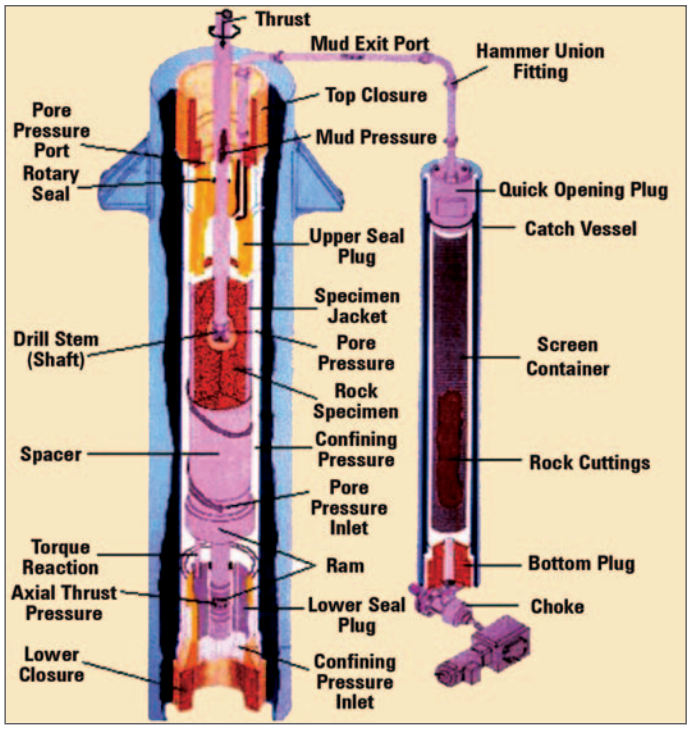
Drilling Engineering Association joint industry projects investigate host of drilling challenges

TODAY'S FAST-PACED drilling and completion industry faces plenty of challenges in pursuing ever-more difficult wells and tapping increasingly marginal resources. Technology has for the past quarter-century been the industry calvary riding to the rescue in this regard. In late, unlamented years of low oil prices and rig counts to match, technology lowered costs and improved efficiencies.

Today, technology enables the drilling and completion of "undrillable" wells in startling water depths and daunting pressures and temperatures. Extended-reach wells span as much as 8 miles. Some "sweet spot" reservoirs become practical to tap.

But new technologies do not simply hatch from eggs. Research, usually costly and sometimes tracking to dead ends, can span years before producing technical enablers.



Schlumberger illustration

Schematic of testing equipment for DEA 162.

Decades ago, major operators led this research effort. As the industry receded during the 1980s, though, more and more of this burden shifted to service firms.

Throughout this transition, the **Drilling Engineering Association** (DEA) has remained a constant as the industry's leading forum for drilling research and development. DEA provides opportunities for researchers large and small to present their ideas and work to the drilling community. Operators, in turn, have the opportunity to fund research through Joint Industry Projects.

Please note that DEA has a new website at www.dea-global.org.

CURRENT JIPS

DEA meets quarterly to review promising research and ideas. It also organizes an annual workshop showcasing some of the best of cutting-edge technology, as well as highlighting field applications. (For more information on the 2007 DEA Workshop, go to www.iadc.org /conferences/DEA_Workshop_2007.htm.)

This article will briefly outline some active JIPs.

DEA 162: INCREASING ROP IN DEEP WELLS

Sponsored by **BP**, DEA 162 ("DeepTrek JIP for Advancing Deep, Hard Rock Drilling Performance Through Controlled, Full-scale Laboratory Drilling Experiments with Aggressive Bits and Specialized Fluids") aims to increase ROP through bit and fluid improvements. The work is being conducted by **TerraTek**, a **Schlumberger** company.

The researchers point out that increasing ROP will lower drilling costs, improving the economics of deep exploration and development.

In the US, hard-rock areas with great hydrocarbon promise include the Rocky Mountains, Tuscaloosa trend, Arbuckle formation, Anadarko basin, among others. Estimates of North American hard rock drilling costs exceed $1.2 billion, according to the researchers. Were ROP doubled, they say, savings could reach $200 million to $600 million.

Challenges of drilling in deep, hard formations include:

- Increasing rock strength with depth;
- Increased shale plasticity and bit balling;
- High overbalance (Borehole - Pore Pressure) resulting in chip hold down;
- High mud solids, high density, increased viscosity;
- Rig and operational limitations, i.e., low hydraulics, bit wear, friction losses, differential sticking, lost circulation, etc;

DEA 162 is an extension of the recently completed Deep Trek testing program, which demonstrated potential for marked improvements in deep drilling performance through aggressive bit design and use of specialized drilling fluids. The testing would involve 6-in. diameter bits, drilling fluids in the 11- to 16-ppg range, 10,000-psi borehole pressure, 11,000 psi - 12,000 psi confining pressure and overburden stress and flow rates up to 300 gpm. Rock types will be the same as used in the Deep Trek project, including Crab Orchard sandstone, Carthage marble and Mancos shale. However, other challenging formations, such as Pierre 1 shale, could also be included.

For more information, go to www .dea-global.org/projects/status/162.html.

DEA 161: PREDICTING WELLBORE STABILITY

"A Proposal to Develop an Improved Methodology for Wellbore Stability Prediction" is sponsored by **Marathon Oil Company**. The researcher is **Knowledge Systems Inc.**

The researchers note that loss of wellbore stability is the major source of non-productive time while drilling, causing an estimated $8 billion in worldwide

losses each year. A clear goal of this project is to identify practical methods that will reduce or eliminate the incidence of unstable wellbores at a fraction of the cost of remediation.

The objective of the project is the identification and development of best practices for practical wellbore stability analysis. The resulting methodologies should be readily applicable by drilling engineers.

Specifically, this project is intended to increase the effectiveness of drilling engineers in planning for wellbore stability. Researchers say project participants will obtain numerous benefits:

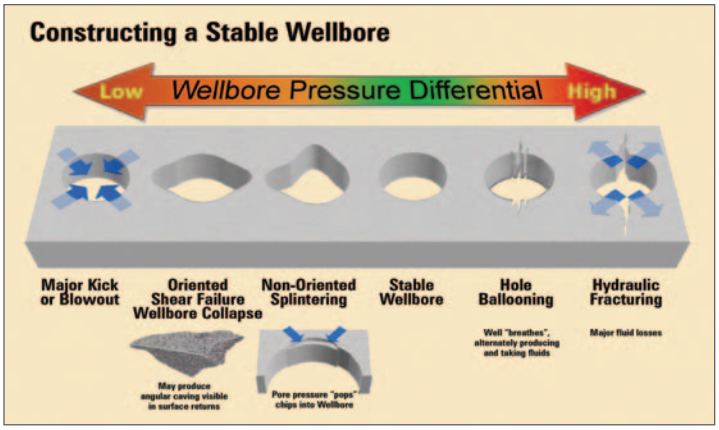
- Reduced well construction time and cost;
- Reduced casing-related costs;
- Reduced mud costs;
- Reduced dependence on contingency casing designs;
- Improved quality of formation evaluation data;
- Maintain hole integrity for maximum production.

Researchers say they will conduct a thorough review of industry wellbore stability analysis practices, then use the results to select the most promising modeling methods. From available sources, they will gather the necessary data to test the selected models on a representative sampling of wells.

For each selected wellbore stability modeling method, an analytical wellbore stability prediction will be generated for the selected wells, using the information available pre-drill. Similarly, we will analyze how these predictions could have been modified using information available while drilling.

Separately, a definitive wellbore stability diagnosis will be prepared for each well using the best practices previously identified. The analyses will be correlated to known wellbore instability indicators like deformation, cavings and pack-offs.

Under certain geomechanical conditions, analytical methods may not produce reliable results. Numerical methods for modeling wellbore failure mechanisms, such as finite element analysis, will be considered as an alternative, provided that such methods are practical and efficient.



This graphic demonstrates the potential consequences of not understanding wellbore pressures and stability (DEA 161).

Knowledge Systems Inc illustration

These predictions will be rigorously compared with the actual well diagnoses to determine the best practices for wellbore stability estimation both pre-drill and while drilling.

For more information, go to www.dea-global.org/projects/status/161.html.

DEA 160: SHOULDER/ THREAD VERIFICATION SYSTEM

DEA 160 targets eliminating drillpipe twistoff caused by lack of shoulder engagement or torque, as well as casing or tubing leaks caused by lack of seal or thread engagement. As envisioned, the "Shoulder/ Thread Verification System" will provide the ability to see and analyze a connection at a later date.

The project is sponsored by **ConocoPhillips**, and the work is undertaken by **Global Systems Inc.**

Technical objectives are to verify shoulder connections and thread and seal engagement on various connections. The researcher pledges also to tailor software and communications for both on- and offshore applications, as well as develop a connection-verification database.

Further details are available at www.dea-global.org/projects/status/160.html.

DEA 159: PLUG AND PLAY

DEA 159 detours from familiar drilling research projects and delves into the sometimes dysfunctional computer and control systems that can plague an otherwise sound operation.

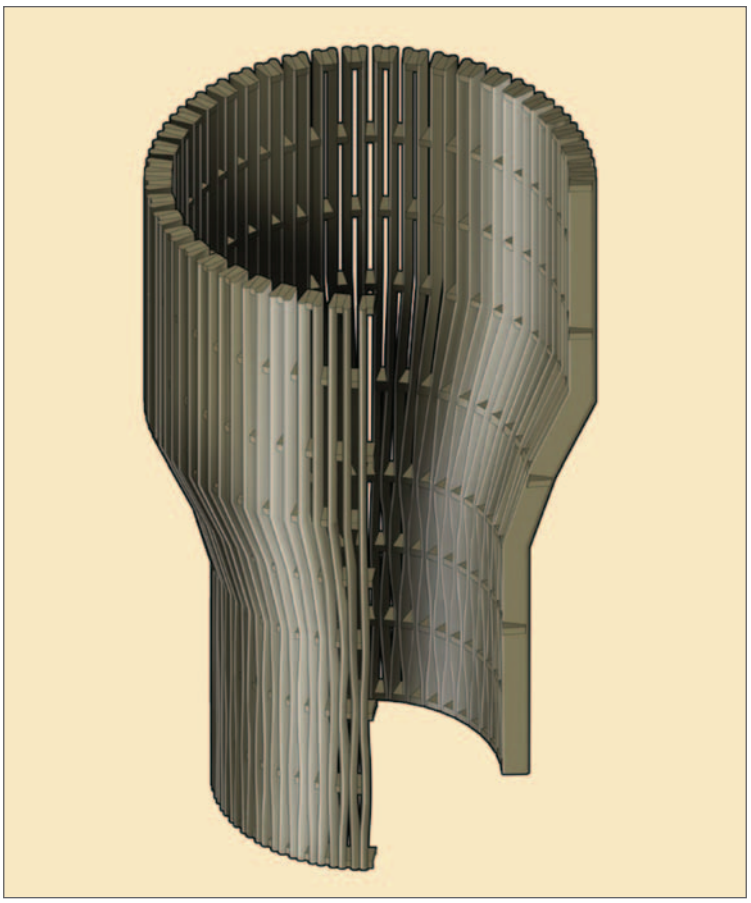
"Implementing Plug and Play for Computer Controlled Drilling Equipment" is sponsored by **BP**. The work is being conducted by the **Athens Group**.

The researcher says that schedule delays, cost overruns, operational problems and potential safety issues have often resulted from lack of standardization in software interfaces between computer-controlled equipment (such as top drives, pipe-handling equipment, drawworks, etc.) and integrated control systems (such as Cyberbase, V-ICIS and DMCS).

That, the researchers say, puts the onus on the integrated control system to resolve any differences in the location and meaning of the various software interface points. Since there can be anywhere from 2,000 to 8,000 such points, the potential for errors are great, and the time to discover and resolve the errors can be long. Worse, these errors are often only detected when the equipment is physically integrated at installation time.

Other industries, notably the automotive and semiconductor manufacturing industries, wrestled with exactly the same situation 10-15 years ago. In response, the semiconductor industry has developed a set of standards known as SECS (SEMI Equipment Communications Standard)/ GEM (Generic Equipment Model) to allow fabrication equipment from multiple vendors to integrate seamlessly on the factory floor. These standards were developed from similar standards that were developed for the automotive industry. SECS/GEM standards implement functionality familiar to computer users as "Plug and Play."

For more information, go to www.dea-global.org/projects/status/159.html.



Confluent Filtration Systems illustration

Schematic of self-expanding tubular (DEA-158).

DEA 158: SELF-EXPANDING TUBULARS

"Development of Self-Expanding Tubular Technology (CFEX)," DEA-158, is sponsored by **Occidental Oil & Gas Co**. The researcher is **Confluent Filtration Systems** (CFS).

CFS says its self-expanding technology represents an early-stage, novel approach to expandables. The technology could provide solutions to numerous problems currently plaguing the industry and present innovative, major-scale applications for casing, screens and other geologic tools.

The proposed JIP aims to assist acceleration and leveraging (or "stair-casing") estimated $1 million to $2 million annual DOE R&D grants. As a part of ongoing technology developments, this research will result in proof, construction, testing and field demonstration of a disruptive-level technology; determine its economic and manufacturing models; and will commence universal applications and market acceptance processes for expandables.

For more information, go to www.dea-global.org/projects/status/158.html.

MORE DEA INFO

Links to these and other projects can be found through www.dea-global.org. In addition, other presentations made at DEA meetings can be viewed in PDF format through DEA's meetings section.