The proposed European Extremely large telescope (E-ELT) will be the largest optical and near-infrared telescope in the world, giving us a much more detailed and deeper view of the Universe from Earth than ever before.

Current major ground-based telescopes have mirrors ranging between 8-10 metres in diameter. The mirror for the proposed E-ELT will have a diameter of 39 meters – the length of 5 classic London buses.

**EXPANDING OUR VIEW OF THE UNIVERSE**

The E-ELT will address many of the key questions in astronomy and astrophysics, thereby significantly increasing our fundamental understanding of the Universe. The E-ELT will enable astronomers to:

- Directly image and investigate planets outside our Solar System, including rocky planets in ‘habitable zones’, and perhaps answer one of humanities biggest questions – ‘are we alone in the Universe?’
- Examine the first objectives in the Universe and the subsequent evolution of galaxies and black holes, helping us to understand how our Universe came to look the way it does today.
- Explore the nature and distribution of dark matter and dark energy, thought to make up most of our Universe, but as yet not directly observed or understood.
- Directly measure the expansion rate and acceleration of the Universe, without the need to make
assumptions such as a standard luminosity for distant supernovae.

These measurements, made possible by a suite of advanced instruments, will have a major impact on our understanding of the Universe.

**THE BIGGEST EYE ON THE SKY**
The biggest eye on the sky will have an innovative five-mirror design that will gather 12 times more light than the largest optical telescopes operating today.

The primary mirror will consist of 798 hexagonal segments, each 1.4 metres wide and 50mm thick, providing more light collecting area than all the 23 current optical research telescopes greater than 4 metres in diameter put together.

A UK consortium based at the OpTIC Glyndwr in North Wales is developing prototypes for these mirror segments, aimed at securing potential contracts worth over €100M for manufacturing the production segments in the UK industry. Other benefits of the related technology spin-off include the potential for huge industrial and social benefits in fields ranging from green energy (laser fusion) to healthcare (high-precision artificial joints with longer life).

Adaptive optics systems will correct for the distortion and turbulence caused by the Earth’s atmosphere and will provide images 15 times sharper than those from the Hubble Space Telescope. Technologies developed for adaptive optics will be pushed to very high performance. They are already finding applications in ophthalmology to help discover diseases of the retina, and enhancing the performance of microscopes to enable new levels of precision in 3D tissue imaging.

**THE UK – WORKING TOWARDS FIRST LIGHT**
The European Southern Observatory (ESO) has been working with teams of scientists, engineers and industrial contractors from across Europe to perfect the telescope’s design and performance.

ESO is an intergovernmental organisation for astronomical research and is supported by 15 countries, including the UK. The UK is playing a leading role in the E-ELT, leading the generation of the science requirements, developing instrument designs and adaptive optics technologies, designing telescope systems through industrial contracts and developing manufacturing processes for the optical elements.

The UK E-ELT programme will build opportunities for the UK industry in the construction of the telescope and its instrumentation. UK companies, including Arup, Ramboll UK, Observatory Scientists, OpTIC Glyndr, Scisys, and e2v have already been involved in the preliminary phases.

The ESO Council has selected a site for the E-ELT on Cerro Armazones in Chile close to the existing VLT site of Cerro Paranal. Civil works in preparation for construction are underway. Contracts for the dome and main structure are planned to be awarded in 2015. First scientific results are planned for 2026.