After a 43-year monopoly of the oil and gas sector in Brazil, Petrobras faced international competition when the National Petroleum Agency opened the market in 1997 with oil concession auctions. Petrobras thrived in the competitive environment and, in less than 10 years, increased profits from \$1.4 billion to nearly \$12 billion.

Most of Brazil's oil is found at great depths, which requires overcoming major technical challenges to pump the oil to the surface. As production soared toward record levels -- 1.9 million barrels on one October day in 2006 -- opti-

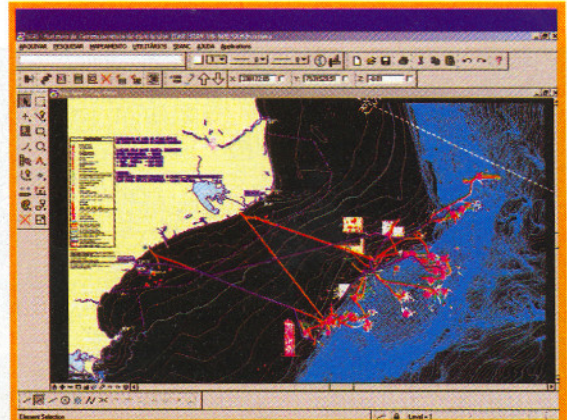
mising operations and minimising risks became a priority. SGO was developed to track subsea assets by the company's Geodesy Unit, Under Sea Services Management, in the exploration and production division based in Macao. The technology has since been patented by the Brazilian Industrial Property Institute.

What makes the SGO system unique is its ability to continuously update the database of obstacles, which include manmade installations -- rigid and flexible pipes, manifolds, platforms, and oil wells -- as well as natural features such as deep-sea topography and bathymetry.

The initial database was constructed from a traditional survey of the Campos Basin. In 1995, a ship equipped with an ROV, navigation and mapping software, global positioning system and hydro acoustics surveyed the basin and compiled a database of all installations.

Using MicroStation, the geodesy unit programmed a customised interface to allow users to query the database and generate maps of specified areas. Now when companies install, relocate, or remove pipes and other obstacles in the basins, they use the SGO to send a report of their activities to the geodesy unit. This in turn updates, adds or removes the obstacles from the system. A batch process updates the database on a daily basis, ensuring that users are accessing the most accurate information.

The graphical environment of MicroStation allowed programmers to provide a user-friendly interface. Last year,



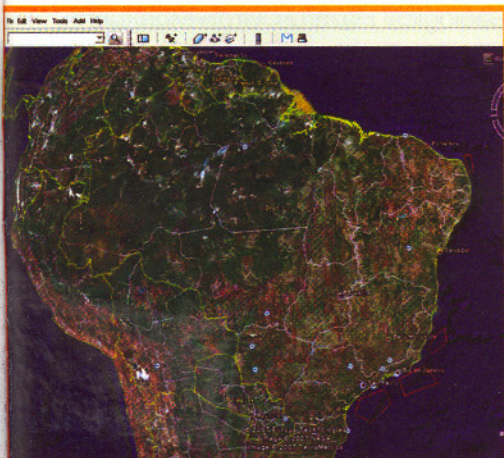
Visualising the location of deep-sea obstacles provide the most efficient layouts for engineers who design and maintain oil pipelines.

the system was accessed more than 44,000 times and generated more than 1,300 maps. The Bentley solution also allowed developers to continually update the programme, evolving from MicroStation 95 in 1996 to MicroStation XM in 2007. All SGO MicroStation Development Language tools have been adapted to run under the latest version of MicroStation. With each evolution, data remained intact and accessible, making the SGO a trusted source of vital information.

Petrobras estimates that SGO saves up to \$ 30 million per year. By clearly visualising the location of deep-sea obstacles, the engineers who design and maintain oil pipelines can define the most efficient layouts while avoiding interferences.

This results in direct cost savings: Deep-sea piping costs about \$ 1,000 per meter, meaning that a 500-meter reduction in piping alone can save \$ 500,000.

The company has announced a strategy to continually increase production and exploration in the Campos Basin, which has an estimated 25 to 30 years of reserves. Over the lifetime of this basin alone, the SGO project will realise a significant return on investment. ■



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