Operations of the VLT by Paranal Telescope Instrument Operators

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The Telescopes and Instruments Operators Group (TIO) consists of twenty-two interdisciplinary professionals chosen from different areas of technology: Engineers and Technicians (Physics, Electronics, Electricity, Control, Automation, Computing, etc) including a former Airline Pilot, Air Traffic Controller, NAVY officer, Satellites Operator, Antenna-Arrays Operator, etc. The activities and level of involvement of the Telescopes and Instruments Operators (TIO) during nighttime and daytime has been evolving over the years, along with the department science operations model.

In order to fulfill the requirements of the recently revised Operations Plan, the Science Operations Department (SCIOPS) implemented a standard training system in order to involve all TIOs in the autonomous operation of the Telescopes and Instruments installed at the Unit Telescopes (UTs), the Survey Telescopes (VISTA and VST), the VLTI Complex (VLT Interferometer), and their auxiliary subsystems (Laser Guide Star, domes, cooling, but also DIMM, ASM, etc.). Experienced TIOs have the additional functions of Weather Officer or Safety Coordinator, depending on scheduling requirements.

The staff training is standardized for all units, and is performed with direct coaching of the Astronomers and the most seniors TIOs. A standard certification process was conceived for every instrument, and was prepared in collaboration with the Instrument Scientist. The TIOs are themselves in charge of producing documents about instrument operations, from the operator‘s point of view (e.g. “Survival Guides”), which clearly define the process of data quality control. Such documents are used to perform the training of the newcomers. In addition to the core operations training, the TIO members receive a training on Optics and Adaptive Optics.

The TIOs contribute to all SCIOPS Operations Groups (General Operations, VLTI, Training and documentation, UT Teams, etc), as well as being active participants of department projects. They also help in the definition of new operational standards. The professional background and the operations expertise acquired by the TIOs allow them to be at the front line for problem detection and resolution (via a strong interface with Engineering).

The VLT

On Paranal ESO operates the Very Large Telescope (VLT) with four 8.2m telescopes (the Unit Telescopes or short UTs). Each UT provides one Cassegrain and two Nasmyth focus stations for facility instruments. In addition each UT is equipped with a Coude focus station from which the light can be coherently combined (interferometric observations). ESO also operates four 1.8m Auxiliary Telescopes (ATs) for the interferometric array (VLTI), and two survey telescopes: the 4m infrared VISTA, and the 2.6m visible VST. Currently there are sixteen scientific instruments operated at Paranal. Eleven of them are located at the UTs, one at each Survey Telescope, and three at the VLTI complex. Furthermore, several other subsystems are required to in support of the scientific operations (complementary Adaptive Optics systems, Laser Guide Star, Delay Lines, etc.)

TIO at Unit Telescopes

The VLT Unit Telescopes are four 8.2m telescopes, which can host up to three different scientific instruments each. The TIO has the full responsibility of operating the telescopes and instruments from sunset to sunrise.

During Service Mode observing, all instruments are available for performing science operations. As a result, the TIO assigned to the UT has to be fully certified for operating all instruments and related sub-systems.

According to the Science Operations Plan each TIO is assigned to drive one single telescope each night. The TIO operates the telescope and its instruments while maximizing operational efficiency and maintaining the safety of the people and the equipment. In normal Service or Visitor Mode operations, the TIO fully performs the scientific observations with the assistance of the nighttime astronomer. In the recently revised VLT Science Operations model, the night-astronomer at the UT leaves the console between 2-4am, while the TIO remains in charge of executing the science programs and their corresponding calibration plans (until sunset). One of the UT night-astronomer remains in the control room (night shift-coordinator) to provide astrophysical and operational expertise, as requested.

TIOs at Survey Telescopes

VISTA (Visible and Infrared Survey Telescope for Astronomy) and VST (VLT Survey Telescope) are the two Survey Telescopes working at Paranal. The TIO has the full responsibility of operating the telescope and its instrumentation from sunset to sunrise.

The Survey Telescopes are operated differently than the UTs as they were conceived to perform a semi-automated execution of science programs, using a suites of dedicated tools to carry out the selection and acquisition of science targets. The TIOs perform alone all the nighttime scientific observations. The operators use the priority ranking delivered by the Observing Tool (OT) to select the programs to be executed. Still, the TIO’s own experience in dealing with varying meteo conditions is of paramount importance to secure optimal operational efficiency of the survey telescopes.

The TIOs assigned to the Survey Telescopes are also closely involved in the different operation tasks of maintaining the systems in operation and carrying data quality control. For instance, TIOs have been involved in the elaboration of the automated Image Quality script, which is also maintained by the TIOs. The coordination of all science operations activities of the telescopes and instruments is also delegated to one senior TIO.

TIOS at the VLTI (Interferometer)

The Very Large Telescope Interferometer (VLTI) coherently combined the light of the four VLT Unit Telescopes, or the four moveable Auxiliary Telescopes (Ats).

Currently two Facility-Instruments (AMBER and MIDI) and a Visitor Instrument (PIONIER) are used at the VLTI. Depending on the instrument and the required application, the combination can be done with two, three or four telescopes (UTs or ATs)

In addition to the instrument, the TIO operates the full array of telescopes and related systems and subsystems. Due to the complexity of the VLTI operations, the Night-time Astronomer works together with the TIO for the full night, sharing duties.

The know-how of the TIO is essential to fulfill the particularly demanding requirements of VLTI observations, and help in the detection and resolution of system failures.

TIOS role at daytime

The activities of TIOS in daytime (Operation Specialist) consist of supporting all daytime operational activities (execution of daytime calibrations, calibration completeness and quality checks, mask-manufacturing, instrument troubleshooting, etc), except for the tasks specifically requiring astrophysical expertise (e.g. support of visiting astronomer). These activities are shared with the Daytime Astronomer (DA).

During the day, the TIOS and DAs are in charge of certifying the completeness and quality of the data acquired during the previous night. This includes also the calibration frames acquired in the following morning, validating also the content of the night report, and delivering the system to the Night-time Astronomer at the beginning of the night, with the required instrument set-up and health checks performed.

Furthermore another significant responsibility of the DA and TIOS is to monitor the instruments through the various QC systems, and investigate possible deviations. DAs and TIOS are at the front-line in case of instrument problems prior to the start of the observing night.