

# ESO & Chile

A scientific and cultural bridge





# The European Southern Observatory in Chile

On 6 November 1963 the initial agreement between the Government of Chile and the European Southern Observatory (ESO) was signed, which enabled ESO to site its astronomical observatory in Chile, beneath the exceptionally clear skies of northern Chile. This was the beginning of a more than 50-year long international success story and the forging of an important cultural link between Chile and Europe. Many ground-breaking discoveries have been made at ESO's observatories and during this collaboration Chilean scientific and technological prowess has developed in step with the advances in astronomy and its associated technologies in ESO's Member States.

The cooperation between Chile and ESO that began more than 50 years ago has proved not only to be solid and long-lasting; but also flexible. Most importantly, this association opens an exciting way into the future — for the benefit of Chile, for the ESO Member States, and for the progress of science and technology.

Tim de Zeeuw, ESO Director General

Tim de Z

Cover: The Chilean sky is one of the clearest and most transparent in the world. Here seen over ESO's Very Large Telescope. Credit: G. Hudepohl/ESO

This page: Four antennas of the Atacama Large Millimeter/submillimeter Array gaze up at the star-filled night sky, in anticipation of the work that lies ahead. Credit: ESO/José Francisco Salgado



# The Observatories

ESO operates three major observatories in Chile, providing astronomers in the ESO Member States and Chile with state-of-the-art observing facilities that can address a wide range of open questions in science.

ESO's first observatory, La Silla, near La Serena, now hosts some of the world's most powerful facilities for the discovery of planets outside the Solar System. These include the HARPS spectrograph at the ESO 3.6-metre telescope, and the Swiss 1.2-metre Leonhard Euler Telescope, while the New Technology Telescope is still one of the best 4-metre-class telescopes in the southern hemisphere. La Silla also hosts several other telescopes operated by institutes from the ESO Member States.

On Cerro Paranal, near Antofagasta, the Very Large Telescope (VLT) has reached maturity, with a full complement of first generation instruments that offer the broadest choice of observational capabilities at any current or planned observatory. The second generation of instruments is currently being installed and will soon be completed. Light from the VLT's Unit Telescopes and the movable Auxiliary Telescopes can be combined coherently to form an interferometer, yielding an unprecedented combination of sharpness and sensitivity in the infrared part of the spectrum. The Paranal Observatory also hosts two of the world's most powerful dedicated imaging survey telescopes — VISTA and the VST. This impressive suite of telescopes has made Paranal the most advanced and productive ground-based astronomical facility in the world.

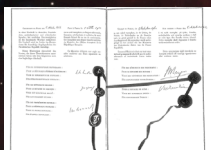
The Chajnantor Plateau, located at 5000 metres above sea level near San Pedro de Atacama, offers excellent conditions for submillimetre-wavelength astronomy. The Atacama Large Millimeter/submillimeter Array (ALMA) of 66 antennas is providing uniquely detailed views of the cold Universe, revealing planet-forming discs around other stars, looking back to the youthful Universe when early galaxies were in the process of forming their first generations of stars, and much more. Also at Chajnantor, the APEX radio telescope combines extremely sensitive receivers with pioneering instrumentation.

The glowing jumble of gas clouds visible in this image make up a huge stellar nursery nicknamed the Prawn Nebula. Taken using the VLT Survey Telescope (VST) at ESO's Paranal Observatory in Chile, this may well be the sharpest picture ever taken of this object. It shows clumps of hot new-born stars nestled in among the clouds that make up the nebula.

## Milestones



1953: Conversations concerning the constitution of a European Southern Observatory start.



1962: ESO is established.



1963: Agreement between ESO and the Government of Chile, the *Convenio* (or *Acuerdo*) to establish an observatory in Chile, is signed.



1964: La Silla is selected as the location of the new observatory.



1966: First light of the first ESO 1-metre telescope.



1969: Inauguration of the La Silla Observatory by President Eduardo Frei Montalva.



## Light pollution

Dark skies are a precious natural resource which deserve protection, most importantly against artificially generated light pollution.

ESO is fully committed to promoting the preservation of the unique quality of the Chilean sky. The most visible form of this commitment is the support given by ESO, jointly with other international observatories operating in Chile and with the Chilean government, to initiatives of protection, information and public outreach. By sharing the scientific results obtained with its telescopes, ESO hopes to increase awareness of the importance of the dark night sky as a most valuable Chilean natural and cultural resource.

## ESO and Chile today

ESO is engaged in a close and very fruitful collaboration with Chile at many levels, including its government, universities, science institutes and industry.

The ESO office in Santiago is an active centre for the education of new generations of researchers, and promotes exchanges between European and Chilean scientists through various collaborations. The Chilean astronomical community also has preferential access to a percentage of observing time on ESO telescopes.

ESO contributes to the development of astronomy in Chile through the funds managed by the ESO–Government of Chile Joint Committee and the ALMA CONICYT Joint Committee, financing a wide range of activities in science, astrotechnology, and education. In addition, ESO carries out several regional and local cooperation programmes in the regions of Coquimbo and Antofagasta, where the observatory sites are located. ESO also promotes natural conservation programmes and an awareness of the local heritage in those regions.

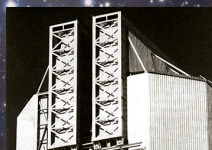
By providing access to its unique dark and clear skies, as well as very attractive conditions for the establishment of world-class international observatories in its territory, Chile has made decisive contributions to astronomy in this past half century. Chile's own scientific and technological capabilities have also grown impressively, making Chilean scientists and engineers very valuable partners for ESO. The operation and continuous development of ESO's facilities in Chile have also provided numerous opportunities for the involvement of Chilean industry, engineering and science in the ESO's projects and activities.



1976: First light of the ESO 3.6-metre telescope.



1987: The Very Large Telescope project is approved.



1989: First light of the New Technology Telescope on La Silla.



1990: Paranal is selected as the site for the VLT following a land donation by the Government of Chile.



1996: Paranal foundation ceremony with President Eduardo Frei Ruiz-Tagle.



1998: First light of the first VLT Unit Telescope on Paranal.



Aerial view of the Chajnantor Plateau, located at 5000 metres above sea level in the Chilean Andes, and home to the array of ALMA antennas.  
Credit: Clem & Adri Bacri-Normier (wingsforscience.com)/ESO

## A history of success

Discussions about a “European Southern Observatory” began in 1953. At the time, South Africa was considered the natural candidate for the new observatory. While European astronomers surveyed sites there, North American astronomers had begun considering sites in Chile. In 1962, when it became clear that the sites in Chile offered even more promising conditions, ESO also turned its attention to Chile. The first ESO Director General, Otto Heckmann, arrived in Chile in May 1963. The Chilean authorities and academia were quick to recognise the importance of Heckmann’s visit, and during his second visit, less than half a year later, the *Convenio*, or Agreement, was duly signed.

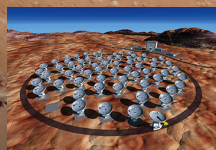
Construction of the La Silla Observatory began in 1965 and soon after, the first ESO telescope, with a primary mirror diameter of 1 metre, was installed. Subsequently, La Silla acquired a large number of other telescopes, the largest of which were the 3.6-metre telescope (which began operations in 1976), and the 3.5-metre New Technology Telescope (first light in 1989) as well as a 15-metre submillimetre antenna. La Silla was inaugurated on 25 March 1969 in the presence of the Chilean President Eduardo Frei Montalva and the Swedish Education Minister Olof Palme.

In 1987, the ESO Council approved the VLT project, aimed at constructing the most advanced ground-based observing facility for optical and near-infrared astronomy. The VLT

consisted of an array of four Unit Telescopes equipped with 8.2-metre diameter mirrors. In 1990, after a land donation by the Chilean government, ESO selected Cerro Paranal as the site for the new telescope. The Paranal Observatory was inaugurated on 5 March 1999 in the presence of President Eduardo Frei Ruiz-Tagle, and it has completely fulfilled its promise of becoming the most advanced ground-based facility in the world. In the wake of these decisions, the 1963 agreement was amended and significantly expanded in scope, committing ESO’s active support for the development of Chilean astronomy and setting up the current stage of partnership between ESO and Chile. The new agreement was signed in December 1996.

In 1997, ESO signed an agreement with the US National Radio Astronomy Observatory to work together towards the realisation of a major project in millimetre/submillimetre astronomy. The result is ALMA, an array of 66 antennas located on the Chajnantor Plateau, which constitutes the largest astronomical project in the world. ALMA was inaugurated by President Sebastián Piñera on 13 March 2013, and it is a partnership between ESO, North America and East Asia, in collaboration with Chile.

In 2012, ESO took the next step by launching the 39-metre European Extremely Large Telescope (E-ELT) project. Green light for the construction of the telescope was given in 2014.



2003: Free concession of Chajnantor by the Government of Chile for the construction of the Atacama Large Millimeter/submillimeter Array.



2005: First light of the Atacama Pathfinder Experiment (APEX) on Chajnantor.



2010: Cerro Armazones, near Paranal, is selected as the site for the European Extremely Large Telescope.



2011: First light of ALMA.



2013: Inauguration of the ALMA Observatory by President Sebastián Piñera.



2014: ESO Council gives green light for the construction of the E-ELT.



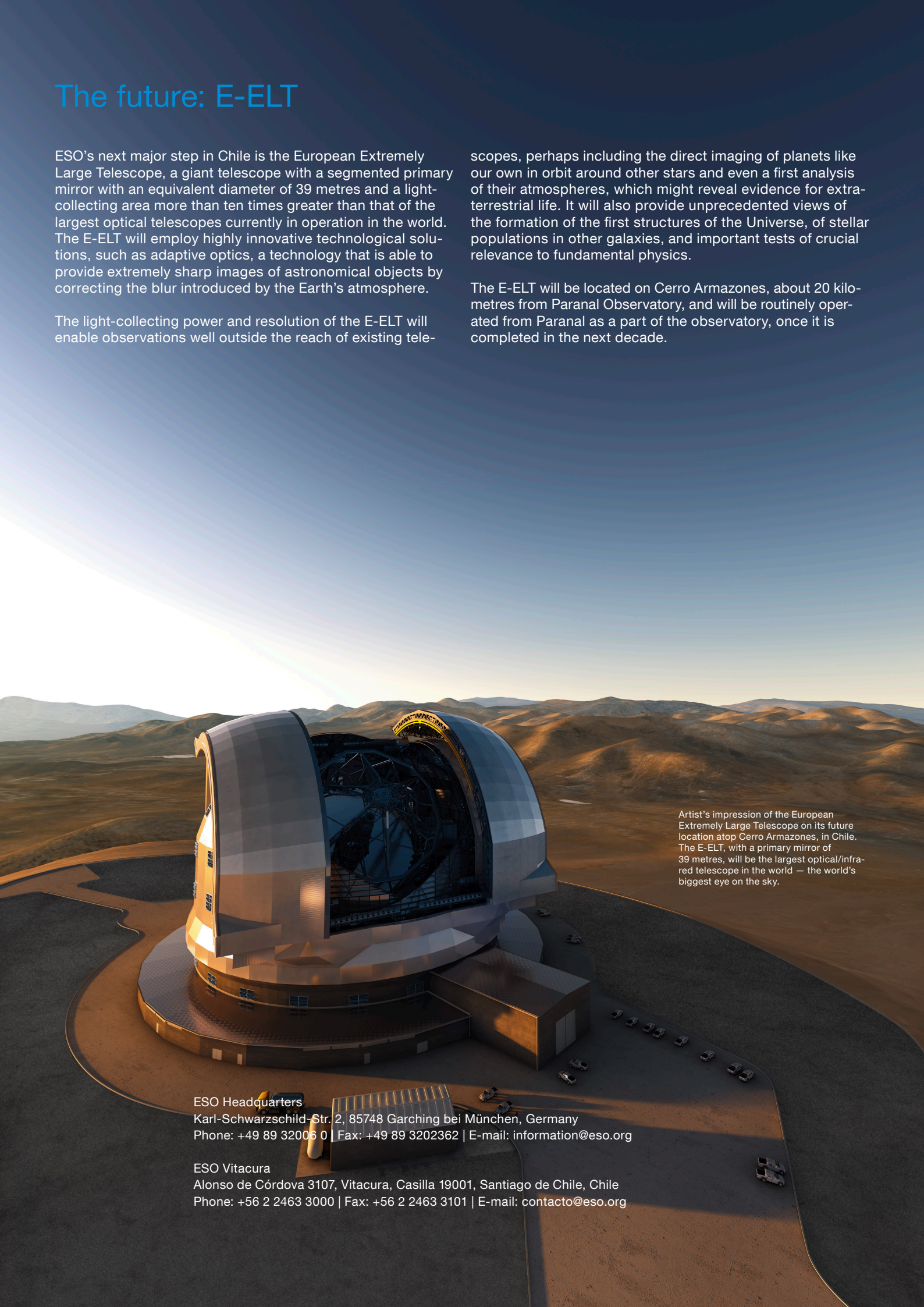
# The future: E-ELT

ESO's next major step in Chile is the European Extremely Large Telescope, a giant telescope with a segmented primary mirror with an equivalent diameter of 39 metres and a light-collecting area more than ten times greater than that of the largest optical telescopes currently in operation in the world. The E-ELT will employ highly innovative technological solutions, such as adaptive optics, a technology that is able to provide extremely sharp images of astronomical objects by correcting the blur introduced by the Earth's atmosphere.

The light-collecting power and resolution of the E-ELT will enable observations well outside the reach of existing tele-

scopes, perhaps including the direct imaging of planets like our own in orbit around other stars and even a first analysis of their atmospheres, which might reveal evidence for extra-terrestrial life. It will also provide unprecedented views of the formation of the first structures of the Universe, of stellar populations in other galaxies, and important tests of crucial relevance to fundamental physics.

The E-ELT will be located on Cerro Armazones, about 20 kilometres from Paranal Observatory, and will be routinely operated from Paranal as a part of the observatory, once it is completed in the next decade.



Artist's impression of the European Extremely Large Telescope on its future location atop Cerro Armazones, in Chile. The E-ELT, with a primary mirror of 39 metres, will be the largest optical/infrared telescope in the world — the world's biggest eye on the sky.

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