

ESO Strategy for the 2020s

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The stability that stems from ESO's inter-governmental status provides the Organisation with the remarkable ability to plan its future years. During its almost 60 years of history, the commitment of ESO Member States towards long-term plans has enabled the resourcing and successful development of world-class projects on timescales of over a decade, projects that have resulted in ESO's building and operating some of the most powerful and scientifically productive ground-based observatories in the world.

Planning is therefore an essential activity. Defining the best plan is a challenge that requires considering a hierarchy of elements that starts with the mission (why we exist), followed by the vision (what we want to be), the values (what we believe in and how we will behave) and finally the strategy (what we want to achieve).

The ESO mission was described in the Convention¹ which entered into force in 1962 and has been ratified by all Member States. In today's wording, ESO's mission is twofold: building world-class astronomical observatories on the ground and fostering cooperation in astronomy. The current ESO vision was implicitly adopted back in 2004 when Council approved the previous version of the strategy, which positioned ESO to deliver the Extremely Large Telescope (ELT) while keeping Paranal and the Atacama Large Millimeter/submillimeter Array (ALMA) at the forefront. The ESO strategy^a approved by Council at its 104th meeting in December 2004 was formulated around the following goals:

- Retain European astronomical leadership
- Complete ALMA and start its efficient scientific exploitation
- Maintain the world-leading position of the VLT, and deploy its 2nd generation of instruments

- Exploit the unique capabilities of the VLT Interferometer (VLTI)
- Build an Extremely Large Telescope on a competitive timescale
- Continue the successful partnership between ESO and its community

The success with which ESO was able to reach these goals has been remarkable. A few indicators are worth mentioning:

- The efficient operation of its facilities coupled with its engagement with the community has allowed ESO to remain a world-wide reference in ground-based astronomy, as evidenced by more than 1000 refereed papers published every year using data obtained at ESO's facilities².
- ALMA construction was completed and operations are now in full swing. The ESO region is the most highly oversubscribed in regard to ALMA observing time, and astronomers from the ESO region are first authors of about 40% of all papers published with ALMA data.
- The 2nd generation of VLT instruments has been completed and is in very high demand by the scientific community, eager to use the new capabilities offered^b. A rolling plan to keep the instrument complement at Paranal competitive is in place and resourced in ESO's long-term plan³.
- The VLTI infrastructure overhaul has been completed and the 2nd generation of VLTI instruments delivered with here again a very high demand from the community^c.
- ESO's ELT, the largest of its kind, has been in construction since 2015^d and is fully funded^e, and the first science observations are planned for the second half of the decade.
- Instrument development in partnership with institutions in the Member States has continued for the VLT and the VLTI, and the same model has been adopted for the ELT instruments, with the first-light instrument already well underway.

Given these outstanding achievements in meeting the goals defined in its 2004 strategy, the ESO Council decided in 2019 to revisit this strategy and the associated goals in order to keep up the organisation's momentum and success rate over the next decade (2021–2030),

in particular for its ongoing flagship project — the construction of the ELT.

At its 150th meeting in June 2019, the ESO Council mandated its Strategy Working Group (SWG) to review the 2004 strategy and to propose to Council an updated document that will guide the organisation over the next decade. The SWG members included Council delegates Amina Helmi, Isobel Hook, René Michelsen, Martin Thomé, Christoffel Waelkens (Chair), and ex-officio members Willy Benz (Council President), Denis Mourard (Scientific Technical Committee Chair), and Xavier Barcons (Director General).

Following the Council mandate, the SWG met twice in the following eight months and status reports were given to Council and discussed in the Committee of Council (CoC) meetings of October 2019 and March 2020. A report detailing the findings of the SWG was presented at the Council meeting in June 2020 and a first draft of the final document discussed by the Committee of Council in October 2020. Hence, despite the difficulties caused by the inability to meet in person during most of 2020, Council invested a significant amount of time in thorough discussions about the best way to extend the strategy that led to the successes of the past decade and a half. Finally, the document outlining the strategy for 2021–2030 was met with unanimous approval at the 155th meeting of Council in December 2020 and is presented below.

In parallel, Council mandated the executive to generate a draft proposal for a statement of ESO's values, taking into account both internal and external input. A proposal is expected to be submitted to Council for approval in 2021.

Finally, Council also expressed the need to develop a collective look at the ESO vision, i.e. what the organisation should become in the long term, beyond the clear strategic milestones agreed. Discussions on this topic have been deferred to a post-pandemic era, when the necessary face-to-face meetings can be resumed.

The rest of this article is taken verbatim from the corresponding sections of document ESO/Cou-1911 conf. as approved

unanimously by the ESO Council in December 2020.

Preamble

Astronomy, arguably the oldest science, is currently enjoying a golden age. Curiosity-driven astronomy has led over the last 50 years to the development of innovative technology that has not only led to a better understanding of the structure and evolution of our Universe and our place within it but also found its way in applications permeating our daily life. From enhanced image and sophisticated signal processing to the development of extreme adaptive optics and data science, astronomy has been at the very root of innovation in ideas and technology. And yet, this development process is only just beginning! The coming decades will see revolutionary observatories coming online covering the sky at different wavelengths and based on equally revolutionary technologies, many of which are still in development.

When ESO was founded in 1962, its mission was to “establish and operate an astronomical observatory in the southern hemisphere, equipped with powerful instruments, with the aim of furthering and organising collaboration in astronomy”. For Europe, it was a revolution starting with five member countries and relatively modest means compared to current standards. Today, with sixteen Member States, one strategic partner, and Chile as the long-standing and trusted host state of the telescopes, ESO builds and operates the most powerful and innovative infrastructure in the world for observational astronomy from the surface of the Earth. This infrastructure edge provided by ESO to the European astronomy community translates into a world-wide scientific leadership in many areas of astronomy. Concurrently, ESO has also pushed for increased collaboration in astronomy by taking ownership of the European participation in ALMA and becoming one of its main Parties, and should continue with hosting and operating the southern array of CTA. Other examples include ESO taking responsibility in coordinating national publications towards the European journal ‘Astronomy and Astrophysics’ or developing science and technology joint programmes with ESA.

At the core of this success lies arguably not just the mere increase in the number of Member States but also the model of cooperation that has been developed over the years, which strongly involves the community within the Member States in all new large developments. This transparent bottom-up process has led to a culture of trust and consensus between the Member States greatly facilitating discussions, decisions, and the definition of common goals or vision.

Emerging from these successes and this culture of consensus is a common vision of the role of ESO for the decades to come: The Organisation should strengthen its position as the world-leading organisation in ground-based astronomy enabling the best opportunities for new discoveries. As such, it should consolidate its position as a key actor on the world-wide scene of existing and future large astronomical facilities regardless of wavelength or messenger by fostering collaboration and synergy. For the next decade, completing successfully the ELT with its original powerful suite of instruments is clearly a central element of strengthening this leadership.

The strategic goals define ways consistent with values prevailing in the Organisation to achieve the vision above, which itself derives from the mission statement. As the SWG embarked on its task, it was realized that while ESO’s mission statement is clearly defined in the Convention and its vision shared among the members of Council, its values needed to be more explicitly defined. A separate document defining ESO’s values is being prepared by the Executive for later discussion and eventual approval by Council. Notwithstanding this document, the resolution below defines the strategic goals which will allow ESO to reach its vision and fulfil its mission over the next decade.

Resolution

ESO Council, considering the report of its Strategic Working Group and recognising that:

- astronomy continuously delivers scientific discoveries of fundamental importance and with a broad societal impact,

and is expected to continue doing so during the coming decade, as new cutting edge technologies enable the development of new generations of telescopes and instrumentation,

- ESO’s role in astronomical research has been steadily increasing throughout the history of the Organisation, relying on highly competent and dedicated staff and fruitful collaborations with the community,
- the successful collaboration between the ESO Member States on science and technology has been of paramount importance for ESO to become the undisputed world leader in ground-based optical-infrared astronomy, and that furthering international collaboration beyond ESO’s boundaries has led to a unique astronomical facility in sub/mm astronomy,
- this constructive collaboration between the ESO Member States should remain the driving force ensuring that ESO can continue its mission for future generations, with an open view on new members and collaborations,

adopts the following strategic milestones for ESO during the decade 2021–2030:

- Implement and operate the ELT as the world-leading extremely large telescope, by
 - a. Enabling the delivery of the fully completed ELT on a competitive timescale;
 - b. Ensuring that the telescope is equipped with the state-of-the-art instrumentation necessary to meet its overarching science goals;
 - c. Engaging fully with the community to ensure the best use of the telescope and its instruments;
 - d. Preparing an ELT archive consistent with ESO-wide standards.
- Ensure that the current facilities remain at the forefront of astronomical investigations, by
 - e. Ensuring, in partnership with the community, that VLT, VLTI, ALMA (with ESO’s partners), including their instrumentation, continue to be state-of-the-art;
 - f. Allowing flexibility to adapt to the changing scientific landscape including multi-messenger astronomy and, accordingly, towards new modes of operation;

- g. Considering the role of La Silla for the ESO community within this evolving landscape;
 - h. Maintaining a high-quality archive and data-management tools for all ESO telescopes, including ELT.
- Ensure that the Organisation is prepared for future projects when financial projections so permit, by
 - i. Engaging with the community in evaluating the evolving international astronomical landscape and to assess the emerging science cases, taking advantage of the time ahead to have an open view on the nature of future projects;
 - j. Maintaining some resources for conducting feasibility studies of promising projects and of their associated technologies;
 - k. Developing a future-oriented human-resource policy consistent with the long-term perspectives that ensures the availability of the needed expertise;
 - l. Being ready to start the selection process for a new project, possibly in collaboration, later in the decade, and only when the financial perspective is clear.
 - Retaining ESO’s leadership role in astronomy, by
 - m. Reinforcing ESO as a stand-alone organisation with its specific domains of excellence, with emphasis on efficient governance, while ensuring ESO remains agile enough for collaborations with other organisations on a case by case basis;
 - n. Outreaching effectively to the citizens in the Member States and beyond to share with them ESO’s discoveries, milestones and plans for the future;
 - o. Coordinating distributed centres of expertise within the ESO community (e.g. ARC nodes, VLTI centres of expertise), and exchanging expertise and training through studentships and fellowships as well as scientific meetings;
 - p. Conducting a technology development programme which enables developing and operating current and future facilities, in collaboration with institutes and industry in the Member States;
 - q. Exploiting the scientific synergies with other organisations (ESA, GW detectors, CTA, SKA) exploiting facilities in a multi-messenger astronomical environment.

Links

- ¹ The text of the ESO Convention can be found in the book Basic Texts Convention and Protocols: www.eso.org/public/products/books/book_0017/
- ² The ESO Publication Statistics is derived from the Telescope Bibliography (telbib) database and can be found here: http://telbib.eso.org/pubstats_overview.php
- ³ See, for example, the Paranal Instrumentation Programme Plan and 6 Monthly report of September 2020, presented to the ESO Council at its December 2020 meeting: https://www.eso.org/public/about-eso/committees/cou/cou-155th/external/Cou-1912_162ndFC_PIP-6month_final.pdf

Notes

- ^a The ESO Council resolution on Scientific Strategy from 2004 can be found in *The Messenger*, 2005, 119, 2.
- ^b Until end of 2020 the number of refereed papers that have used data from 2nd generation VLT instruments are: MUSE (494), KMOS (83), X-shooter (796) and SPHERE (223).
- ^c After the commissioning of GRAVITY and MATISSE, VLTI observing time requests reach 200–250 nights per semester, a clearly higher request than prior to P95 when the infrastructure upgrade began (F. Patat, ESO Observing Programmes Office).
- ^d ESO Council confirmed the approval of the ELT Programme at its December 2012 meeting and authorised the start of Phase 1 of the ELT construction at the December 2014 meeting.
- ^e At its December 2020 meeting, the ESO Council committed the funding for the entire set of activities included in building the ELT and bringing it into operation.

Juan Carlos Muñoz-Mateos/ESO



This beautiful photograph of the glimmering arch of the Milky Way as seen through a crystal ball, shining with billions of stars and entwined patches of gas and dust, offers an intriguing perspective on our home galaxy. It was taken by ESO’s Photo Ambassador Juan Carlos Muñoz-Mateos, who hopes to “help others feel what it’s like to look at the night sky from one of the darkest and most barren locations on Earth” — the Atacama Desert, home of ESO’s Paranal Observatory.