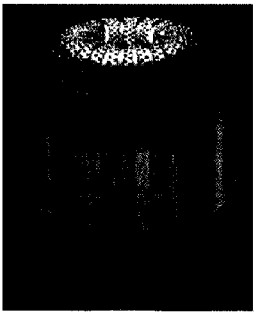

At its Elk Hills Naval Petroleum Reserve in California, the Department of Energy used a diamond drill bit similar to this to achieve a record-setting 1,058 hours of drilling operations without having to remove the bit. Diamond bits generally are run between 230 and 260 hours without a trip.

Sandia National Laboratories, working to solve problems for both geothermal and oil/gas drilling, applied a diffusion bonding technology, an o utgrowth of defense research. The technique interlocks the molecules of the diamond cutters and the bit stud, creating a permanent bond. Department scientists also developed a computer code for optimizing cutter facings and drill bit design and contributed the use of one-of-a-kind drill bit testing facilities to manufacturers.

Within one year of the Department's successful demonstration of the prototype drill bit, dozens of U.S. companies were applying the technology to manufacture the world's first commercial polycrystalline diamond compact bits. A new world record was set by the bit: 20,000 feet of drilling without a bit change. For time-critical drilling, into hard rock or deeper formations or in offshore operations, the drill bit can save as much as $1 million per well. Today, U.S. companies sell more than 4,000 of these diamond bits each year. The polycrystalline drill bit now accounts for one-third of the worldwide drill bit market, and sales are well above $200 million per year.

Called "crosswell seismic imaging," the technique minimizes much of the subsurface interference by lowering the soundwave generator and receiver into the boreholes.... The results are resolutions beyond what the industry imagined possible just five or six years ago.

Detecting Hydrocarbons by Sending Sound Waves Between Wells

Traditionally, companies have searched for natural gas and oil by sending sound waves from the surface deep into underground formations and measuring their reflectance. Because the seismic signals pass through thousands of feet of rock during their round trip, they become diffused and less effective. A new technique, developed in DOE's national laboratories and now being offered commercially, overcomes many of these limitations. It could represent the next major advancement in geologic imaging technology.

Called "crosswell seismic imaging," the technique minimizes much of the subsurface interference by lowering the soundwave generator and receiver into the boreholes. Sound waves travel directly from wellbore to wellbore over much shorter distances and at higher frequencies. The results are resolutions beyond what the industry imagined possible just five or six years ago. Where traditional techniques can "see" geologic objects 50 feet across, the crosswell technique can see objects 5 feet across, revealing much greater detail in the images of underground rock formations and increasing the potential for finding natural gas and oil deposits.