Five Years VLT

As of 1 April, 2004, ESO's Very Large Telescope has been available to the users' community for five years. Here we celebrate this anniversary.

Catherine Cesarsky, ESO Director General

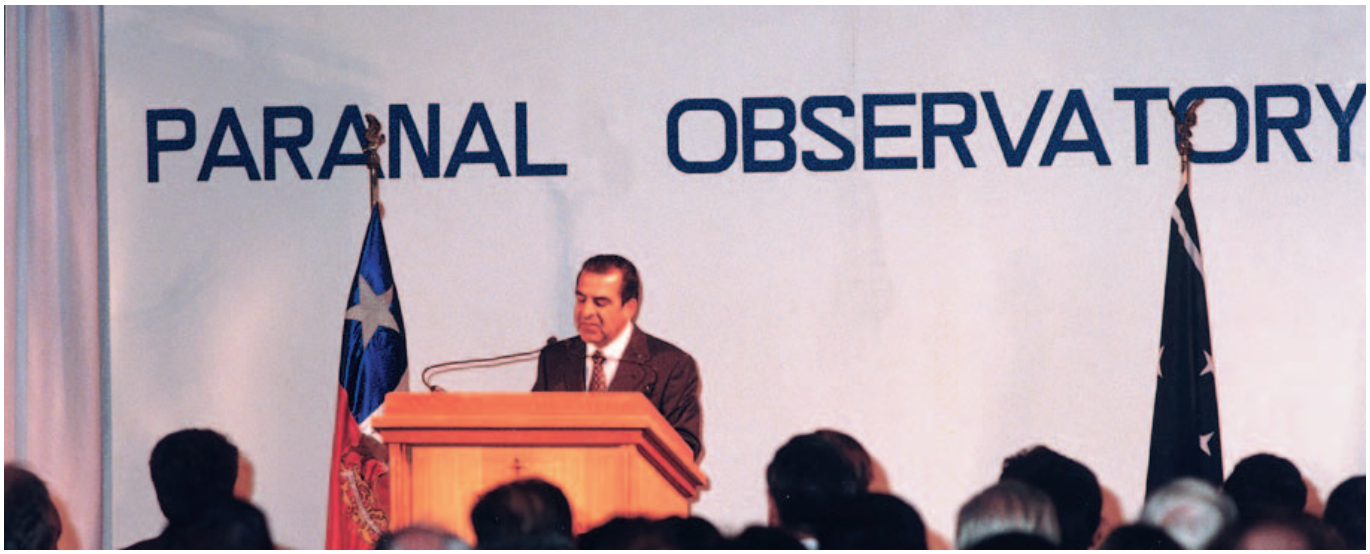
Five years of Paranal Observatory... I remember the tremendous impression this place, in construction, made on me when I visited it as a member of the Visiting Committee. It remained fixed in a corner of my brain, and filled it when the search committee seeking a successor to Riccardo Giacconi approached me. It was a challenge I could not refuse, but also the fulfillment of an unacknowledged dream.

I was only a spectator at the inauguration of the Paranal Observatory, in March 1999. I had known the Director of the VLT programme, Massimo Tarenghi, for many years, as I met him when he was in Geneva; to this day we speak to each other in French. Of course, we spectators were all excited when we were invited to see, at the same time as President Frei and his wife, the newly baptized telescope Antu in operation, but undoubtedly Massimo's more than justifiable pride and pleasure added much to the occasion. I also remember the delighted smile of Jason Spyromilio all through the night; he was operating the telescope. Many of the other people who had contributed were there, and many others could not be there other than in spirit, but all joined the celebrations. With the proverbial luck of ESO, the seeing was 0.25″, comparable to first light of NTT, as I have heard, and the spiral galaxy chosen was superb. A truly unforgettable occasion for a future DG.

Kueyen had had its first light a night or two earlier, but I have partially witnessed, as DG, the installation of FORS2 and of UVES. I was struck by the swiftness and ease with which UVES was installed: I had gone to Paranal to see a commissioning, but in fact it was front line science from the start. I had missed the first lights of Antu and Kueyen, but I was there for Yepun and Melipal. I recorded my impressions of Yepun's first light in *The Messenger* at the beginning of my second year as DG (A Midwinter Night's Dream; 2000, *The Messenger* 101, 1). Massimo and Jason were there, with Krister Wirenstrand and Rodrigo Amestica, and last but not least Roberto Gilmozzi, by then the Director of Paranal Observatory, who rushed to reduce the first couple of images as nimbly as a graduate student. I had never thought that everything could work so easily and fast, and at the back of my mind imagined that it must have been rehearsed somewhat. But for Yepun, the secondary had been late and was only just being installed when I arrived. The team was clearly a bit worried, but again everything worked instantly, the loop was closed, the guide star shrank, and they obtained the first image delivered by the smoothest mirror on earth. Roberto again reduced the data, while champagne was flowing, which we shared with the team of journalists from Discovery Channel who immortalized for us that fantastic night.

This was truly the precursor for a marvelous period. Since then it has been success upon success, with only very few setbacks. One by one, instruments have arrived, been commissioned and offered to the community. Interferometry also gave superb results from the start; just now we have had the first fringes of the second VLTI first generation instrument, AMBER. At first, the community hated things like P2PP, service observing or ESO standards. Now, most of the astronomers we serve are satisfied, as testified by the reports of both visitors and service observers and by the Users' Committee, and we have also acquired a distinguished group of collaborative laboratories.

We celebrate today the feast of the construction of the VLT, under Massimo Tarenghi, of its instruments under Guy Monnet, and its end-to-end system under Peter Quinn. Just as impressive as the construction has been the passage to smooth,



His Excellency the President of the Republic of Chile, Don Eduardo Frei Ruiz-Tagle, speaking at the Inauguration Ceremony of Paranal Observatory on March 5, 1999.

efficient and highly skilled operations. Roberto Gilmozzi, now seconded by Jason, has instilled in the observatory the high standards and enthusiasm necessary to keep it such a unique place. Of course, these are the leaders, worthy of praise. But the teams they lead are equally impressive and it is to their effective and sustained efforts, to their dedication and professionalism, that we owe the success of the VLT.

Peter Gray, followed by Roberto Tamai, has implemented preventive maintenance with such skill that these unequalled telescopes have unbelievably low downtimes. Dedicated service astronomers and TIOs, under Gauthier Mathys, have been delivering first rate data, night after night, and the quality has been checked in Garching. And the community is increasingly exploiting the ESO data archive, a rapidly growing and valuable asset. The VLT has become the internationally recognized benchmark of observatory excellence.

Finally, and most importantly, the fruits of these efforts are being reaped: the Paranal Observatory has already given rise to an impressive number of scientific results, many of which could not have been obtained elsewhere. The VLT Programme Scientist, Alvio Renzini, reviews some of the scientific highlights in an accompanying article in this issue. Overall, the VLT has been a most remarkable success, and will contribute to science at the highest level for years to come – a fantastic achievement of which we can all be justifiably proud.

Riccardo Giacconi, ESO Director General, 1993-1999

The achievement of the first light at the VLT in 1998 represented for all of us working at ESO the achievement of a wonderful scientific, technical and sociological effort which had consumed many years of our lives.

When I joined ESO in January 1993 much preparation had already occurred. Lo Woltjer had been able to convince the European Community of the desirability of a large telescope array. The success of the NTT in the 80's gave confidence to ESO that the technology would work and that the organization could cope with the VLT. Under Harry van der Laan's directorship much effort had been expended by scientists and engineers to plan and initiate the work. It is also true that during this period the foreseen date for first light had been receding by about one year per year. An audit undertaken by Massimo Tarenghi and myself under the scrutiny of outside experts revealed that some of the cost estimates had been somewhat optimistic and that the program should be scaled back to allow for some contingency. The decision was made then by ESO Council to delay the start of the VLTI.

In my opinion, the leadership capabilities, dedication, technical and scientific competence of Massimo Tarenghi were essential in achieving success of the VLT. By carrying out the program on time and within cost, it was possible to recover the VLTI infrastructure development.

Also indispensable to this success were the profound changes which occurred at ESO as a whole. All of the staff became involved in a single coordinated effort to achieve a level of excellence and productivity rarely achieved in astronomical projects in all aspects of the Observatory activities. I was convinced that given the great lead of the Keck Group in the US in utilizing the 10-meter telescope it was important for VLT to become an even more effective machine to do science competitively.

La Silla had been operating with some very good and also some marginally productive telescopes. With the advice and support of the Science and Technology committee of ESO, half of telescopes were closed and the remainder improved to the VLT standards. By doing so we used La Silla telescopes to test software and hardware to be used on VLT.

Prof. R. Giacconi with the 17-year old Jorssy Albanez Castilla from Chuquicamata near the city of Calama, winner of the essay competition, in which schoolchildren of the Chilean II Region were invited to write about the implications of the names given to the four VLT unit telescopes.

Following a suggestion by Joe Schwarz, the command system of NTT was turned into the 5th VLT by Jason Spyromilio and his team, a fundamental contribution to VLT software development. The 3.6 meter was completely upgraded by Jorge Melnick and his team and for the first time its angular resolution was limited by seeing. Dietrich Baade provided a wide field camera for the 2.2 meter MPG/ESO telescope. Alan Moorwood built a prototype of ISAAC (called SOFI) for the NTT with great technical and scientific success. Sandro d'Odorico persuaded Jim Beletic to join ESO. Jim soon closed the sensitivity gap between US and ESO CCD detectors. These contributions are only examples of the unity and dedication of the ESO staff in supporting the VLT efforts.

The technical achievements of the VLT team under Massimo Tarenghi's leadership produced one of the most sophisticated telescopes today. The selection of beryllium for the secondary mirror, the use of parallel efforts by industry to select prototypes for the primary mirror support, the excellent and enthusiastic support by European industry were important factors in the VLT success. Site development was carried out in an exemplary fashion under the leadership of Jorg Eschwey.

The overall technical improvements in pointing, the rapidity of the active optics in coming to the best focus, the perfection of the optical surfaces have become standards for all ground-based telescopes to emulate.

Also important was the willingness of Massimo to invest considerable effort in support of end-to-end software development. This philosophy of operation came from the Hubble Telescope experience, through me, Jim Crocker, Peter Quinn and Roberto Gilmozzi. Also Piero Benvenuti as head of the European Coordinating Facility for Hubble had significantly contributed to

the development of the Hubble Science operation and archiving system.

The main thrust of this effort was to present the observers with calibrated data in almost real time, the ESO staff assuming the responsibility for the data quality. Thus, for the first time, a major ground-based telescope was optimized for science productivity in the same sense that Hubble was. The robust and much expanded Educational and Outreach program received much attention during this period. The rate of science publications of ESO actually increased rather than decreased during this heavy involvement in hardware building.

So first light was for all of us the clear demonstration that we had all together succeeded. We had concluded a treaty with Chile, we were in Paranal, the first telescope worked like a charm (the first real demonstration of active optics), and we had succeeded in also preparing the infrastructure for VLTI.

It is difficult to convey the sense of gratitude I felt for all of the staff at the time, and for Massimo Tarenghi in particular, for their tremendous achievement. The ESO Council, all of its committees, and the European Astronomical Community can remember with pride their contribution to the achievement of this turning point in European Astronomy. I am confident of ESO's success in ALMA and OWL!

Roberto Gilmozzi, Paranal Director

In 1994, I joined ESO from HST to head the optical instrumentation group knowing I was to help in what was envisaged to be the premier observatory on earth. I thought that being on the supply side would be challenging enough. Little did I realize that I would end up at the receiving end of those efforts. In 1998 I was asked to shift from instrumentation and to build up the group that would initiate the science operations at the VLT in April of 1999. One of the great pleasures associated with this change was to be present at the observatory when the official first light event took place in May of 1998. Those were exciting times indeed and sufficiently fun that I stuck around during some of the commissioning to watch UT1 grow into a real operational telescope and FORS1 and ISAAC be mounted on to it. I had had many observing runs at ground based telescopes in many different observatories and like most people I was very happy with 0.6 arcsecond images and used to images above one arcsecond. In the commissioning phase we would try to take images when the conditions were good. As we saw more and more of what UT1 could do, we also recalibrated our expectations. Sub-arcsecond was 'nice', sub-half arcsecond was 'good'. Below 0.3 arcseconds was something to be pleased about (and was most frequent when the then Paranal director, Massimo Tarenghi, was on site!) The beautiful science verification image of the HDF-S was built up during the commissioning period by using those times when the conditions were good. This remains one my favorite images from the telescope.

Less than a year after the first light of UT1 we had another first light, this time UT2. Paranal only a few days before the official inauguration of the observatory and the official start of operations was indeed a hectic place. It was great to be able to have UT2 side by side with UT1 and FORS1 giving 0.25 arcsecond images the night before the assorted dignitaries and guests arrived to celebrate.

The moment of truth, for the astronomers, was of course the start of science operations in April of 1999. We had been careful to recruit as many old hands as we could so that the expertise was present to handle most situations. Gautier Mathys from the NTT, Jean-Gabriel Cuby with ISAAC and SofI experience, Chris Lidman from NTT and SofI, Herman Boehnhardt and Thomas Szeifert from FORS plus telescope operators like Norma Hurtado from the NTT and on the data flow side Jose Parra and Blanca Camucet also from the NTT to archive the data. Period 63 was going to start whether we were ready or not. I do not think we had clear performance criteria for success or failure during that first period. The motivation and excitement (maybe even a bit of panic) associated with putting the first 8.2-m into operation took up too much effort to leave time to worry about details like downtime. Whatever the downtime ended up being, we would just have to live with it. Thanks to what in retrospect were clearly heroic efforts by Peter Gray and his crew, as well as the science operations staff, we ended the first semester (P63) with 11% downtime. Not bad for a start. Secretly the commissioning crew headed by Jason Spyromilio had had a goal but did not tell us, apparently to see how we would do. We beat their goal by almost a factor of two and probably their expectations by even more. A year later this figure was down to 2% and pretty much it has hovered about this number for the past 5 years.

There are a lot of anecdotes of the first months of operations, mostly arising from misunderstandings by users of how the instruments worked and what would be sensible to request. We had the users often change manually the FIMS files that set-up FORS. Unfortunately never actually for the better but with a lot of heartache as we always thought we had made some mistake when things went wrong (and catching that spurious line feed added by the user's editor did take a lot of head scratching!). We had the observing program that demanded 0.4 arcsecond image quality but only exposed for a fraction of a second before presetting to a new position, making the use of excellent seeing time the least efficiently used time on the telescope. The observer who had the slit at a position angle of 7550 degrees and complained that the control software complained. The 0.1 arcsecond offsets between object and sky in the infrared caused some puzzled faces in the control room. The user who complained about the inefficiency of the observations but refused to use the automation built into the system. Of course it was not only the users who had to learn how to interact with the observatory. We also had to learn how to get the best out of our system. When should we start a 0.6 arcsecond program, when the seeing is at 0.5 and pray it does not get worse, or at 0.7 and hope it gets better? How do you populate the nightly queues?

Over the years we have found our path through the maze of opportunities that the VLT presents and the community has pushed us to the limits of what the telescope, instruments and astronomers can do. Together we have worked towards the same goal, to get the best science out of this beautiful machine. The astonishing results on the Galactic Centre, the metal poor stars, Uranium spectral lines, the high redshift galaxy rotation curves, micro-quasars, gamma-ray bursts, high redshift supernovae etc, all attest to the power of the VLT and its operational model. The beauty of the images from the telescope is so great that one of them was voted amongst the 10 most inspirational images of the 1990s. The European astronomical community can be proud of its achievement at Paranal.

In this issue of the Messenger you will read about the first light of another telescope on Paranal, the first of the four 1.8-m auxiliary telescopes that are to be used in the VLTI. Ever more exciting times lie ahead for Paranal with VISIR, SINFONI and the laser guide star all coming this year. Five years after the start of operations on UT1, the observatory operates its telescopes with very little time set aside for engineering (less than 10%) and very low technical downtime. Combined with excellent weather and great image quality we provide the European community with unsurpassed observing capabilities. As director of this Observatory since 1999, I have been privileged to be part of this adventure.