Space at Harwell
MULTIDISCIPLINARY INNOVATION

HealthTec at Harwell
MULTIDISCIPLINARY INNOVATION

EnergyTec at Harwell
MULTIDISCIPLINARY INNOVATION

Element Six

Element Six is a global leader in the design, development and production of synthetic diamond and tungsten carbide solutions. Part of the De Beers Group, the company has primary manufacturing sites in the UK, Ireland, Germany, South Africa, and the US.

We caught up with them to understand how the dramatic fall in production costs of synthetic diamond affected their business and how they responded.

We learned that a near constant stream of new ideas, collaborations and resulting innovation is critical as Element Six, 'E6', create new solutions for markets that may never have considered the use of diamond. Diamond is the best conductor of heat, more than 5 times better than copper, making it ideal to keep high power density electronics - for example in satellites and cellular base stations – cold. Moreover, spin qubits in diamond can be manipulated and read out at room temperature enabling a new class of quantum-based magnetometers.

Element Six's clients range from auto and aerospace manufacturers, energy and construction companies as well as semiconductor, space and health industries. Innovation has been the core of this business since its origins in the late 40s', helping to unlock new industrial applications by using diamond's remarkable properties. An influx of new market players appearing in the last two decades, mostly in Asia, has led to dramatic price reductions in synthetic diamond. This created a requirement for continual evolution in technology and markets. Innovation, rather than heritage, was now the watchword.

One example of such evolution was E6's focus on the oil and gas market in the early 2000s, where at that time diamond drill bits were not traditionally used. However, the down time associated with changing drill bits, especially on an offshore rig, might generate costs of hundreds of thousands of dollars per day. This, coupled with the need to efficiently meet growing consumer demand, drove the adoption of a new diamond solution. In this landscape, Element Six worked in close collaboration with oil and gas players to understand high-cost pain points, developing new products for them, and subsequently investing in the development of more innovative offerings. Success in this venture transformed tool performance, reliability and safety, opening new paths to more collaborative approaches to solution development.

A more recent E6 project enabled strides towards sustainability in the airline sector by capitalising on diamond's cutting potential. The airline industry's reduction in carbon emissions to date has been largely based on switching to light but brittle carbon fibre reinforced plastics in aeroplane production. Prior to the use of synthetic diamonds in the manufacturing process, the drilling of these new materials was exceptionally time-consuming and wasteful, which proved an obstacle to wider uptake. Thanks to new diamond solutions, this sector can now continue to reduce the weight of flying stock and drive down emissions, while ensuring safety and structural integrity.

Element Six's linchpin has been its ability to target scale applications that get step change benefit from a diamond solution, whether that be cooling electronics to enable greater internet bandwidth or machining your smart phone screen. As **Dr Daniel Twitchen, Chief Technologist at E6, reveals**, "our differentiation comes from innovation enabling step change diamond solutions to solve important problems. Bringing materials like diamond into a new application is rarely a straight switch; it requires new tools and processes." Integration is both complex and hard, but the results can be game-changing. This is why, Twitchen continues, "we need people and partners who are obsessed with finding new things and solving problems as much as we are. Whether it's a start-up or an established business, our doors are open to new applications and problems.

Twitchen admits there have been many 'single moments' over the last seventy years that have fundamentally changed the business. To survive and prosper, each moment required hard and brave decisions, with the common theme, in more recent periods, of an intimidating speed of change in the external environment: 'Without hesitation a very important day in the determination of the new E6 was the opening of our facility at Harwell'. Access to 'other people's kit' and expertise when brand-new solutions are developed and tested is an obvious asset to a company like Element Six. Twitchen estimates they collaborate with their peers on the campus multiple times in any one month, which he views as essential. He adds, "being located in a place with easy accessibility, and attracting the best international talent wishing to start their careers at E6, have been absolutely critical for an ideas-based business like this one. People are the single most important asset we have."

As Element Six looks forward to a future after Brexit and COVID-19, they are optimistic and focussed on continuing to impact multiple industries with their diamond solutions and R&D expertise, while welcoming the ever-growing flow of new ideas and collaborations.

What do they wish people understood about your field of science? Twitchen replies: "Diamond is no longer regarded for what it represents as a gem stone, but for what it truly is - no more, no less - a remarkable material that can transform industries and improve our quality of life."

To find out more about Element Six, visit: www.e6.com