Two years after the start of its biggest downturn, the oil and gas industry has accommodated for lower oil prices by reducing operational costs. At the same time, increasing profitability includes accessing new reserves by extending laterals, creating complex wellbore geometries and drilling through difficult formations. The industry relies more than ever on intelligent technologies to help lower costs and improve efficiency in increasingly challenging operations.

Drillbits have a major influence on drilling performance. If the bit has excessive cutter wear or damage, the ROP will drop and can limit the bit from drilling ahead. At this point, the bit must be replaced, which adds rig time. Also, bit inefficiencies affect ROP, and bit vibrations can cause reliability issues and failures in other bottomhole assembly tools such as the motor, rotary steerable system and MLWD tools.

Today, polycrystalline diamond compact (PDC) bits drill more than 90% of the worldwide footage. However, the shearing action of their fixed cutters proves less than ideal for many applications. Fixed cutters are brazed into the bit, and only about 20% of each cutter is used. As they drill ahead in hard and abrasive applications, a wear flat develops, which results in lower ROP. Often these bits will be replaced, and each additional run adds costs.

Looking to lower drilling costs by increasing ROP and eliminating multiple bit runs, the drillbit domain sought a paradigm shift similar to what was seen with the advent of engineered fracture design and horizontal drilling. Knowing the limitations of PDC bits when drilling through formations that are high-impact, abrasive or have...
high-compressive strengths, Smith Bits, a Schlumberger company, turned its focus to the very foundation of bit performance: the cutting element.

The bits engineers began improving bit performance in the design of the first unique geometry cutting element, the ONYX 360 rolling PDC cutter. Utilizing the entire circumference of the cutter, this design incorporates a rotating action that allows the diamond edge to stay sharper longer in hard and abrasive formations. Offshore Australia, a custom PDC bit fitted with ONYX 360 rolling PDC cutters saved 50 hours and US$1 million, by increasing run length by 40% and exceeding average offset ROP by 19% through highly-abrasive sandstone interbedded with siltstone and silty claystone in the Browse Basin.

The next development was for drilling in hard, interbedded applications that lead to chipping or breakage on conventional flat cutters. The geometry of the Smith Bits Stinger conical diamond element creates a thicker diamond table that amplifies the cutting and plowing by concentrating a higher point load on the rock. The result is increased footage, reductions in bit runs and increased rig-time savings, which is critical offshore.

Offshore Indonesia, a StingBlade bit saved 23.45 drilling hours and US$240,000, by increasing ROP compared to the benchmark offset well by 53%, drilling directionally through high impact and hard formations that are prone to stick/slip challenges.

For increased cutting efficiency in applications that are softer but still see high impact or high torque and torque fluctuations, Smith Bits designed its latest cutting element. The geometry of the Axe ridged diamond element combines the shearing action of a conventional cutter in PDC bits with the crushing action of tungsten carbide insert in roller-cone bits. The 70% thicker diamond table increases durability to maximize ROP throughout the run, while the ridged shape reduces cutting force required for less overall torque and less reactive torque fluctuations.

Better bit performance starts with better cutting elements. Proven, intelligent technologies like the unique geometry cutting elements will lead the way for a new era of drilling efficiency and effectiveness—much needed for the oil and gas industry of today.