A BOLD MOVE

Three years in the making and a $4 million investment, Gregg Drilling & Testing creates a new market by unveiling its latest technology—Seabed Cone Penetration Testing. **By Mike Price**

Chances are you've heard of the term *cone penetration test* (CPT). If not, you most likely will come across it soon as the CPT is becoming more common throughout the world as an alternative to traditional drilling.

Developed in the 1950s at the Dutch Laboratory for Soil Mechanics to investigate soft soils, the test method consists of pushing an instrumented cone tip into the ground at a controlled rate (usually 2 cm per second). The resolution of the CPT in delineating stratigraphic layers is related to the size of the cone tip. Typical cone tips have a cross-sectional area of either 10 or 15 cm^2, corresponding to diameters of 3.6 and 4.4 cm.

The CPT has applications for both the geotechnical and environmental drilling field. The use of this well-established technology has increased over the last few years due to improvements of its electronics, allowing for easier computing in the field.

"It's less invasive and usually more cost-effective," says John M. Gregg, CEO and founder of Gregg Drilling & Testing Inc., a company headquartered in Signal Hill, California, that offers environmental drilling, geotechnical and geothermal drilling, in addition to CPT services for site investigation and remediation.

"You can usually get two to three times the footage in a day with CPT technology than you can with traditional drills, and it's generally lower impact on the site. It's just pushing down a small 1½-inch-diameter probe with no real cuttings or waste generated as opposed to drilling methods that produce waste and expose people to the soil."

For the last 15 years, Gregg Drilling & Testing has employed the CPT for land-based applications. More interest has been generated recently in using the test method for deep water offshore purposes where there has been new oil finds. The depth of water (8000 to 10,000 feet) is too deep for jack-up rigs to do the drilling, so anchored floating platforms are required.

In order to know what kind of anchor system to design, CPT technology can be used to investigate the top 120 feet of soil in deep water.

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(Above) The Seabed CPT is lowered into the water by the launch and recovery system during sea trials in the port of Long Beach Harbor, California.

The potential of this emerging market—coupled with the need to diversify its business—drove Gregg Drilling & Testing to develop the first-of-its-kind, full-scale deep water Seabed Cone Penetration Testing system.

Using a hydrostatically compensated cone, Gregg Drilling & Testing's Seabed CPT is capable of working in water depths of up to nearly 9900 feet. The underwater system incorporates telemetry and robotic components from Schilling Robotics LLC located in Davis, California.

The Seabed CPT pushes the standard 10 and 15 cm^2 cones, as well as T-bar tests. The system can also push a thin-walled piston sampler to obtain undisturbed samples in the upper 20 feet of sediments. For deeper sampling, it offers jumbo piston core samplers up to 65 feet in length.

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Weight Matters

When you get into deep water, handling large weight can get pretty tricky.

As the weight increases, the cable (umbilical) size increases. As the umbilical increases, its weight increases, so the depth range decreases. So the heavier something weighs, it really multiplies when you're in deep water.

By the time you usually reach 6000 feet, Gregg says, whatever the weight is that you have on the bottom, you have that much weight in cable as well.

"The challenge with CPT technology is that it uses reaction weight to push probes into the soil," he says, "so you want a frame that weighs a lot to push the probe into the soil. In order to do both of those things, we've developed a suction system. We use the soil and negative pressure to create a suction that we can generate reaction with so we can push the probe deeper while still keeping the module light."

With a submerged weight of just about 5 tons, the Seabed CPT can achieve a reaction force of up to 20 tons, meaning it picks up approximately 15 tons just from its suction pump.

Designing a light module was partly the responsibility of Ron Boggess, marine services operations manager for Gregg Drilling & Testing.

To make the Seabed CPT operate in the soft sediments in deep water, Boggess and his team built the CPT so that it would be insensitive to external hydrostatic pressure. They did so by pressurizing the inside of the probe and modifying the load cell design.

"That way we can design something to measure the strength of the soil without having the added load of the outside water pressure," Boggess says.

Put it this way. In 10,000 feet of water you have about 5000 psi of water pressure, and the soil you want to measure the strength of typically has the consistency of oatmeal. When pushing something that already has a giant load sitting on it, the strain gauges become insensitive.

Gregg Drilling & Testing was able to develop a cone that reads zero at the mud line, which negates the effects of overburden or water pressure and instead can concentrate solely on the soil strength, increasing the likelihood of accurate soil strength parameters in deep water.

Figure 1. A drawing of the Seabed CPT being handled via an umbilical and launch and recovery system.

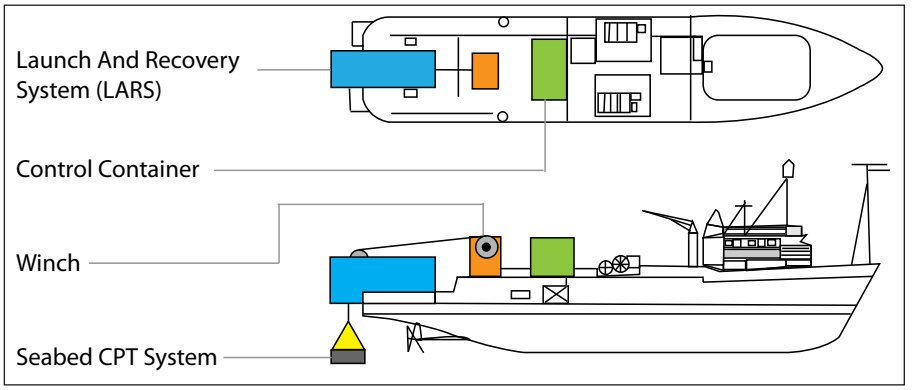

Figure 2. An operator working inside the control container.

"Not only does Ron know how to design something from an engineer's point of view, but he actually knows how to build it too," says Daniel T. Meyer, MGWC, and the CFO of Gregg Drilling & Testing. "I think those two capabilities are extremely important. It's the know-how-to-build-it aspect that actually gets things done."

The company is protecting its cone design by having it patented to ensure that even if companies copy Gregg Drilling & Testing's technology, it won't necessarily have its probe.

"There are not a lot of other systems that work in that depth of water," Gregg says, "but the systems that have been developed up until now just relied on dead weight to push into the soil. None of them were able to get to the capacities that we're at."

Schilling Robotics supplied the control system and hydraulics for the Seabed CPT. The control system consists of electrical and communications components, subsea hydraulics, along with topside hardware, console components, and advanced component monitoring and diagnostic software.

The operating system of the Seabed CPT is handled via an umbilical and launch and recovery system (Figure 1).

'A Little Bit Scary'

At the same time Gregg Drilling & Testing was building the Seabed CPT, the company was also building a market for it.

Getting users to embrace new technology and do things differently than what they've done in the past is one

thing, but not having a market to sell it to is another. However, the feedback the company has received points to it being accepted.

That's why Gregg Drilling & Testing spent approximately $4 million and put thousands of hours into the three-year project.

"I'm hopeful it will work out, but like anything, there are no guarantees," Gregg says. "It's been a little bit scary—building a market as we build the product. But you can't sit still. You've got to develop something and this is the direction we chose to go."

In-water testing of the Seabed CPT commenced in April in Long Beach Harbor, California. The system was then sent to work offshore last month and is now available for commercial use.

Gregg says the system will more than likely be used by the oil industry (40%), the scientific industry (40%), and the ocean mining industry (20%).

Encouraging data of the future of the deep water market further backed Gregg Drilling & Testing's decision to design its Seabed CPT.

In *Offshore* magazine, Douglas-Westwood's *World Deepwater Market Report 2009-2013* forecasts that the deep water oil and gas sector will spend $162 billion from 2009 to 2013, which will be 36% more than the amount spent in the preceding five-year period. The bulk of deep water developments are led by "major oil companies and well-placed network operations centers that Douglas-Westwood believes will not be hit by the economic downturn and turmoil in the debt markets to the same extent as smaller players."

New regulations calling for more up-front site work for the construction of anchored floating platforms and jack-up rigs by the Minerals Management Service, a bureau in the U.S. Department of the Interior, has also pushed the need for the Seabed CPT. The regulations were spurred following Hurricanes Katrina and Rita in August and September 2005, when floating platforms went missing.

"We didn't know that was going to happen when we started production of the Seabed CPT, but it's been a nice little boon for us," Gregg says, "because our tool gets that type of site information very well. That really helped our case in developing our market."

Even though it took Gregg Drilling & Testing three years to build the Seabed CPT, Boggess has been working on developing CPT equipment since the late 1970s. He says the system they have designed—deep water deployment of standard CPT technology—is the first new product to come along in the CPT industry since 1985.

"At this point, I'm lucky to be working with a company like Gregg that is willing to step up and try something different," says Boggess, who has worked for the company for more than 10 years.

Gregg, who started the company in 1985, would like to claim that the process of designing the Seabed CPT, or any other product for that matter, is done methodically. Not so.

"We sort of *Forrest Gump* our way through things and sometimes we get on the right track," he says. "We've certainly had our share of failures, but we keep trying stuff and sometimes some of it sticks." *WWJ*

Figure 3. The Seabed CPT unit shown on land in a storage warehouse.