A New La Silla Site Operations Paradigm

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ABSTRACT

In 2007 ESO Council endorsed a concept to maintain the La Silla Site within the context of a streamlined operational and support scenario. La Silla remains part of the La Silla Paranal Observatory Division, and supports science projects of the ESO community using the 2.2m, NTT and 3.6m telescope. Infrastructure to host externally funded projects at national telescopes is provided.
A detailed Site Operations Plan for La Silla 2010+ had been developed, and is been implemented since October 2009. We describe its implications on staffing, infrastructure, and science operations. We report our first experience gathered under this new operations paradigm.

Keywords: Observatory Operations, Infrastructure, Re-engineering

1. INTRODUCTION

The La Silla Observatory is the first Observatory of the European Southern Observatory (ESO) in Chile, located on top of a mountain ridge at an altitude of 2400m in the south of the Atacama Desert, approximately 600 km north of Santiago de Chile. Since its operation started in the late 1960s it has become a leading astronomical site with home of two major 4-metre class telescopes. The 3.58-metre New Technology Telescope [1] (NTT) broke new ground for telescope engineering and design and was the first in the world to have a computer-controlled main mirror (active optics), a technology developed at ESO and now applied to most of the world's current large telescopes. The ESO 3.6-metre telescope [2] is now home of HARPS [3] (High Accuracy Radial velocity Planet Searcher), a spectrograph with unrivalled precision, and undisputed leader in the world-wide hunt for low-mass exoplanets. Astronomical research obtained through La Silla facilities manifests in about 300 refereed scientific publications per year (approximately constant over the last ten years), thus representing a world-wide competitive Observatory of its class [4].
Having to operate the flagship of European astronomy, the Very Large Telescope (VLT), and on the horizon the European Extremely Large Telescope (E-ELT) and the necessity of funding this emblematic project, in 2007 the ESO governing bodies endorsed a plan regarding the La Silla future operation within ESO and in particular within the joint La Silla Paranal Observatory division. This decision assured the continuous operation of the site within stringent budget restrictions.
The re-engineering of the La Silla Observatory site implied a significant reduction in human resources and operational budget. The challenge to reduce costs by maintaining high standards for science investigation was encountered through a careful analysis of the infrastructure and resource requirements expected to support a consolidated collection of telescopes and instruments. The Site Operations Plan developed was called La Silla 2010+, and its implementation started in October 2009 (with ESO period P84).
The implications of this plan have been exposed mainly towards the ESO scientific user community [5].
In this contribution we describe the implementation of the La Silla 2010+ plan with respect to site organization and support scheme. Within less then one year of its starting date we have collected first experience within the new scheme, and report first results. We compare the feedback of scientific users and technical downtime statistics with previous years. We conclude this contribution with some deliberations about what we consider the success factors of such a major re-organization of this Observatory and outline risks.

2. LA SILLA OPERATIONS UNTIL 2009

Operations of the La Silla site had continuously evolved over the decades, and were always adapted towards new scientific or technological challenges, requirements and constraints. However, never before it had to face a reduction in operations and maintenance costs by a factor of three, as prompted by the implementation of the LS 2010+ plan. Before the new model has been applied, La Silla operations were carried out by the Science Operations and the Engineering Departments with the support of Logistics and Maintenance Groups. These two groups were incorporated into corresponding Departments covering the whole La Silla Paranal Observatory sites.
In 2007, a staff of 9 persons in the Logistic Group, 10 persons in the Maintenance Group, 27 persons in the Science Operations Department and 22 persons in the Engineering Department were supporting the ESO telescopes NTT (with the instruments EMMI, SOFI and SUSI2), 3.6m (HARPS, EFOSC2 and CES) and 2.2m (FEROS, WFI and GROND). In addition, the La Silla site supported the national telescopes: Danish 1.54m and 1.2m Swiss-Euler, REM and TAROT. The last two named telescopes are remotely controlled and require only limited support.
Science Operations was based on the active presence of (one or more) staff astronomers on-site providing the support for nightly observations. The astronomers were in charge of supporting the visiting astronomer (inductions and astronomical-scientific consultancy), scientific quality control, preparations of technical time and instrument tests, planning and executing observations in service (queue) mode, instrument science calibrations, instrument commissioning, preparation of observing statistics, etc. Observations were carried with the active support of the Telescope Instruments Operators (TIOs) that served as the interface between the astronomer and the telescope-instrument.
Engineering provided the support to telescopes and instrumentation. This technical support was given in areas of electronics, software, IT, mechanics, cryogenics, vacuum, optics and data handling. A number of engineers and technicians were kept on stand-by to give the necessary support to telescopes and instruments. The goal of the engineering department was to keep technical losses and downtime below 2% of the scientific useful time. This goal was typically achieved. The premises of La Silla hosted a well equipped mechanical workshop and laboratories and provided expertise in all related works. Projects were developed on-site to improve the observing facilities.
The Maintenance group worked across the observatory giving support in areas of domes' electro-mechanics, HVAC, power supply, water supply, building maintenance and vehicles maintenance. Logistics was providing accommodation and food services, cleaning, transport, security services and on-call medical services, supplemented by off-site support facilities in the nearest city La Serena.

3. THE LA SILLA 2010+ OPERATIONS MODEL

3.1 Scenario

The scenario for the new operation model considers that:

1. La Silla maintains the capacity to support the astronomical user community for science projects on ESO facilities.
2. Minimal operations and support service to external scientific project teams can be granted.
3. La Silla does no longer support science operations in the classical sense. In particular, no ESO staff astronomers are present on site to support visiting astronomers. Observations in visitor mode become the only mode available to the community.
4. La Silla remains part of the La Silla Paranal Observatory division.

Point (1) and (2) imply that ESO maintains the infrastructure operational, including power supply, water supply, building maintenance, vehicles for the ESO staff members on site, IT and network support (control computers, intranet and internet), accommodation and food services, security services, on-call medical services. Specialized and trained manpower is contracted from experienced engineers and technicians working in the Organization. Expertise of former key personnel in La Silla is kept. Point (3) means that the past organizational scheme of La Silla operations is discontinued. In particular, the four independent departments (maintenance, logistics, engineering, science operations)

cease, and are merged into “Site Operations”, a self-contained, cross-disciplinary, department. Point (4) implies that staff - although in general assigned to a specific position in La Silla - can in principle be working on another site of Observatory (esp. Paranal) upon requirements, and abilities. It also implies that a few activities (e.g. low-frequency maintenance tasks, or repairs involving a larger team and/or expertise not available in La Silla) may practically be delegated to staff that is primarily assigned to another site. It implies high flexibility and mobility.
In particular, La Silla staff supports the following telescopes and instruments:

- 3.6m (HARPS)
- NTT (EFOSC2, SOFI and optionally a Nasmyth focus for visitor instruments)
- 2.2m (WFI, FEROS and GROND)

In addition, technical assistance and basic maintenance is provided for projects operated by different institutions:

- classically operated Danish 1.54m and Swiss 1.2m Euler telescopes
- remotely operated Schmidt QUEST, REM, TAROT and TRAPPIST telescopes

The reduction of site activities is accompanied by several actions taken. The new operations model implies that all observations are carried out in classical Visitor Mode. Already in the year 2008 Service Mode observations have been discontinued at La Silla. At the same time a minimum run length of three nights is requested for La Silla proposals to reduce the turnover of visitors at the telescopes. Long and dedicated observing runs at La Silla are further encouraged through the possibility to apply for Large Programs with duration for up to four years (instead of two at other ESO facilities).
Next, the instrumentation support and operation plan was simplified and streamlined. No physical instrument changes are required, greatly reducing the workload, and configuration changes. Software and hardware standards have been frozen. The stable configurations adopted do not require further development of projects on site.
The mechanical workshop and their staff were relocated to the Paranal site. The telescopes’ control room and staff offices were centralized in order to reduce the people’s displacement on the site. A new transport and working hour scheme was introduced to cope with the reduced staff, always considering the need to maximize efficiencies and synergies. The resulting optimization was accompanied by an active human resource policy that considered staff re-assignments in other sites of the organization, early retirement packages and retirements within the expectations.

3.2 Organizational Structure

The La Silla 2010+ model considers three main groups to give the necessary support to the before mentioned premises. These are Technical Maintenance and Engineering Support (TMES), Day and Night Operations Support (DNOS) and Site Logistics and Administrative Support (SLAS).
A total of 23 persons are currently running the observatory with the support of contractors that are dedicated mainly to activities in the area of logistics (accommodation, food services, cleaning, transport, policlinic and security). This number will be reduced to 20 persons by the end of year 2010 due to reaching retirement ages of three staff members.
A dedicated Site Manager leads the La Silla site operations department and supervises and coordinates the activities of all groups.
TMES has two branches that cover the preventive and corrective electro-mechanical maintenance for telescopes, instruments and site infrastructure as well as system engineering expertise in all areas related to operation engineering of the supported equipment.
System engineers play a crucial role in the framework of LS 2010+. In an environment of reduced resources, they provide system level knowledge and a global problem solving approach. They provide a fast evaluation and classification of a failure condition and a realistic estimate of consequences in terms of expected technical downtime, and practical operational consequences. They are in charge of the interface between the site and the visiting astronomers and supervise the inductions of visiting astronomers with the telescope and instrument. Beside immediate action taken for troubleshooting, engineering support is required on a daily basis to support routine operations and maintenance: coordination, task prioritization, documentation and reporting, and acting as backup and substitution for unforeseen missing on-site resources in operations and maintenance. The engineer acts therefore usually as a Site Operations Coordinator on-duty.

Periodic (daily, weekly or monthly) checks of the equipment and infrastructure is done by technicians that act through a computerized maintenance management program (MAXIMO). The maintenance cover areas including the water plant, power distribution, HVAC, hydraulic systems, pneumatic systems, vehicles maintenance for internal use and transport to/from La Serena.
The La Silla remains in critical areas of expertise on site that can give a direct support to the presented problems (electronics and some mechanics); others like software, IT, data handling (DHA) and optics are referred to external support from Paranal. This is done either through direct, real-time remote support, in case of software or by sporadic and programmed visits for IT, DHA or optics. Whenever a problem cannot be handled by the staff on the site, the support from external companies or other sites of the organization is requested.
DNOS incorporates the TIOs (Telescope Instrument Operators) that represent the direct interface with the astronomer during the observations. During day time the TIO is in charge of preparing the setup and start up of the telescope and instrument, calibrations if necessary and the backup recording of the previous observing night.
The night TIO is the telescope and instrument operator as well as the weather officer in charge to determine the observing feasibility based on the meteorological conditions in the site. Each telescope/instrument has a dedicated night TIO that helps the astronomer during the night observation. In the event that specific scientific questions rise during the observation, the visiting astronomer can contact an astronomer as helpdesk in Paranal.
SLAS serves as a centralized communication, provisioning and logistics hub for staff and visitors. It organizes the boarding and lodging of staff, astronomers, contractors or visitors to the site through subcontracted personnel. Food is supplied by an external company that provides the provisions used for meals prepared by another specialized company.
Ground transport to and from La Serena is organized according to a fixed transport schedule on Mondays, Wednesdays and Fridays in order to reduce trips and therefore costs. Special trips have to be exceptionally authorized.

3.3 Working Scheme

The optimization of the staff transport from/to the observatory is related to the working schedule applied on the site and to the cost involved in the transport, without harming the functioning of the site.
Work is organized in three different shifts depending on the type of work performed in the site. These are Monday to Monday, Wednesday to Wednesday and Monday to Friday shifts. These start-end shift days are in accordance to the transport offered and in–line with the requirements of contractual working hours for staff.
The Monday to Monday type is reserved to technical people that give a full coverage to the site in areas directly related to operations of instruments and telescopes. These shifts are in general for system and electronic engineers as well as some general maintenance staff.
The Monday to Friday shift is covered by personnel in areas of general (programmed) maintenance or where a full coverage on the site is not required. Most people working for subcontracting companies have this type of shift.
Wednesday to Wednesday shift is mainly populated by DNOS operators that need special transport to cover the night and day shift. Two transports are arranged in order to cover the night shift (leaving early in the morning of the departing shift) and a second transport in the afternoon for the day support.

3.4 Operation Support

Observations in the La Silla 2010+ are foreseen exclusively in visitor mode by Visiting Astronomers (VA). Service mode observations that require the presence of a staff astronomer are not supported any longer. VA have to consider that the support delivered is limited to logistical and technical support. This is the most visible difference to the long-standing support scheme that ESO provided to VA in the past.
Therefore several measures have been taken to help the VA to prepare their observations and to guarantee successful scientific return.
Support starts once the observing program is accepted by the Observing Program Committee (OPC). The Principle Investigator of the selected research program is contacted to start organizing the travel to the observatory, and to conceive an observing strategy. Already at that point – typically 6-8 month in advance of the actual observations – the possibility to interact with a contact scientist is announced. This allows the future visitor to clarify any queries well before arriving on the mountain. To mitigate the risk to loose observing time by inexperienced astronomers, in particular students, ESO is granting full travel support for a second, experienced, observer.
Four to six weeks before arriving to La Silla, the VA assigned to the program receives a personalized e-mail that explains in more detail the operation system and the requirements for this type of observation. He is informed about the

technical support that he/she expects to receive in his/her stay in La Silla, the links where to get the right information in the web and preliminary appointment at the site with the system engineer. During observations, visitors will mainly interact with TIOs. To cope with this requirement, TIOs are undergoing substantial training in astronomical techniques and basic data reduction, lectures given by ESO fellows and staff astronomers.
A critical area of the new model is to guarantee astronomical data quality control. This is accomplished primarily by remote monitoring of the instrument parameters that are collected on a daily, routine basis through dedicated calibration observations. For this reason, standard ESO pipelines have been ported from Paranal instruments to their La Silla counterparts. In addition a few dedicated shifts of support astronomers based in Paranal are scheduled during reserved technical and calibration nights to ensure a continuous control of health check parameters, and allow to take corrective action on-site, if needed.
Upon arrival in La Silla the VA receives a welcome package including room keys, telephone calls code, computer account, flashlight, safety information and map of La Silla. After reconnaissance of his/her room and premises of La Silla, a day operations support staff will contact him/her to visit the New Operations Building (NOB) where the telescopes' control is located and where he/she is assigned an office and a terminal during the stay. The integrated control room/office building eases the direct interaction of visitors with the entire observatory staff, in particular day and night operations, the system engineers and with other visitors to exchange experience.

3.5 Engineering Support

TMES covers mechanics, electronics and infrastructure, areas that have been assessed to be most critical for operations. All other specialties are obtained from Paranal Observatory or external companies. Problem reporting is pursued through a computer aided reporting application (LPRS, La Silla Problem Reporting) in full analogy with the corresponding Paranal reporting system. LPRS are typically generated in the night, and sent by the TIO during observation. Daily meetings chaired by the Operations Coordinator ensure follow-up and coordination.
Knowing the type of problem and the area where the problem has been found, the System Engineer organizes and distributes the work to the different technicians or engineers depending on the type of work to be performed.
Remote support is delivered in the areas Software, data handling and IT from Paranal. The La Silla control system can be accessed through dedicated channels without violating stringent security rules, and SW problems can be solved in-situ.
Planned visits on-site of Paranal staff supplement the support strategy, and ensure overall system integrity and consistency as well as knowledge exchange.
Medium-frequency activities consider the regular and programmed visits of a Optical Engineer or Technician for mirror and instrument optics maintenance and cleaning, for approximately two-three days every month. Maintenance of the IT infrastructure and network (routers, switches, cables) require regular visits of ESO IT staff, for approximately two-three days every month. Low-Frequency maintenances activities are actions that are done every 6 months or more, and are also supported by Paranal staff in the areas of mirror washings and coatings, or major modifications or upgrades.
Infrastructure maintenance covers the control of the water plant, power lines and power generators maintenance, heating and hot water plant as well as all buildings and installations of the site.

3.6 External Services

External service providers are contracted in the following areas: food provisioning and preparation, cleaning, basic infrastructure maintenance, site security, first aid and transport. All these services are provided by companies selected after a competitive call for tender in each of the services, and had been tunes to the reduced numbers of staff present. The external service providers are managed on-site by SLAS.

4. FIRST RESULTS AND LESSONS LEARNED

The results of the re-engineering exercise are measurable. A variety of metrics can be applied, with the main antagonists being resources and investments versus quality of service. While the compliance with a defined budget line can be relatively easily established and controlled, the measurement of quality of an astronomical service provider such as the La Silla site as part of the La Silla Paranal Observatory is more difficult. And it is beyond the scope of this paper to assess the quality of astronomical research enabled through the services provided, e.g. through bibliometrics.

However, a systematic and homogenous collection of user satisfaction indices and observing statistics for more than 10 years allowed to build up a powerful database in which long-term trends can be assessed and evaluated for La Silla.

4.1 User Satisfaction

User satisfaction is assessed through a standardized questionnaire that each visiting astronomer is asked to fill after the observing run in an End Of Mission report (EOM). The poll probes the perceived direct administrative, technical and scientific support received from ESO staff, the performance of facilities (instruments, telescopes and infrastructure) and the logistics services.
Although the running of the new model is still short, first result of the observing period 84 (October 2009 to March 2010) and part of period 85 (April and May 2010) can be here presented. Comparisons are made with a similar period of the years before, and are displayed in Figure 1.
The quality of user support as perceived through the (missing) support astronomer is the most obvious difference in the new model expressed through the EOM reports. However, the missing support astronomer does not seem to have an influence on e.g. program completion, or the perceived support received through the TIO or the technical support service.

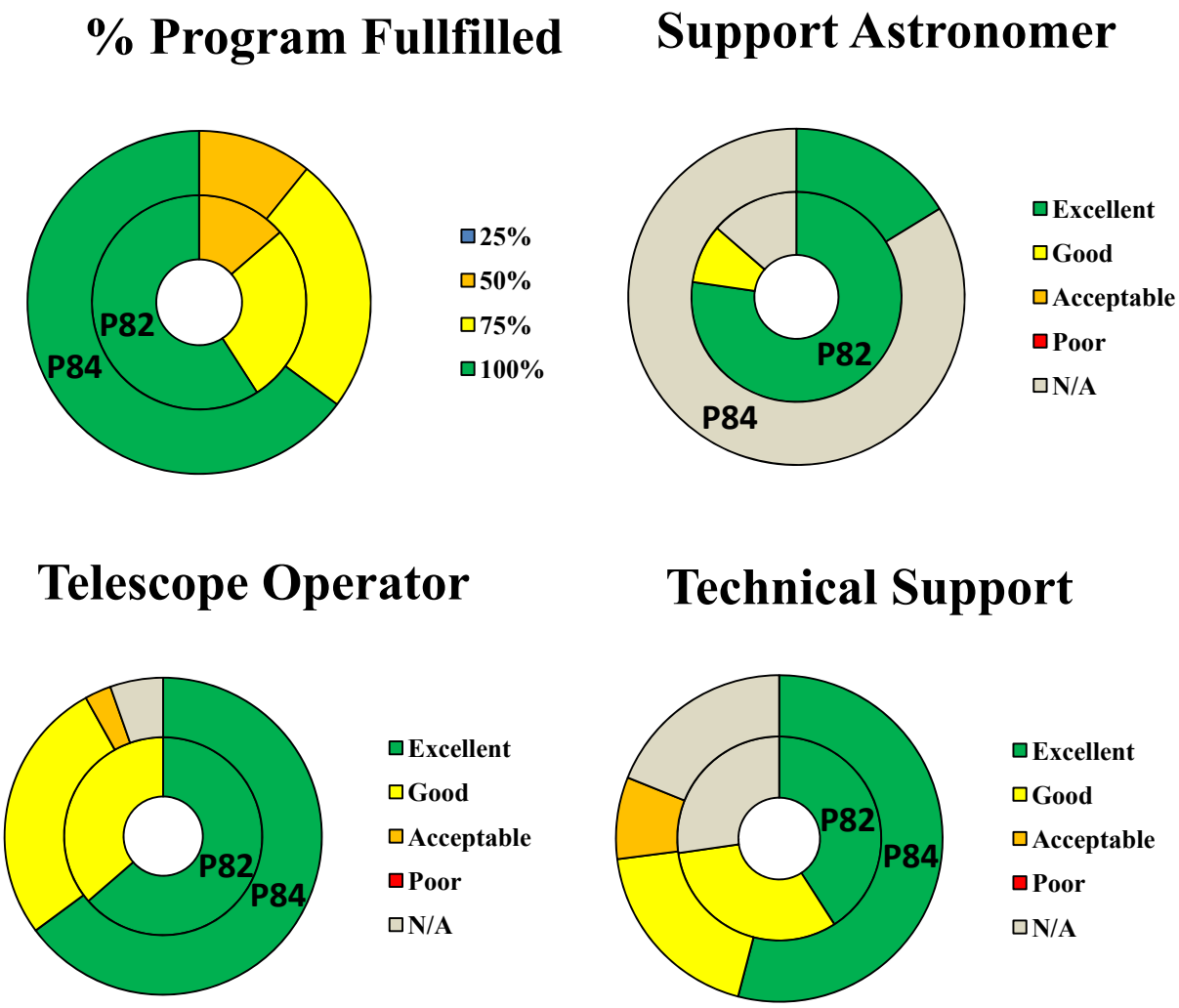
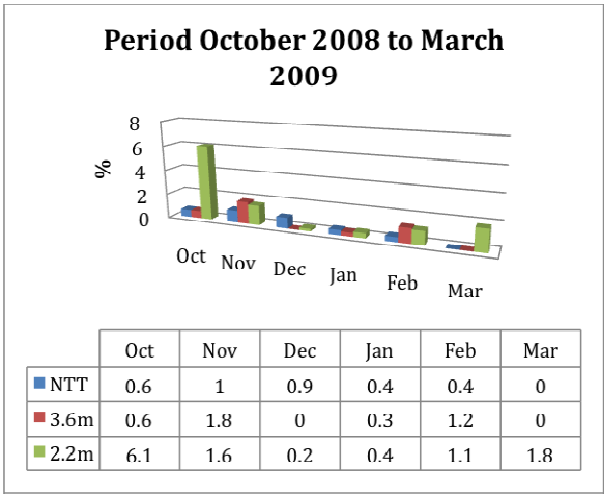


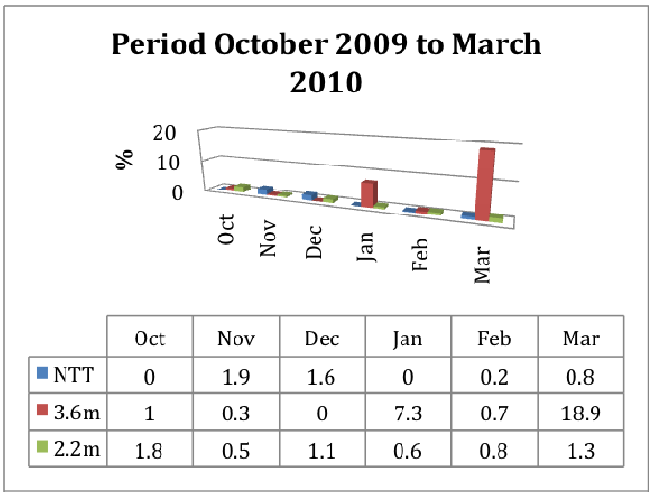
Figure 1. Comparison of the user satisfaction as obtained through the End-Of-Mission reports in periods P82 and P84.

4.2 Technical Downtime

Another indicator is related to technical problems that impact astronomical observations. Technical downtime is measured as percentage of the offered science time for each telescope operated by ESO. The technical downtime can be considered as a proxy for system reliability and problem solution speed. Severe technical problems that impact routine science observations are usually punctual failures. Figure 2 gives evidence that punctual problems may lead to loss of significant observing time, but on a very infrequent basis. Up to now no significant change can be inferred with the new operation scheme, although slower response times (no night time troubleshooting, more lead time required in case off-site support is required) may impact the downtime statistics in a longer term.



	Oct	Nov	Dec	Jan	Feb	Mar
NTT	0.6	1	0.9	0.4	0.4	0
3.6m	0.6	1.8	0	0.3	1.2	0
2.2m	6.1	1.6	0.2	0.4	1.1	1.8



	Oct	Nov	Dec	Jan	Feb	Mar
NTT	0	1.9	1.6	0	0.2	0.8
3.6m	1	0.3	0	7.3	0.7	18.9
2.2m	1.8	0.5	1.1	0.6	0.8	1.3

Figure 2. Comparison of the technical downtime for the NTT, 3.6m and 2.2m telescopes during periods P82 and P84.

5. SUCCESS FACTORS AND RISKS

A streamlined operations model of the La Silla site of ESO's La Silla Paranal Observatory has been developed since 2007 and has been implemented since October 2009. It is too early to draw final conclusions on the sustained performance of this model. But first indicators appear promising in the sense that this important Observatory can continue to contribute to world-class astronomical research despite the substantial reduction in operating costs. The following points appear critical as success factors to us:

- The site before implementation of the streamlined operation plan had been technically well-maintained and equipped with state-of-the-art technology derived from VLT standards.
- The site is part of a large, world-class Observatory which can support the site in case of major problems.
- The re-engineering process itself incorporated the expertise of Observatory staff into the definition and description of the future operations plan and thus generated wide acceptance of the plan among the staff
- The sites counts on experienced and motivated staff that took ownership on most processes on-site
- The novel support scheme, unusual for an Observatory run by ESO, constitutes a certain cultural change and thus requires wide explanation and acceptance by the user community.

The new operations paradigm in La Silla is an interesting benchmark to probe flexible and streamlined operations schemes. It should be reminded, however, that continued operations of an astronomical site like La Silla is driven by scientific excellence and thus requires convincing strategies and associated investments.

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