

Control Systems in ESO's Telescopes and Instruments

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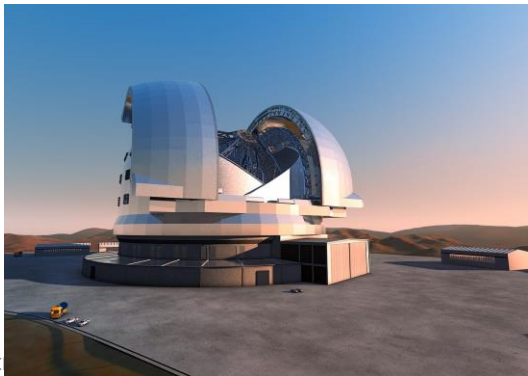
- Introduction
- The ELT
 - Control System
- The VLT
 - Maintenance
 - Obsolescence
 - VLT/ELT Interoperability
- Instrument Strategy

- Presentation gives some examples of Control Systems in ESO's telescopes & instruments
- Control systems often built in house supported by dedicated industry contracts for components (example: ELT M1 LCS)
- In other cases, control systems are part of larger contracts for subsystems (example: ELT M2/M3/M4/M5)

- ESO's industry contracts very different in volume:
 - From few kEuro to several 100MEuro
- Chances for small companies as well as major global players
- Different kind of contracts:
 - Complete (sub-)systems
 - Components
 - Manpower
 - Know how/consulting

The Extremely Large Telescope (ELT)

- Largest optical/infrared telescope in the world
 - 39m segmented primary mirror
 - Science: exo-earths, deep universe, resolved populations
 - Construction ongoing
- Project
 - Construction 2014-2027, on Cerro Armazones
 - ESO cost: ~1300 MEUR incl. instruments and contingency



See:

<https://elt.eso.org/about/webcams/>

■ ELT Control System implementation is distributed

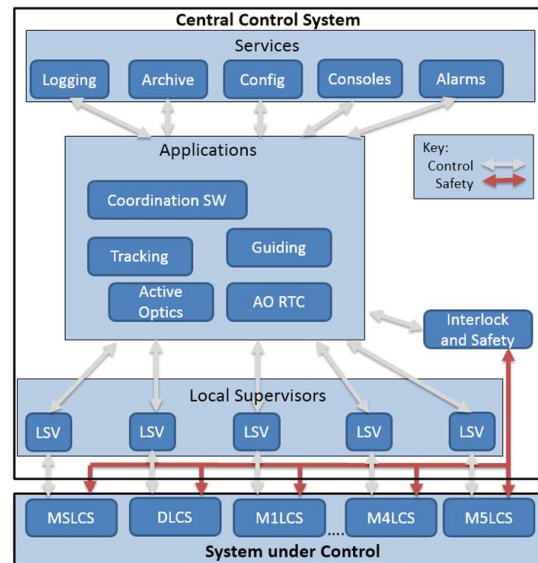


Contracts:

- Subsystems with their Local Control System (LCS)
- Dedicated SW contracts

ESO:

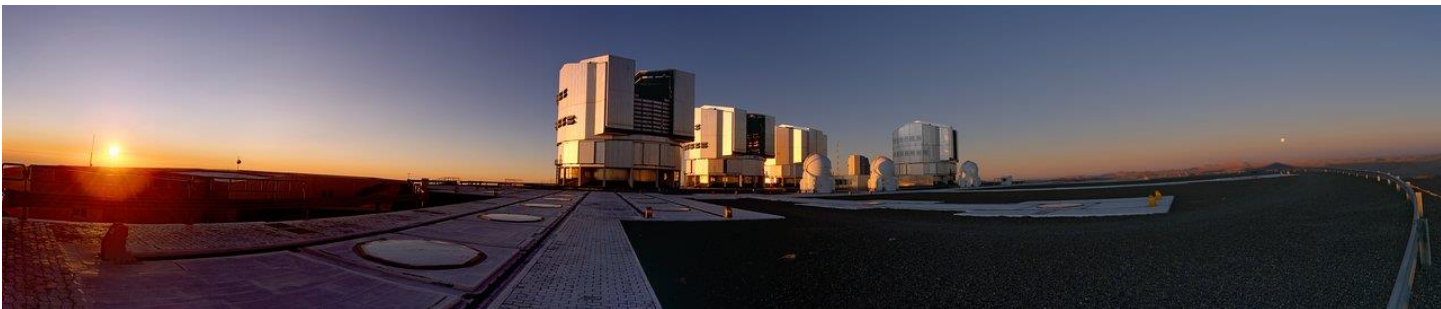
- Central Control System
- Local Supervisors
- M1LCS



- Subsystem LCS's in development by suppliers
- M1LCS: first version available and under test
- Central Control System and Local Supervisors in development at ESO
- Support for ESO internal development by outsourcing contract
 - Call for tender planned for Q4/2022
 - Up to 4 FTE/year for up to 5 years
 - Contribution to CCS, LSVs and related activities

The Very Large Telescope (VLT)

- In operation since >20 years
- 4 unit telescopes (UTs) with 8.2m primary mirror
- 3 instruments per UT
- 4 additional auxiliary telescopes (ATs) with 1.8m
- Interferometer (VLTI) with additional instruments



- The control SW for VLT/VLTI consists of >2 million NLOC
- New release every year
 - ~200 bug fixes
 - ~50-100 changes due to new features and improvements
- New features mainly from requirements of new instruments and infrastructure
- Supported by outsourcing contract
(4 FTE per year over 2+1+1+1 years)

- Years of operation bring obsolescence problems
- Projects to upgrade/refurbish usually done in house
- Examples:
 - Replacement of electronic components
 - Introduction of new standards (e.g. VME -> PLC)
 - SW changes often a consequence (drivers, OS version)
- Some parts of the work contracted; HW to be purchased
- The total budget over next 5 years for upgrades is ~1.5 MEUR (not limited to control systems)

- ELT and VLT Operations to be done by one common team
- Some upgrade of VLT components to ELT technology under obsolescence projects
- Activities for integrated operations being discussed/planned right now
- Examples:
 - Common SW environment (repository, build structure, ...)
 - Common alarm system
 - Common data flow tooling

- Instruments for VLT and ELT are mainly built by consortia (institutes and universities)
- Typical development time: ~5 years
- Lifetime of instruments 10 – 15 years
- Consortia follow ESO's technical standards (Electronics, cryo, ...)
- Instrument SW built on base of ESO's Instrumentation Framework



- New frameworks for ELT instruments:
 - ELT IFW (Instrument FrameWork)
 - RTC Tk (Real Time Computer Toolkit)
- New VLT instruments also based on IFW and RTC Tk
- Several releases of IFW and RTC Tk to consortia made already; development of additional functionality continues
- Possibly some contribution by outsourcing contract (see ELT)



Questions

