

A Long Expected Party — The First Stone Ceremony for the Extremely Large Telescope

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The ceremony to seal the time capsule, signalling the beginning of construction of the dome and main telescope structure for the Extremely Large Telescope, took place at the Paranal Observatory on 26 May 2017, in the presence of the President of Chile, Michelle Bachelet and many international guests. Owing to high winds, the ceremony could not take place as planned on the levelled site on Cerro Armazones, but instead was held at the Paranal Residencia. A brief report of the event and its organisation is presented, and the welcome speech by the ESO Director General is included.

Late May is becoming a time for major highlights in the history of the Paranal Observatory. On 26 May 2017, over two hundred guests from Europe, Chile and the rest of the world gathered at the Paranal Residencia to celebrate the First Stone of the Extremely Large Telescope (ELT), as well as the connection of the Observatory to the Chilean power grid. This was exactly 19 years and one day after Antu, the first Unit Telescope of the VLT, saw first light, and one year and one day after the signature of the largest contract in the history of ground-based astronomy, for the construction of the dome and main structure of the ELT.

The date of the ceremony was carefully chosen to allow the presence of the President of Chile, Michelle Bachelet, who had expressed a strong personal interest in using this opportunity to pay her first visit to an ESO site. The support of the Chilean government to ESO's activities was made very visible by the attendance of the Ministers of Economy, Mining and Energy, and of many other Chilean authorities. The ambassadors of 12 of the 15 ESO Member States were present, as well as the Council President, Patrick Roche, members of the ESO governing bodies from the Netherlands, France, Spain and Italy, and higher offi-



Figure 1. ELT Project Manager Roberto Tamai illustrates to President Bachelet the approximate real size of each of the nearly 800 segments that will comprise the ELT primary mirror, in front of a model reproduction of the telescope and enclosure, flanked by the Director of Operations, Andreas Kaufer (left), and the Director General, Tim de Zeeuw.

cial from the governments of the latter two countries.

The significance of the event in the history of ESO was symbolised by the presence of the former Directors General Lodewijk Woltjer, Harry van der Laan and Catherine Cesarsky, as well as the Director General designate Xavier Barcons (see Figure 8). The leaders of major observatories and astronomy organisations including the Atacama Large Millimeter/submillimeter Array (ALMA), the Association of Universities for Research in Astronomy (AURA), the Carnegie Institution for Science, Gemini, the Giant Magellan Telescope (GMT), the Large Synoptic Survey Telescope (LSST), the National Radio Astronomy Observatory (NRAO), The University of Tokyo Atacama Observatory (TAO) and the International Astronomical Union (IAU) were also present. Managers of companies that are key to the ELT construction, most notably Astaldi and SAESA, were among the participants as well. Correspondents of numerous national and international media covered the ceremony, which was featured around the world.

The ceremony had been planned to take place at the top of Cerro Armazones, where the ELT will be located and where a large tent was being erected one week ahead of the event. However, in the days before the event exceptional conditions, with windspeeds much higher than usual, prevented the completion of the prepara-

tion works. Despite sustained efforts until the last possible minute, under nearly heroic conditions that involved crews staying at Armazones overnight waiting for the winds to abate, the day before the event it was decided to revert to a backup plan already prepared in cooperation with the Presidential team and to host the ceremony at the Paranal Residencia. This may well have been a blessing in disguise, as the comfortable environment of the Residencia made the ceremony much more interactive and protected the attendants from the hostile conditions on that day at Cerro Armazones, although at the cost of reducing the obvious symbolism of a ceremony on the summit where the ELT will rise.

Upon the arrival of President Bachelet and other senior dignitaries, an informal welcome reception took place at the Residencia which gave ample opportunity for interaction among the participants and with the President (Figures 1–3). This included, as planned, the leadership of the Paranal Union, who presented the President with a small vase containing soil from the five ESO sites in Chile (Vitacura, La Silla, APEX, Paranal and Armazones).



Figure 2. President Bachelet is shown posing for selfies with children from Taltal during the First Stone event in the Paranal Residencia.



Figure 3. Paranal Union leaders pose with President Bachelet after presenting her with a vase containing soil samples from the five ESO sites in Chile.

The formal ceremony started at 13:30 with the arrival of President Bachelet and the ESO Director General in the lower area of the Residencia, where the attendees were already waiting. A sequence of introductory videos was shown about the ELT (Figure 4) and the companies Astaldi, Cimolai, REOSC and Schott, which have so far signed large ELT contracts. Also included was a video prepared by SAESA, the company that has built the extension of the grid to Paranal and Armazones.

A welcome speech (presented on p. 5) was given by the Director General, in

which a vision of a large telescope advanced a century and a half ago by Jules Verne was compared with the reality of the construction of the ELT. His speech was followed by one from Paolo Astaldi, President of the leading partner in the ACe Consortium that is building the dome and the main telescope structure. Next was a speech by the internationally renowned astronomer María Teresa Ruiz, currently President of the Chilean Academy of Sciences. The closing speech was given by President Michelle Bachelet, who stressed the importance of astronomy for the development of Chile and the great significance that the event had for

the country. As President Bachelet noted in her speech, “With the symbolic start of this construction work, we are building more than a telescope here: it is one of the greatest expressions of scientific and technological capabilities and of the extraordinary potential of international cooperation”.

The highlight of the ceremony came with the filling and sealing of a time capsule which had been manufactured in the Paranal workshop by Patricio Alarcón and his team. The Director General started by depositing a copy of the ELT Science Case as foreseen in 2011. President



Figure 4. (Left) Roberto Tamai, Project Manager of the ELT; Paolo Astaldi, President of the Astaldi construction group; Tim de Zeeuw, ESO Director General; Michelle Bachelet, President of the Republic of Chile; and María Teresa Ruiz, President of the Chilean Academy of Sciences, watch the opening video at the ELT First Stone ceremony.

Figure 5. (Right) The glass plate donated by President Michelle Bachelet to be included in the time capsule. The legend in Spanish reads: “Abriendo el cielo de Chile a las preguntas de todo un planeta”.





Figure 6. The time capsule that was filled during the ELT First Stone ceremony, manufactured at the Paranal mechanical workshop. The cover includes a 1:5 scale reproduction of a segment of the ELT primary mirror, made in Zerodur®.



Figure 7. The ESO ELT Team braving the wind on Cerro Armazones on the day after the official ceremony.

Bachelet followed by depositing a copy of the lavishly illustrated book, “Atacama”, coauthored by ESO staff member Gerd Hüpdepohl. Next, the Director General unrolled two posters with the pictures and names of staff working at ESO at the time, which were held up by the Director General and the President to be shown to the audience, then rolled up again and left inside the capsule. At that point, a group of six school children from the town of Taltal, in whose grounds Cerro Paranal is located, were called upon to join the President and the Director General to place in the time capsule their drawings

describing what the observatory means for them. The Press Release¹ contains more details of the event, with photographs and videos.

Finally the President deposited a pen made of Chilean copper and the last item to be added to the time capsule was an elegant plate of glass, with the sentence “Opening the sky of Chile to the questions of a whole planet” written in Spanish, from President Bachelet (Figure 5). The time capsule was then closed with a cover that contains a 1:5 scale reproduction of a segment of the ELT primary mirror made in Zerodur®, the same material of which the actual segments will be made by Schott, with the flags of the ESO Member States and Chile engraved and a legend commemorating the ephemeris (Figure 6). The capsule is in storage at

Paranal, until the time when progress on the construction of the dome allows it to be encased in one of the walls, where its cover will be left visible.

Following the ceremony many of the guests paid a visit to the VLT telescopes, which the President was unfortunately unable to join because of another commitment. In parallel, the extension of the Chilean electrical grid, constructed by SAESA with the support of the Chilean Government, was celebrated and the Armazones power station, that converts the voltage from 66kV to 23kV, was inaugurated.

The First Stone event was also the occasion to introduce the team of the ELT Project Managers to Paranal colleagues. The agenda of the four-day ELT Team visit included: the presentation of the ELT team and updated status to Paranal colleagues; exchanges of experience and lessons learned, and discussions on subjects of mutual interest; an extensive visit to the telescopes and technical facilities; and a visit to Armazones (Figure 7). This contact will facilitate the assembly, integration and verification of the ELT and its smooth integration into the operations of the Paranal Observatory.



Figure 8. Past, present and future Directors General of ESO at the Paranal Residence. From left to right: Lodewijk Woltjer (1974–1987); Harry van der Laan (1988–1992); Catherine Cesarsky (1999–2007); Tim de Zeeuw (2007–2017); and Xavier Barcons (2017–). Regrettably, Riccardo Giacconi (1993–1999) could not attend the ceremony.



Figure 9. President Bachelet accompanied by most of the Paranal logistics team who played a major role in organising the ceremony.

The symbolic laying of the ELT First Stone coincided with the signature of the Armazones site handover to the ACe Consortium, following resolution of a number of technical and legal matters. From now on, access to Armazones will have to be approved by ACe. In the next few months, the on-site construction activities will begin giving shape to the gigantic telescope and change the physiognomy of Armazones forever. All the hard work will eventually lead to another, even bigger, celebration; the First Light of the ELT in 2024.

Acknowledgements

The success of the event and all the concurrent activities in the same week at the Paranal Observatory owes much more than can be described in this article to the Paranal logistics team led by Christine Desbordes (pictured in Figure 9); to the Education and Public Outreach Department led by Lars Christensen and by Laura Ventura in Chile; to the many colleagues working at Paranal who agreed to leave the comfort of their rooms at Paranal for a couple of nights stay in Antofagasta, thus making it possible for many important guests to stay at the Observatory on the nights before or after the First Stone event; to the executive assistants of the Cabinet and the Representation in Chile, Isolde Kreutle,

Jane Wallace, Priya Hein and María Adriana Arrau, for handling and coordinating the invitations, confirmations and transport schedules of many of the guests; and to the production company, Macoffice, which took care of the hardware for the ceremony, including the tent at Armazones whose installation was ultimately prevented by the wind. ESO is also indebted to the Presidential Avanzada team for their invaluable assistance and advice with the preparation of the ceremony.

Links

¹ Press Release on ELT First Stone: <http://www.eso.org/public/news/eso1716>

Text of Speech

Welcome

Tim de Zeeuw, ESO

President Bachelet, Ambassadors, Ministers Céspedes, Rebolledo and Williams, Members of the Congress, Senator Giannini, State Secretaries, Council President, Council delegates, Mr. Astaldi, Messrs Sammartano, Marchiori, Diaz and Allende, former Directors General Woltjer, van der Laan and Cesarsky, Director General designate Barcons, other distinguished guests, colleagues and friends, it is a pleasure to welcome you on this historic occasion.

It is unfortunate that the unusually inclement weather prevents access to the platform on Cerro Armazones, so we gather here in the Paranal Residence instead.

Let me start by taking you back about 150 years. In 1865, Jules Verne published a famous book entitled "The Journey to the Moon". It turned out to be uncannily prophetic, describing an Apollo-sized capsule with three persons on board, launched by a monster cannon located near Tampa in Florida, very close to Cape Canaveral. All at the initiative of an American gun club, with a key role for, yes, a French scientist.

It is probably less well known that the story also describes the construction of a giant telescope at 4300 metres altitude on Longs Peak

in Colorado, in order to be able to see the capsule orbiting the Moon. Verne calculated that this needed a telescope with a main mirror of 4.8 metres diameter, which was fully two and a half times larger than that of the largest telescope at the time, Lord Rosse's Leviathan of Parsonstown, Ireland. A bold step! Verne mentions that the telescope tube was 84 metres long and that the entire system was built in a single year. The site had of course to be in the United States for reasons of national pride.

It took a century before Borman, Lovell and Anders orbited the Moon in Apollo 8 in December 1968. It took another eighty years before Verne's giant telescope was built, not in Colorado but instead on Mount Palomar in California, and with an improved design. This

is the world-famous 200-inch telescope, often referred to as the Big Eye, and inaugurated in 1948.

Only 40 years later, technology had already advanced sufficiently to gain another factor of two in mirror diameter, and today a dozen fully steerable 8–10-metre-class optical telescopes are in operation, including the world-leading Very Large Telescope (VLT) here on Paranal. It is a distinct pleasure to recognise Lo Woltjer, who initiated the VLT project and got it funded and approved, Harry van der Laan who selected Paranal as the site, placed all the major contracts and designed the successful collaborative model for instrumentation development, and Catherine Cesarsky who brought the VLT to full operation. Riccardo Giacconi had a key role during construction and first light, but could unfortunately not be here today.

Nearly twenty years have passed since first light of the Very Large Telescope. ALMA has meanwhile been constructed on Chajnantor in Chile by an international partnership and is operational, and telescope technology has advanced again. Today we officially start construction of the Extremely Large Telescope (ELT). Its dome will have a diameter of 85 metres and a height of approximately 80 metres, so that Verne's telescope tube would fit. However, the ELT has a segmented main mirror with a diameter of an astounding 39 metres. This is a jump of a factor four to five over any existing telescope! The collecting area of the ELT primary mirror is nearly 1000 square metres, which is larger than that of all 8–10-metre-class telescopes in the world combined. Jules Verne would have liked it!

A revolutionary telescope needs an excellent site, and the choice of Cerro Armazones was the result of a world-wide site selection process, chaired by Rene Rutten, who is here today. The Chilean government generously extended the land donated to ESO in 1995 towards the east, so that it now contains both Paranal and Armazones, and ESO can operate the ELT as part of the Paranal Observatory. The first discussions on this topic were with President Bachelet during her previous term. The process was completed under President Piñera, with key preparatory work done by Ambassador Rodriguez of the Ministry of Foreign Affairs and by ESO's previous representative Massimo Tarengi. Since then ICAFAL, also represented here, have prepared the giant platform and a new access road, so that today we take the next step, again with President Bachelet. I am sure that the location of the ELT in Chile is a justified source of national pride, just as in Verne's story.

The Chilean government carefully protects the quality of the night skies and realises that the international observatories provide training and employment for many Chileans: telescope operators, technicians, engineers, astronomers and administrative staff. Chilean universities have developed internationally competitive astronomy programmes, and some have started engineering programmes for astro-technology, creating capabilities and know-how that will benefit Chilean society more generally. ESO is proud to be associated with this impressive growth of capabilities, which is also reflected in the fact that the President of the Chilean Academy of Sciences, María Teresa Ruiz, who will also speak today, is an internationally acclaimed astronomer.

Almost exactly a year ago, ESO signed the largest ever contract in ground-based astronomy with the ACe consortium, consisting of Astaldi, Cimolai and the nominated sub-contractor EIE Group, for the construction of the giant dome and the 3000-tonne telescope structure. Today's event marks the official start of the construction of the telescope structure and dome of the ELT.

Today also marks the connection of Paranal and Armazones to the Chilean electrical grid. The Chilean Government has helped ESO to find a solution for the supply of power to the Observatory, through the Comisión Nacional de Energía, la Superintendencia de Electricidad y Combustibles, and the Ministries of National Assets and Foreign Affairs and our consultants from MegaRed. The connection to the central grid in Paposo is managed by Grupo SAESA, and I am very pleased that it is represented here today. The grid connection will reduce costs, provide greater reliability and stability, and will also reduce the Observatory's carbon footprint.

It has taken 18 years to get to this point, thanks to the efforts of many people all over the world, including former Italian delegate Nanni Bignami who unfortunately passed away very suddenly two days ago. Roberto Gilmozzi initiated the precursor 100-metre-diameter OWL project, Riccardo Giacconi promoted it, Catherine Cesarsky oversaw the careful process that resulted in the start of a full design study in early 2007 for what was, by then, a single European project, and Jason Spyromilio led the extended design effort, carried out with industry in the Member States.

In the years that followed it was possible to convince the 15 ESO Member States to commit significant additional funding for the ELT Programme despite the financial crisis. I am very grateful for this support, which was provided

because of the enormous scientific return and ESO's track record in delivering quality. The key authorisation for construction was granted in 2014 under Council President Barcons, who is now the Director General designate.

Two other giant telescopes are planned, the Giant Magellan Telescope (GMT) on Las Campanas here in Chile, and the Thirty Meter Telescope (TMT) in the northern hemisphere. Together with the ELT, these telescopes will open a new era of discovery whose implications may well go beyond astronomy. The cooperation between these three projects to address technological challenges is yet another example of international collaboration for the sake of science. I am pleased to acknowledge our colleagues from GMT and TMT present here for this joint endeavour, as well as for providing the framework of a stimulating and healthy competition from which we all benefit.

The size of the primary mirror of the ELT, and the revolutionary telescope design which includes built-in adaptive optics to correct for the turbulence in the atmosphere, will make the ELT the world's biggest and sharpest eye on the sky for the foreseeable future. This giant leap in capability is as large as that experienced by Galileo when he first turned his telescope to the heavens!

The goal for its use is not that of Verne, to see details on the Moon, or the developments in the Moon Village proposed by the European Space Agency, or to watch all of Middle Earth, but instead to study the deep Universe, to resolve the light of nearby galaxies into that of its constituent stars, and above all to image and characterise the rocky planets that we now know orbit most stars. It is in fact possible that the ELT will find evidence for life on other worlds. It is ironic that this would be done from the magnificent desolation of the Atacama Desert.

The ELT construction effort is carried out by a large team with staff from across ESO, led by Roberto Tamai who works closely with ESO's top management. Many team members are here. Roberto will make sure that the construction will stay on schedule, so that what was once a dream becomes reality.

The ELT will no doubt produce discoveries that we simply cannot imagine today, and it will surely inspire numerous people around the world to think about science, technology and our place in the Universe. This will bring great benefit to the ESO Member States, to Chile, and the rest of the world. For this reason we seal the ELT time capsule today for all mankind.