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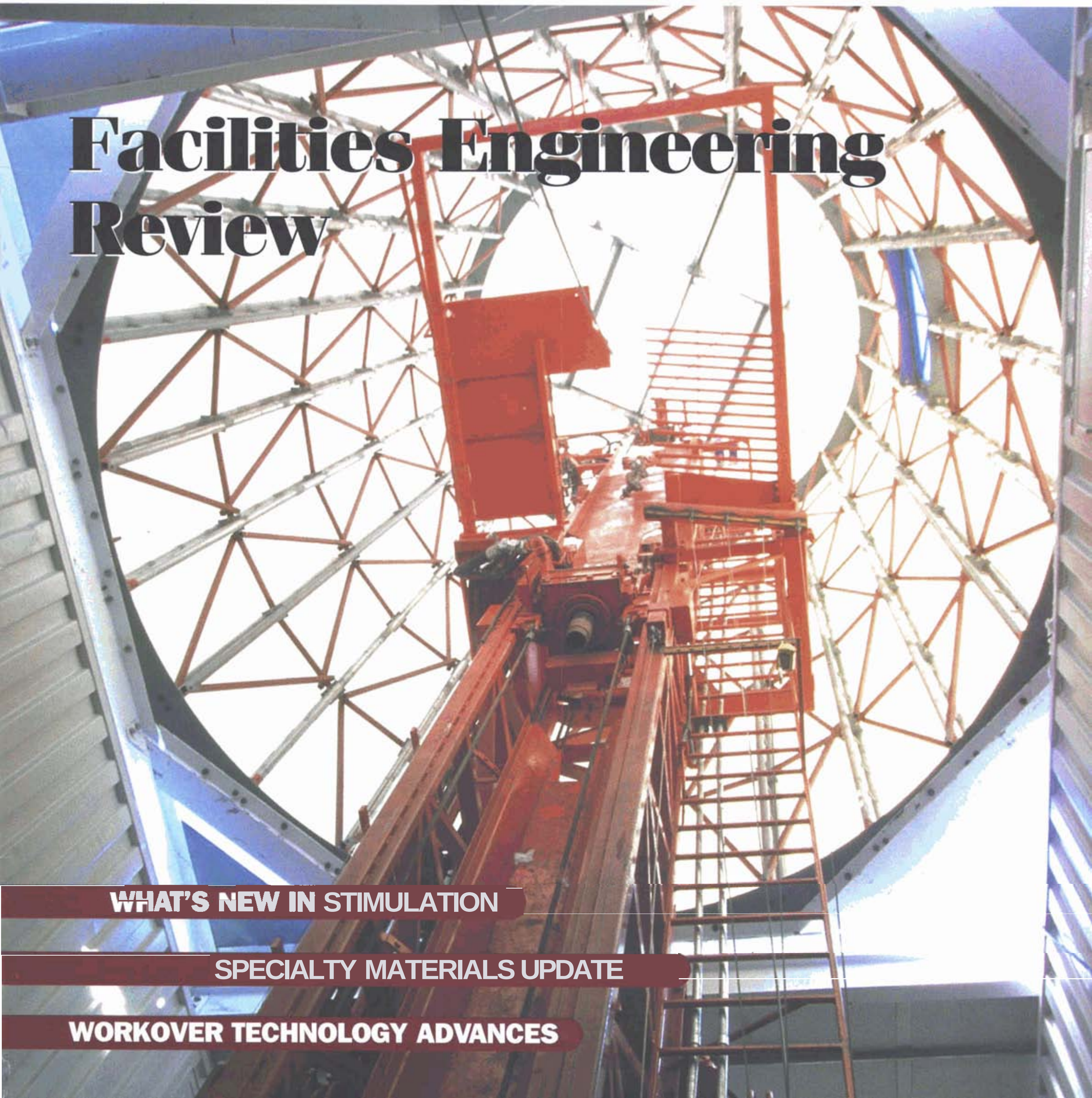


Facilities Engineering Review

WHAT'S NEW IN STIMULATION

SPECIALTY MATERIALS UPDATE

WORKOVER TECHNOLOGY ADVANCES

Innovation aids oilpatch operations

Alloys and new applications of existing hard goods make better work possible.

By DON LYLE, Executive Editor

The traditional image of oil and gas as a heavy iron industry is giving way to a new image that features new products made of non-traditional materials that make operations work more smoothly, protect the environment and even allow jobs not previously feasible.

The key to every oilpatch operation is a reservoir capable of economic production of oil, condensate and/or gas. The key to that source of profits is the wellbore, and many of the innovative products that have been introduced to the market focus on that key.

Industry needs

In North America at least, those reservoirs lie at greater depths where higher temperatures and greater pressures challenge traditional equipment. That challenge shows up in the latest round of research projects commissioned in the US Department of Energy (DOE) Deep Trek research programs supported by US $11 million in government funds and $5.5 million in private money.

In the latest round, Schlumberger Technology Corp. is developing and will market a high pressure/high temperature (HP/HT) measurement while drilling (MWD) tool that works in deep, vertical and horizontal wells at temperatures approaching 400° F (204° C). The new tool will send direction, inclination, tool face and gamma ray measurements in real time back to the surface. Contractors will be able to retrieve the tool without tripping to remove the entire drillstring assembly.

Another DOE project calls on Honeywell International to build a suite of HP/HT components that can be used for instruments in gas wells below 15,000 ft (4,575 m) at temperatures as high as 437° F (224° C).

Bubbles

Cementing Solutions, Inc. is working with industry partners and 3M Corp. on a cement that uses tiny glass bubbles to lighten the weight of the cement but will overcome the compressibility challenges of foamed cement.

The Scotchlite bubbles offer cement densities as low as 6 lb/gal, low shrinkage, faster setting time, easy mixing and predictable density at the bottom of the borehole. A 1997 Westport Technology Center study showed cementing accounted for 15% of total well costs, or $1.8 billion a year, and the average failure rate was 15%. Repair of those failures raises the cementing portion of the well to 17%, or $470 million a year.

Noble Corp., with help from Aquatic, has developed lightweight aluminum riser for use in deepwater wells. (Photo courtesy of Noble Corp.)

Drill pipe

The industry has directed much of the research emphasis on new materials and alloys in pipe, drill pipe, casing, risers, tubing and line pipe.

For example, the DOE reports the first test of a composite drillpipe worked "flawlessly" during tests in a short-radius horizontal well drilled by Grand Resources Inc. in Tulsa County, Okla. The company plans to use the pipe in at least 14 more wells.

The drillpipe is made of carbon-fiber resin by Advanced Composite Products & Technology Inc. of Huntington Beach, Calif.

The Grand Resources team entered an existing well that had been abandoned since 1923, kicked off just below 1,200 ft (366 m) with 2112-in. composite pipe, made the turn to horizontal in 70 ft (21 m) and reached an oil-bearing zone at 1,000 ft (305 m) in the horizontal section.

Larger diameter — $5^1/_2$-in. — drillpipe is currently undergoing tests. That pipe could mean a big boost of offshore drilling, since it is less than half the weight of conventional pipe.

Theoretically, composite pipe could push wellbore limits even past the 50,000 ft (15,250 m) mark available with titanium pipe.

Aluminum risers

Another high-potential product tested successfully combines an idea from U S based Noble Corp. with the manufacturing capability of Russia-based Aquatic. Together, the companies have created aluminum risers that Noble used on five wells for Petrobras offshore Brazil, and the aluminum pipe will be coming to the Gulf of Mexico this summer.

Speaking at the Drilling Engineering Association meeting in Galveston, Texas, Noble Project Engineer Tom Prosser said Noble has been working on the aluminum alloy riser for 4 years and, in 2003, used it on wells drilled by the *Noble Leo Segerius* drillship.

Noble began working on the project after examining future prospects for its offshore drilling fleet. That examination showed that weight on board the ships and riser tension were among the chief restrictions to rig use in deep water.

Noble went to Russia because of its substantial bauxite deposits, which supply the aluminum alloy base. The manufacturing plant was the only one in the world capable of producing pipe and flanges in the sizes the company needed.

The result is a basic riser that can be as much as 30% lighter than steel for on-board storage. When the riser is combined with the aluminum alloy auxiliary service lines, the system is as much as 45% lighter than steel.

They have used the riser in water depths to 4,300 ft (1,315 m).

In water depths to 5,000 ft (1,525 m), Prosser said that in water depths of 5,000 ft (1,525 m), the aluminum riser can save between $20,000 and $40,000 a joint for syntactic buoyancy modules. Below 5,000 ft

(1,525 m), the savings approach $70,000 per joint.

Oilfield pipe

Substantial work is going into the tried and true oilfield pipe as well, said Juan Carlos Gonzalez, product development manager for Tenaris, who directly supports Carlos San Martin, the company's technology director.

Tenaris has a full-time research and development department working on new ways to use metal pipe better.

It has developed a 3% chrome low-alloy steel tubing for use in carbon dioxide environments with minor amounts of hydrogen sulfide. It also produces a proprietary 13% chrome alloy for use in carbon-dioxide environments with a pH factor greater than four and small amounts of hydrogen sulfide. It resists corrosion at high temperatures.

Tenaris also has developed a hollow sucker rod. These rods allow better transfer of torque forces and help overcome resistance to turning.

They offer another advantage. The operator can use the rods to inject fluids into the wellbore. For instance, Gonzalez said, a company might inject a diluent to help produce heavy oils. The rods were designed to work under high loads in deep wells.

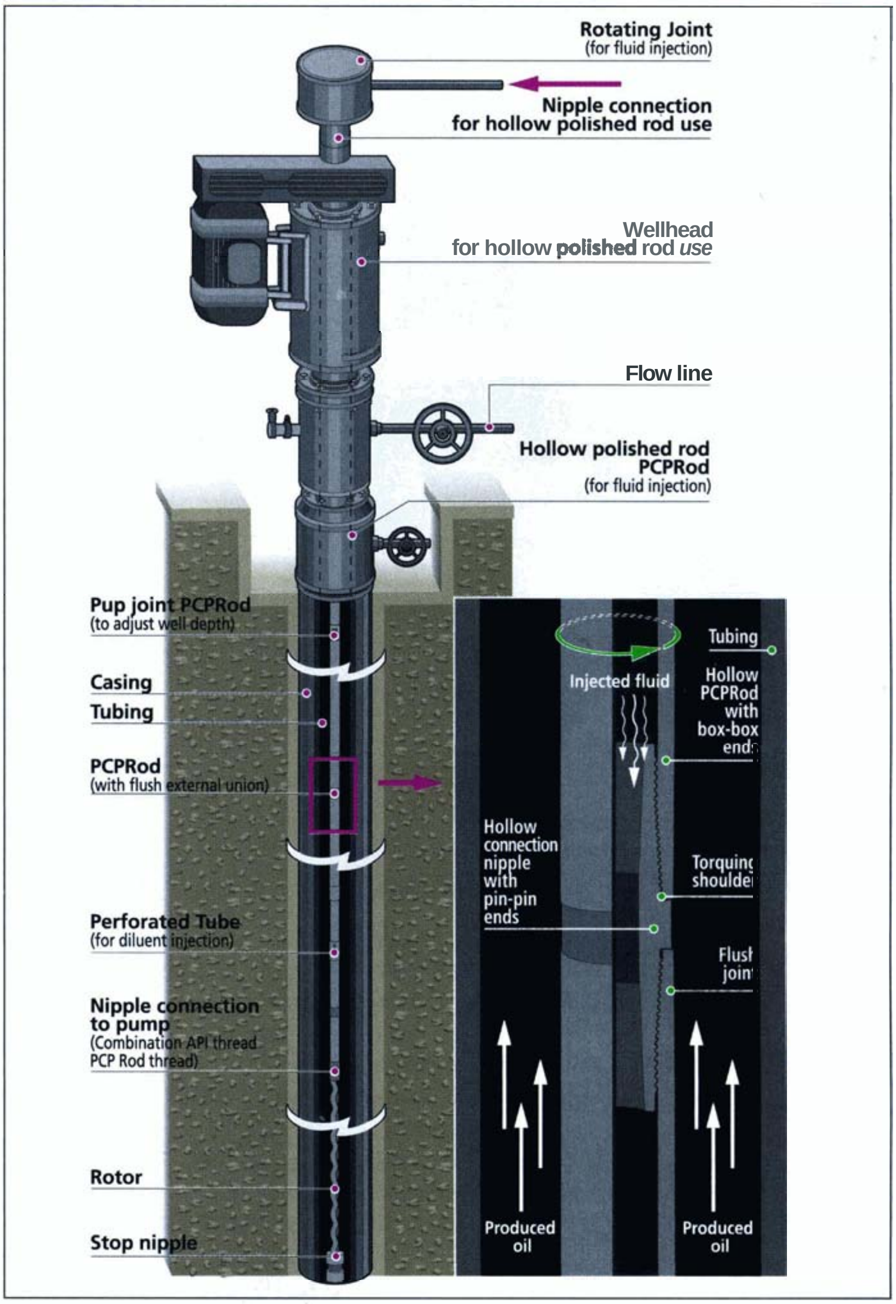
The Hydril Advanced Composites Group uses two elements in its spoolable line pipe for the oilfield. The pipe has an inner, plastic liner to contain fluids. A hybrid laminate contributes the pipe's strength. That laminate is carbon and glass fibers in an amine-cured epoxy resin. The outside scuff layer protects the laminate.

The technique's advantage allows custom design of the plastic liner to fit each oilfield requirement, whether it's salt water, oil and gas in gathering lines, compounds for injection, disposal lines or transmission line.

Polypropylene filters

Even applications as basic as filter cartridges from water injection and gas purification are getting better, according to Hamid Omar, technical director of Syntech Fibres (Pvt) Ltd. of Karachi, Pakistan.

New continuous, non-round polypropylene fibers in spun yarn cartridges help keep the yam in place. The continuous filaments are melt-spun using a new method that doesn't require spin-finish chemicals, and air pressure helps create randomly oriented, intermixed, looped and entwined filters of bulky yam. The combination keeps particles from being unloaded, even under fluctuating flows and pressures.



Research helped create hollow sucker rods that allow operators to inject fluids into the wellbore. ***(Diagram** courtesy of **Tenaris)***

Plastics have found their way into the guts of oilfield operations, as well as in applications such as those provided by Ensinger Hyde where they are used in chemical-resistant bearings, pump parts, valve seats, piston rings, transmission parts and bearing cages.

These are just a few of the applications in which specialty materials have improved operations and efficiency in the oilpatch. There are many more applications and materials built by many more companies.

New challenges in reaching for oil at greater depth in hotter environments under higher pressure with corrosive gases and liquids will call for even more specialty materials to provide solutions to more complex problems. E&P