Developing the most powerful ground-based astronomical facilities

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ESO – European Southern Observatory

Public
The ESO Mission

- ESO (European Organisation for Astronomical Research in the Southern Hemisphere), intergovernmental organisation

- Mission (Convention 1962):
  - Build and operate world-class ground-based astronomical facilities
  - Foster collaboration in Astronomy

- ESO enables:
  - Scientific discoveries & understanding of the Universe
  - Other: Development of new technologies, impact in economy, international cooperation, education, training etc

- Complementing other ground & space facilities

- In collaboration with scientists, R&D institutes and industry
Currently 16 Member States
- Last: Ireland (2018)
- 10-year partnership with Australia in La Silla Paranal programme 2018-2027
- Brazil and ESO signed accession agreement in 2010, but accession process incomplete. BR not a member of ESO, but welcome to join/renegotiate at any stage

Personnel ~700+.

ESO Programmes:
- La Silla Paranal – in operation
  - La Silla
  - VLT/I Programme in Paranal
  - APEX (Partnership MPIfR/OSO/ESO)
- ALMA (Partnership ESO/NSF/NINS) – in operation
- ELT – in construction
- CTA-S – finalising design phase by CTAO

ESO is a key actor in the European Research Area, with a central role in European astronomy (EIROForum, ASTRONET, cooperation with ESA, CERN, EC/ESFRI…)
La Silla

and many hosted telescope projects…
VLT system

Status 2019
VLT first light on the night of 25 to 26.05.1998 on UT1

Planetary Nebula NGC 6302
Unique successful test of General Relativity around the SgrA* BH

ESO builds the telescopes and all the infrastructure

Instruments developed in partnership with consortia
- ESO provides capital costs and oversight
- Effort from consortia compensated by GTO

ESO operates the entire facility
- Technical downtime < 3%
Largest sub/mm radio interferometer
- In operations since 2011

Global partnership: ESO, NSF (NA) and NINS (EA)
- Executives are AUI/NRAO (NA), ESO and NAOJ (EA)
- On-site operation by JAO (Joint ALMA Observatory)

Array Operations Site in Chajnantor (5050m)
- 66 (movable) antennas, over a 16 km plateau
- Back end and correlator

Operations Support Facility at 3000m, near San Pedro de Atacama
Science operations

- Cycle 5: 3800 hr obs
- Cycle 6: on-going
  - 66 antennas available
  - Target > 4000 hr
- Cycle 7: >1800 proposals submitted

Science production: more than 1200 refereed papers so far

- Typically, the ESO region
  - Submits 41% proposals
  - Leads 41% of the papers
  - Allocated time: 34%

ALMA development:

- Development roadmap for next decade focused in doubling sensitivity
Largest optical/infrared telescope in the world

- 39.3 m segmented primary mirror & adaptive optics
- Transformational science objectives
  - Including exo-earth, galaxies and first light
- Construction 2015-2025 (~1200 MEUR)
- On Cerro Armazones, to be operated as part of the Paranal system
  - Operations costs foreseen in ESO’s budget
ELT progress

M1 LCS Development Status

Subsystem | Libraries and Applications
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RuntimeDB | LFC (old) LFC (prod)
Data Framework | FEAdapter, FE/Galileo, FE/Mono, FE/ES/Mono, FE/PacMon, FE/NetMon, FE/NetMonitor, FE/Mono, FE/PacMon
Sync | rpckeeper, rpdeep, rpdeepMon, rpdeepNet
Net | NetAdapter, NetMon, NetConfig
PDC | PDCAdapter, PDC/Mon, PDC/Config, PDC/Config, PDC/Config, PDC/Config
FDIR | FDIRAdapter, FDIR/Config, FDIR/Config
Data Recorder | DataRecorder
Scripts | Test/Configuration, Test/LC
GUIs | FE (pynode), RuntimeDB (QDbrowser), Status
Common | RPClient, CDeamon, CMonitor
Tools/Config | RPClient, CDeamon, CMonitor, RPClient, CDeamon, CMonitor

* = 1st version available, ** = in progress, *** = not started
CTA and ESO

CTA-Southern array to be hosted and operated by ESO in the Paranal-Armazones area
Science enabled by ESO

1090 papers in 2018
>30% use archival data

The legacy of Riccardo
Made the strong point that ESO should focus on what individual member states cannot do alone

Aligned the entire ESO strategy to deliver the VLT, supporting rigorous approach to project development
  ➢ Installed yearly “VLT reviews”

Postponed the VLTI, securing all civil work and basic infrastructure to let it develop in the future

Overall science drive and service to the community

Agreed with Chile the current legal framework ”Acuerdo interpretativo…” (1995)

Channeled European efforts to participate in ALMA through ESO, as an equal partner with the USA
Thank you!