Remote Operation at Paranal

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Public

Quick introduction

- We are not doing in Paranal Remote Operation in the sense that APEX does (cf presentation by Carlos de Breuck)
- But we do support visitor observation
- And we do support a lot of technical activities remotely.
- The arrival of the European Extremely Large Telescope (ELT) will require developement and implementation of an infrastructure to support operation remotely.

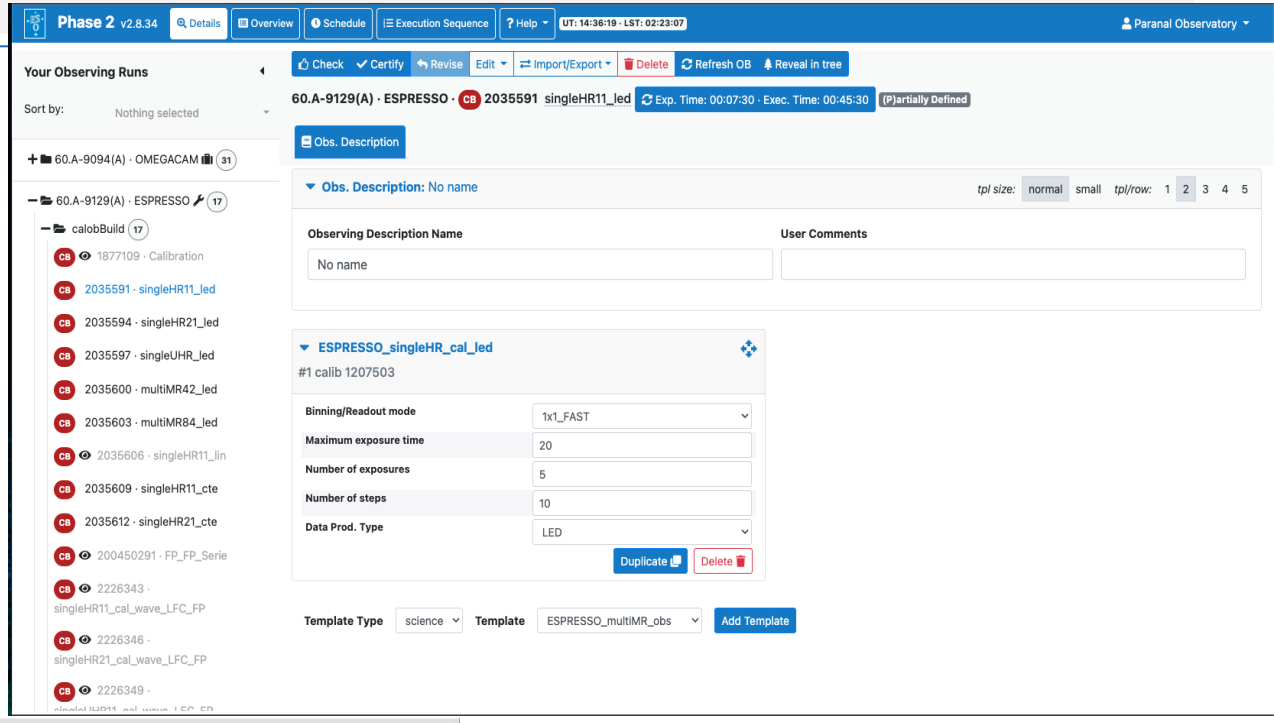
Operation modes in Paranal

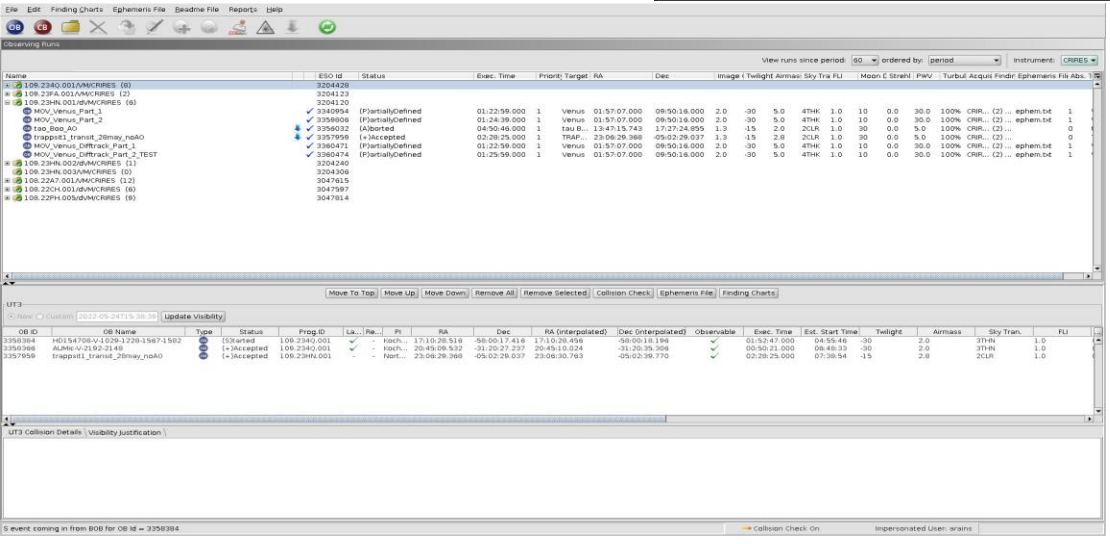
- We have 2 main mode of observation in Paranal
  - Visitor Mode: observer travels to the site and is assigned time on a specific date
  - Service Mode: PI of the approved programs prepare their observation on form of Observing Blocks that are then available in Paranal. . The night-time crew on Paranal will then select the observation according to the outside conditions and the science priorities.
- Additional observing mode for transient:
  - Target of Opportunity for observation that have to be done on the following 1 to 4 nights
  - Rapid Response Mode: To be done within minutes from activation to follow fast track transient

Preparation of the observation

Preparation from Home with the Observation Preparation tool: p2

Observation in Paranal with our Visitor Observation Tool, vOT





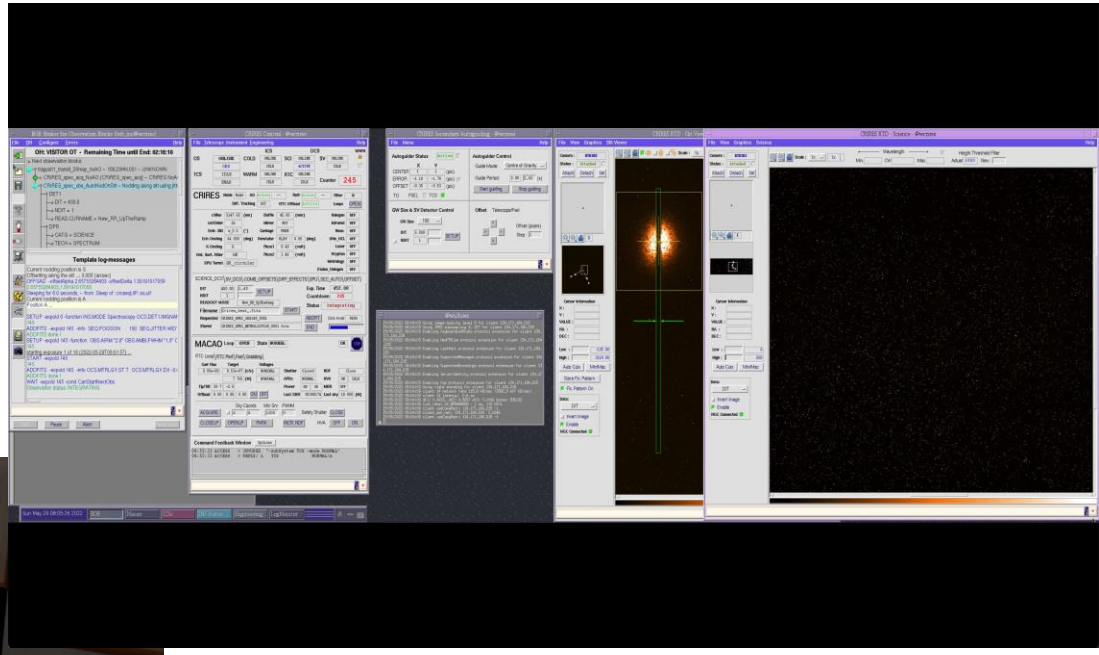
OB prepared at home are saved in a DataBase in Garching. From there they are synchronized in a local DB in Paranal and made available for execution.
Modification made in Paranal are also synchronized via the same process and visible in p2

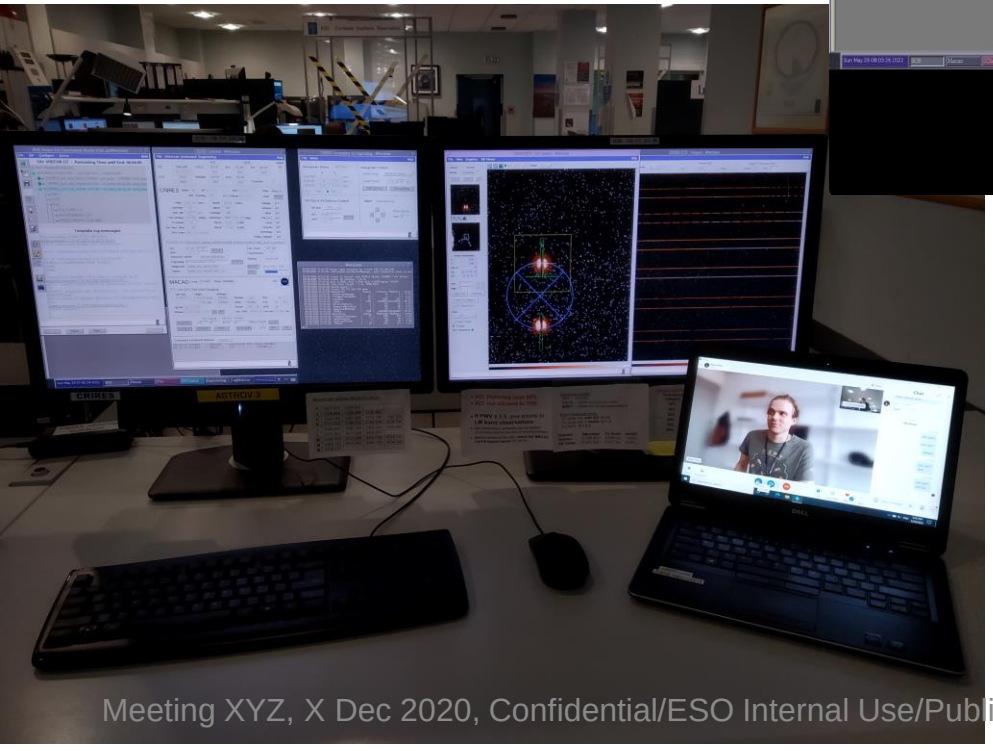
A new mode of observation

- This way of preparing and replicating observation allowed to implement a new mode: Designated Visitor mode (dVM)
- Observation scheduled at a fix date but executed from “home”
- Mode was implemented for:
  - Short observing runs (up to 1night) or
  - For observing run made of a number of slots over a long time but each one short in general 0.5 nights each.
- Observor from home can modify his observation on the fly.
- He has access to the data (including selected processed ones) from the ESO archive in Garching in less than 5 minutes
- The observor can also see the observation live via our eavesdropping software: POEM

dVM setup

In Paranal





POEM at home

Benefits and drawbacks of dVM

- Less travel between Chile and Europe minimizing our carbon footprint and cost
- Add flexibility to the schedule for short runs or run with multiple slots
- But only dVM would reduce the connection to the scientific community that visitor mode on site brought.
- During the Covid pandemic, we could restart VM observation faster allowing also dVM for run longer than the defined ones.
- We are restarting regular VM soon but will consider the balance between the two modes for the future.
- Longer term in the ELT era, such mode with added flexibilty (flexible dVM) should be explored to optimize the science return.

Access policy to the control network

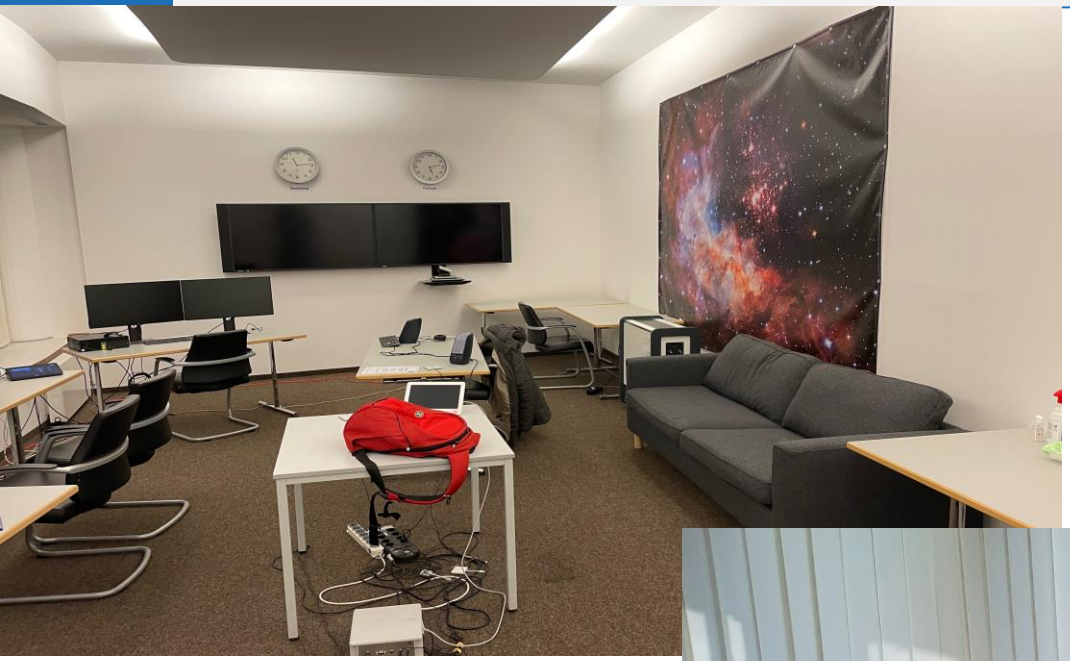
- Control network in Paranal is extremely protected.
  - Connection between the various telescopes are protected to avoid risks
  - No connection from the outside world is allowed
  - Limited connection even from other networks in Paranal.
- To allow support from Santiago/Garching we implemented a specific configuration:

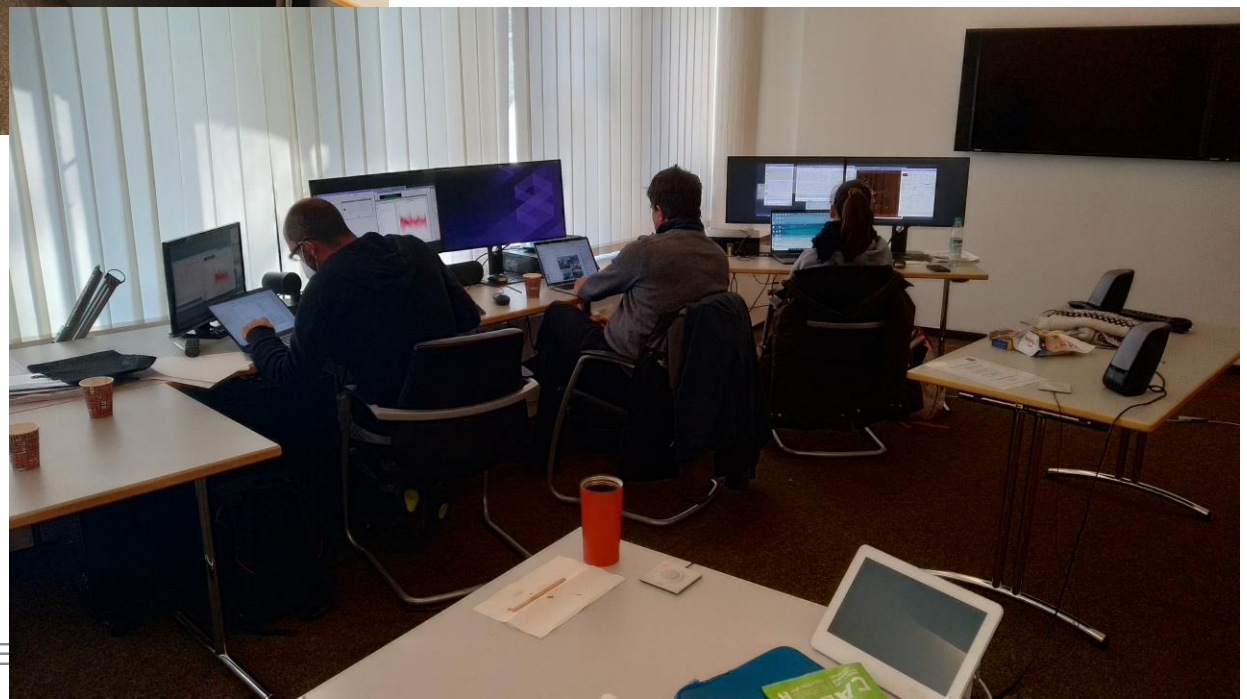
Remote Access Facility (RAF/G-RAF)

From this specific set of computers installed in specific rooms with access control, you are for all intent and purpose within the control network.

And as such you can access all the operational machines in the Control Room.

RAF/GRAF configuration





Usage of the RAF/GRAF

- RAF/GRAF is not planned to support regular operation or visitor observation.
- Support of commissioning/technical activities with the following use case:
  - Support from experts/commissioning teams from Garching during long period of technical time
  - Support of astronomers/engineers from Vitacura when only limited of time is needed
  - In case of emergencies requiring specific expert.
- During the Covid Pandemic this allowed us:
  - Support the restart of operation after the closing of the observatory
  - Provide support for regular operation to limit the staffing on the mountain
  - Support critical activities/maintenance that were delayed by the closing
  - Support commissioning of new systems as they were arriving on the mountain while reducing staffing on site.

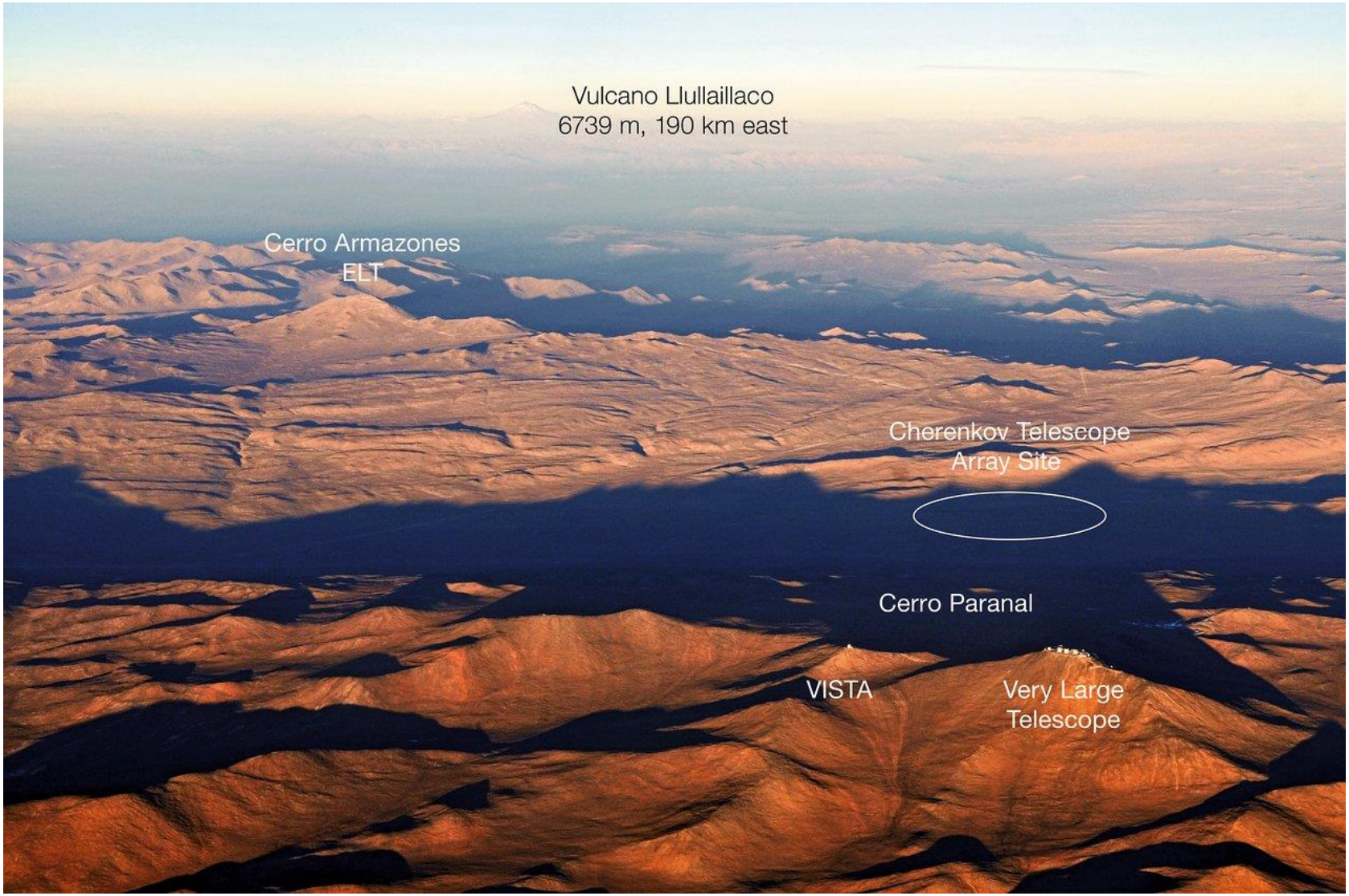
Remote use during the Pandemic: what was done and what could we learn.

- Extend wifi access to all the mountain to allow connection to remote support from experts at the system site.
- Specific protected access to the control network were opened from other locations within Paranal to to have technical or operational support on site while limiting staffing in the Control Room.
- We implemented for software engineers additional protected access from home/office to help during the restart of the observatory and other critical activities. It allowed us operations with just one software engineer in Paranal instead of the usual 5 to 6 software engineers.
- These temporary implementations were a good test bench on how to address some of the constraints that the future ELT will generate on the work in the observatory.

Lessons from the Pandemic

- Remote support during AIV and Commissioning proved to be very helpful but can for now not replace completely on-site presence.
- To allow secure and efficient remote support on the control system level, appropriate safety and security measures are critical and need to be investigated.
- Beyond access to the computer, the communication between teams on site and off site is essential. Efficient and user friendly communication tools needs to be investigated and implemented.
- Stable and fast internet access at the telescope and system locations is critical for remote maintenance support.

ELT and the future of Paranal



The ELT Era (I)

- Operation plan for ELT foresee that it will be integrated within the Paranal observatory and operated from the current site of the VLT
- Due to the distance between Paranal and Armazones (45 minutes driving time), requirements for corrective maintenance needs to be minimized → solid remote monitoring and control scheme necessary to allow preventive/predictive maintenance.
- For ELT troubleshooting, remote assistance from technical experts to staff intervening at the system location will be critical →usage of advanced technologies like augmented reality and VR goggles needs to be explored.
- Integrate Garching Engineering better into regular operations to make use of:
  - Existing ELT knowledge gained during construction & AIV
  - Make use of the time difference between Germany and Chile to analyse problems early and prepare workplan

The ELT Era (II)

- ELT observations will have a stronger dependency on atmospheric conditions and system status.
- Telescope time will also be at a premium (we expect 50 to 100 more time requested than available).
- The available time and how we use it for science requires optimization: New modes of operation may be required beyond the existing ones.
- Communication infrastructure will be needed to allow

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- The available time and how we use it for science requires optimization: New modes of operation may be required beyond the existing ones.
- Upgrade of our communication infrastructure will be needed to allow direct and efficient interaction with either support team or directly observers.

How do we prepare for those challenges?

- Establish within the Integrated Operations (IOP) Programme dedicated pilot projects to exlore different forms of remote operations or operations support.
  - Investigate new technology options that would allow such approach.
  - Plan the development of the necessary internet infrastructure.
  - Refine the requirements for performance monitoring using the VLT as a "test bench".
  - Involve the staff and the community in preparing for all those changes.