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THE EUROPEAN ELT: STATUS REPORT

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Abstract. This paper provides a brief status report on the European Extremely Large Telescope (ELT) as presented at the annual meeting of the SF2A held in Paris in June 2006. ESO, together with its community, is defining at rapid pace the contours of the E-ELT, with the aim of finalizing the project baseline by the end of 2006 for immediate study and development under a timescale competitive with other projects. We also briefly review the status of the ELT activities in France.

1 Introduction

Since the previous status report at the 2005 SF2A meeting, the situation of the European ELT has considerably evolved. A review of the OWL-100 m project took place in November 2005. The review board praised ESO's efforts for producing and in-depth Conceptual Design Study which had lasting value for the design and construction of an Extremely Large Telescope. However, the board identified a number of serious risk areas, including budget and development timescale, and therefore recommended that the project proceed to Phase B with a down scaled design that would better balance science return, competitiveness, risk, performance and affordable cost.

The OWL design will remain in the history of telescope projects as an amazingly ambitious project that was truly breaking the traditional 'factor of two increase in diameter every 50 years'. OWL will also remain in history as the first plausible project that was purposely aimed at imaging, for the first time in human history, earth-like planets around stars other than the Sun. With a smaller diameter, this goal will be significantly harder to achieve.

Considering the outcome of the review and the ESO Council's resolution on scientific strategy commanding that 'ESO's highest priority strategic goal must be the European retention of astronomical leadership and excellence into the era of Extremely Large Telescopes', ESO took a series of actions to proceed with a rebaselining of the European ELT Project, with the aim of proposing a baseline reference design involving the community by the end of 2006.

2 The E-ELT program

ESO set up five working groups dealing with Telescope, Science, Instrumentation, Adaptive Optics and Sites. Within 3 months, these working groups delivered their reports, capitalizing on previous work performed as part of the OWL study and on the ELT science case elaborated by the OPTICON ELT working group. A sub-committee of ESO's Scientific and Technical Committee (STC) was setup: the Engineering and Scientific ELT Committee (ESE), which includes the chairpersons of the five working groups. In the meantime, ESO setup an ELT project office, headed by J. Spyromilio, and R. Gilmozzi as P.I. of the project. Meanwhile, ESO's council established an ELT Standing Review Committee to report directly to him.

The French (non-ESO) members participating to these various working groups and committees are: J. Bergeron (Science WG), J.-L. Beuzit, M. Ferrari (Adaptive Optics WG, chaired by G. Rousset), G. Lemaitre (Telescope WG), V. Coude du Foresto and J. Vernin (Site WG), J.-G. Cuby (Instrumentation WG). The French members of the ELT Science & Engineering Committee (ESE), acting as a sub-panel of ESO's STC, are G. Rousset and J.-G. Cuby. J.-L. Puget is member of the ELT Standing Review Committee (ESRC).

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The five working groups delivered their reports in March / April 2006, and these reports are available on the ESO web page (http://www.eso.org/projects/e-elt).

The Science WG revisited the ELT science case previously elaborated under the auspices of the FP6 OPTICON program, in particular in the light of the reduced telescope diameter. The instrumentation group listed up to 12 instruments that could be contemplated to cover the parameter space, without, in this early exercise, attempting at combining or prioritizing them. The telescope WG evaluated a number of possible telescope designs with a diameter of 42 meters (geometric average of area between 30 and 60m) that could be up or down scaled in the range 30 to 60 meters. The Adaptive Optics WG synthesized the AO requirements for an ELT, proposing baseline developments and roadmaps for AO developments, including technological developments and demonstrators. The Site WG categorized site characteristics, listed all sites considered throughout the world and compiled the available information.

After this initial work, ESO's project office started to design two 42m telescope designs, one of Gregorian type, and one with 5 mirrors, see figures 1 and 2. Work proceeds on the Basic Reference Design, which will be presented at STC in October 2006, then to the ESRC in November, and finally to the community at a conference to be held in Marseilles (France) from November 27$^{\rm th}$ to December 1$^{\rm st}$. The outcome of this Basic Reference Design, its evaluation by ESO's committees, and the initial feedback from the community will then be presented to ESO's council in December 2006 with the aim of approving the selected design(s) and giving mandate to Council members to seek the additional money required for the construction of the project.

At this point in time, ESO is working on a baseline budget of 700 MEuros approximately, part of this budget being available in the long range plan of the organization. The timescale is competitive, as requested by Council, and foresees first light in 2015.

The ESO E-ELT program is complemented by an FP6 program, the ELT Design Study, started in 2005 for 4 years. The ELT Design Study is a technology development program, originally aimed at generic technological developments. It is anticipated that some ELT Design Study activities will be re-adjusted to provide better focus with the E-ELT program as it develops at ESO. It is worth noting that the site evaluation activities are mostly carried out within the FP6 program. The sites currently tested by the Europeans are in Chile, Argentina, Canary Islands and Morocco.

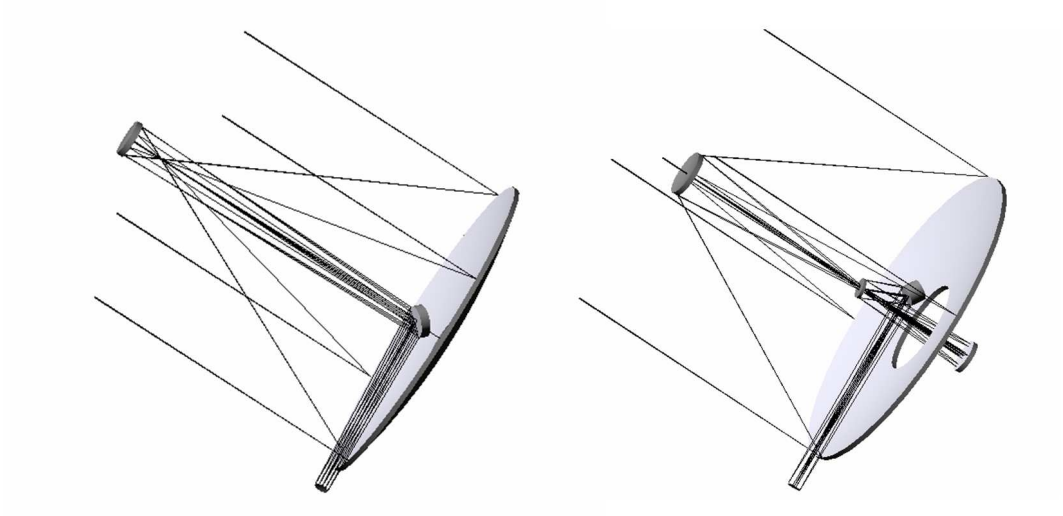

Fig. 1. The two optical designs of the European Extremely Large Telescope currently evaluated by ESO in the context of the Basic Reference Design. Left: Gregorian design, Right: 5 mirror design. The 5 mirror design, if in appearance more complicated because of the extra mirrors, is in practice more compact – like a traditional Ritchey-Chretien design – and provides for an easier integration of adaptive and tip-tilt mirrors in the telescope

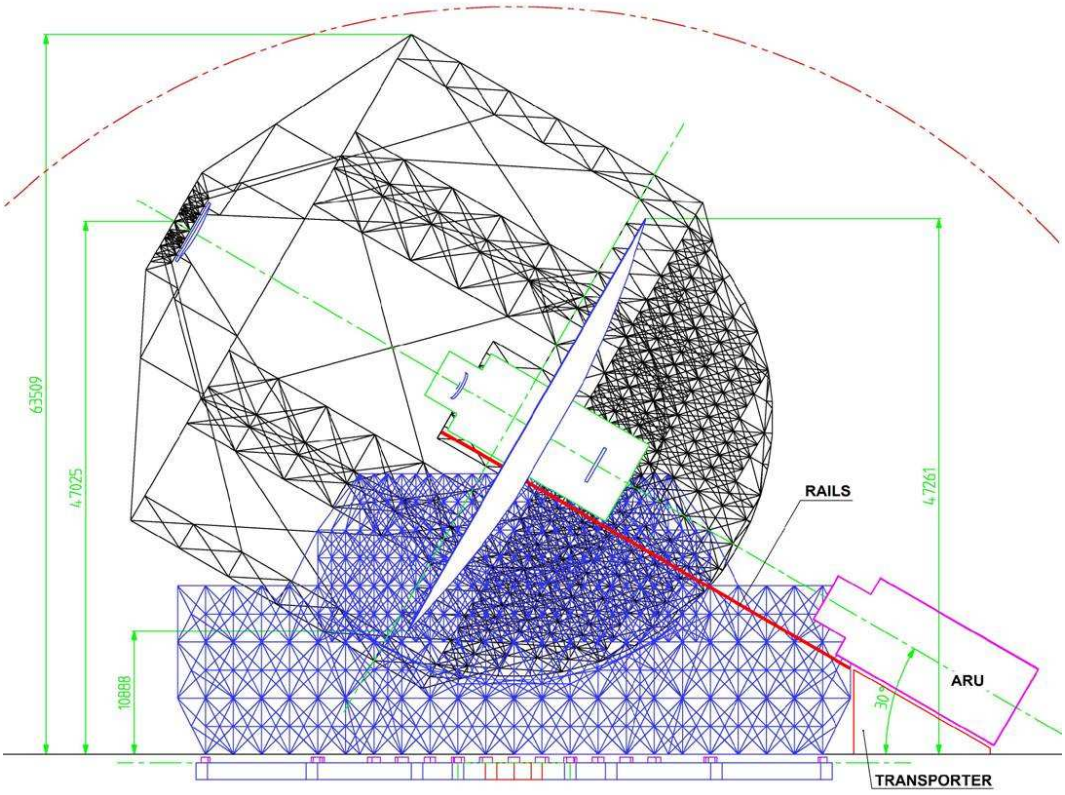

Fig. 2. Structural view of the European Extremely Large Telescope currently evaluated by ESO in the context of the Basic Reference Design. The azimuth structure has 4 tracks, 370 m in total length, and weighs 2500 tons ; the altitude structure has 4 cradles, 230 m in total length and weighs 2800 tons. The mass of the primary mirror is $\sim$ 220 tons. This view corresponds to the 5 mirror design, illustrating the integration and / or maintenance operation of the central 5 mirror unit.

3 French ELT activities

There is in France an ELT Working Group setup by INSU, see http://www.oamp.fr/elt-insu/. This group is in charge of surveying the ELT activities in Europe and coordinating the French activities. A roadmap is being elaborated, which includes R&D, scientific and instrumental activities. There are clearly two ELT highlight science cases where the French interest is strong, supported by instrumental developments, namely: the multi-object near IR spectrograph for cosmology and the high contrast imager for exoplanet studies. The relevant institutes are working together, in the European context, to join their efforts and their expertise. Meanwhile, the national programs (INSU) are including the E-ELT in their long range perspectives. These activities are also supported at regional level, in particular in the framework of the national 'Pôles de compétitivité'. These actions have allowed to get initial support from the newly setup 'Agence Nationale de la Recherche' (ANR), and will help seeking more support from ESO and FP7.

4 Conclusion

The year 2006 is a year of transition in the E-ELT program. ESO is pursuing an aggressive development towards the Basic Reference Design of an Extremely Large Telescope, the E-ELT, with a $\sim$40 m diameter. The aim is to complete this design in 2006 for a development of the project in a competitive timescale for first light in 2015.