Looking through the largest telescope in the world

With four times greater resolution than the most powerful telescope currently in use, the forthcoming European E-ELT telescope by ESO features the unique European technological expertise of Reosc (subsidiary of Sagem) in high-performance mirrors.

With a diameter of almost 39 meters, the E-ELT* will be the first ground-based telescope able to detect water on small exoplanets orbiting stars similar to our Sun. It will be located in Northern Chile at Cerro Armazones, a site where atmospheric turbulence is particularly low, providing the ideal conditions for astronomical observations. The giant telescope designed by ESO** should enter service in 2024. It will feature a five-mirror design: the primary mirror (M1) with a diameter of 39 meters consisting of 798 segments, each 1.45 meters wide, which will capture the light and redirect it towards the secondary mirrors M2, M3 and M4. The M4 mirror, alongside the M5 mirror, will compensate for imperfections introduced by atmospheric turbulence, as weak as they may be. “The M4 means that scientists will enjoy an image with a resolution that is approximately equal to that of a space telescope of the same diameter,” explains Thierry Batut, CEO of Reosc, a subsidiary of Sagem (Safran), the leader in the design and production of high-performance optics. “It’s one of the most critical parts of the E-ELT,” adds Batut.

Ultra-high-precision polishing

Following an international call for bids, Reosc was allocated the task of manufacturing all of the segmented mirrors forming the optical surface of the M4 mirror. “The M4 is a circular, vitro-ceramic mirror measuring 2.4 meters in diameter and made up of six glass petals that are 2 millimeters thick with a flatness of just a few microns,” explains Batut. To achieve such a result, we begin with a sheet of glass that is polished with precision, before being progressively made thinner until the required thickness is achieved. This operation lasts several months for each petal. The petals are critical optic components, the only type of their kind in the world, and we are the first to manufacture them.”

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The segments are then shipped to Italy to be fitted with 5,200 actuators. The tiny actuators oscillate the surface of the mirrors very quickly in order to compensate for the atmospheric turbulence mentioned before. "Our ability to transport such fragile components also requires world-class expertise," says Thierry Batut. "We were required to assess the level of vibration depending on the modes of transport and demonstrate our ability to carry out such an operation."

Time-tested expertise

The next milestone for Reosc will be the call for bids for manufacturing the 798 segments for the M1. "Back in 2003, we produced quite similar components for the Gran Telescopio Canarias, the most powerful telescope currently in use," recalls Thierry Batut. "We have also supplied ESO with seven prototype segments for the E-ELT, thus demonstrating our ability to follow the observatory's specifications. We are, therefore, in a good position to respond to this call for bids." This would see Reosc manufacture almost one segment per day... as well as manufacture all of components in three years!

* European Extremely Large Telescope

** European Southern Observatory
Learn more

About Sagem's expertise in astronomy

Read the press release about being allocated the contract for the M4 mirror