Using Mud Pulses to Transmit Downhole Drilling Telemetry

One of the most important, time-saving innovations in today's drilling industry is "measurement-while-drilling" instrumentation. Before its invention, operators determined drill bit direction by ceasing drilling, removing hundreds or thousands of feet of drill pipe, and lowering an instrument into the well. Readings would be taken, the instrument retrieved, drill pipe would be lowered back into the hole, and drilling would recommence. A Department of Energy research project with Teleco, Inc., helped change that expensive, time-consuming process. It pioneered a wireless system could transmit the location of a drill bit by sending pressure pulses through the drilling mud from the bit to the surface.

Because of its performance and safety advantages, mudpulse telemetry has gained wide acceptance in the drilling industry.

Mudpulse telemetry offered several new benefits for the the drilling industry: (1) the capability to receive bit orientation data from the base of the borehole while drilling was underway, (2) real-time information on drill rates and equipment performance, (3) a way to evaluate, or log, a geologic formation almost instantaneously during drilling, (4) the ability to steer the drill bit, and (5) the means to receive advance warnings of impending well drilling hazards.

Mudpulse telemetry has gained wide acceptance in the drilling industry. By 1996 its commercial use was saving the natural gas and oil industry as much as $400 million per year in drilling costs, not including the benefits of reduced personnel injuries and greater environmental protection. The net present value of benefits from DOE's $2 million R&D investment in this technology in the 1970s now exceeds $4 billion (in constant 1996$).

Fracturing Gas/Oil Formations with "Reservoir Friendly" Carbon Dioxide and Sand

In the tightly-packed shale formations of Appalachia, natural gas producers often inject nitrogen under intense pressure to fracture the rock, creating pathways for gas to flow. Nitrogen by itself, however, isn't able to carry tiny sand particles, called proppants, that keep long fractures open after the nitrogen pressure is relieved. To keep the fractures from re-sealing, operators often resort to injecting water-based foam with the nitrogen to carry the sand grains into the