0.56″ of spherical aberration, similar to the 0.53″ given by Antares.

4. Measurements made during May 1996 with ADONIS by P. Prado and E. Prieto showed that the spherical aberration was between 0.5″ and 0.6″.

In addition, during the June nights, the following measurements were done with Antares:

At the nominal focus, 0.56″ of spherical aberration was found, 30 cm below the nominal position, 1.0″ was measured and at 10 cm below the nominal focus, a negligible spherical was found (0.11″). Both 3rd-order calculations and computer simulations showed that, to remove 0.5″ spherical at this telescope, one has to move the focal plane down by 120 mm. This coefficient (240 mm/″) corresponds to what was measured by Antares in June and also corresponds to the coefficient given by Ray Wilson (237 mm/″). We know now how much we have to move the focal plane to correct a given spherical aberration. But first we have to confirm the value of the residual spherical aberration. F. Franza and B. Delabre measured 0.27″ in 1982, however, we do not know the exact conditions under which this value has been obtained. Since February 1996 we have measured spherical aberrations of the order of 0.5″.

Although we can now trust the Antares measurements, the apparent variability of the spherical term (see Table 4) has still to be understood. Ray Wilson suggested that this could be produced by mirror seeing. This interpretation is very appealing, but it is not easy to understand how this can be produced in practice, because these layers would be required to have the size of the pupil, and in addition, remain stable over one night. There are at least two possibilities:

(a) The mirror is enclosed in the centre piece. Stable layers of air could be formed more easily above the mirror, inducing a spherical term.

(B) There is a direct influence on the beam, at the level of the Cassegrain adapter. One year ago, a heat source (rotator encoder) was spotted only 30 cm away from the beam inside the adapter. This source could have been a cause of “variable” spherical term. The Cassegrain hole is now insulated to shield off this heat source.

In addition, during the last months, mirror cooling has been applied, and this could explain why the “spherical” term never reached very high values. Substantially, Ray Wilson’s interpretation seems very attractive; in this case the spherical aberration would be the product of a misplacement of the focal plane, combined with a (variable) component induced by mirror seeing or air instabilities along the light path. Of course we have to confirm this by carrying out much more measurements and simulations.

There is still a lot of work to do, however the goals should be achievable. Of all the traditional 4-m-class telescopes, the 3.6-m has certainly the best intrinsic optical quality, but it does not give the best images – not yet.

6. Pointing Model

E. BARRIOS; ESO

The pointing of the 3.6-m has been erratic for a long time: pointing models were repeated quite often and an individual model was needed for each instrument. What was more worrying, the model was not stable in time.

In the last two years, several changes occurred, both from the operational and from the physical point of view. The models are now performed by starting from scratch (and are not anymore incremental); stiffening of the spider has been applied, and the new TPOINT (Wallace, 1995) software has been made available. Several pointing models have been repeated during the last year, as frequently as possible, with all instruments and top-end configurations. The results are summarised in a report (available in the WWW page of the 3.6-m+CAT TT).

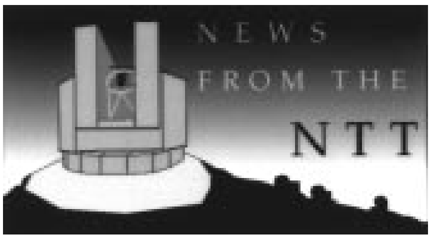
Substantially, the behaviour of the telescope is quite regular, and pointing models with an RMS of less than 10″ are obtained by using only a limited number of physical parameters (14), without the need of polynomial terms.

Models performed before and after the June 1996 intervention, of course, are different, but they remain stable with time, largely independent of instrument and top-end exchanges. The parameters used are indeed the same for the 3 instruments at F/8.

Although these performances are not yet comparable with the best pointing telescopes, they are satisfactory for the instrumentation presently available at the 3.6-m telescope. Some physical limitations exist at the moment on the telescope (i.e. hysteresis in the secondary unit); however, we think that these performances can still be improved by refining the measurement technique, and by collecting enough data to search for second-order terms.

7. Acknowledgement

During this technical time at the 3.6-m telescope both shifts of the Mechanics Support Team have been involved at the same time, together with the staff of the Telescope Team, putting in a lot of effort to accomplish the mission and to cope with all the unpredictable. Special thanks shall be given here to both teams!



The NTT upgrade project has the following goals:

1. *Establish a robust operating procedure for the telescope to minimise down time and maximise the scientific output.*
2. *Test the VLT control system in real operations prior to installation on UT1.*
3. *Test the VLT operations scheme and the data flow from proposal preparation to final product.*

J. SPYROMILIO, ESO

This article is being written at the end of August during the second phase of the NTT upgrade project. I am pleased to be able to describe some of the activities undertaken while the NTT has been off-line. For those not wishing to read much further, the short news is that we are progressing according to the detailed daily schedule with some tasks running one or two days ahead of time. In the context of the overall aims of the project and the critical question of “when will the NTT be back on-line?” such minor variations do not have any significant impact. However, the adherence to the schedule during the hectic first couple of months suggests that we have correctly budgeted for the time needed.

So we hope that by the 1st of July 1997 the NTT can return to full service sporting its new software and hardware and also a new operations scheme.

The NTT was taken off-line on schedule on the 1st of July. The observations on the 30th of June, also known as 'last light', were in fact unfortunately clouded out. As mentioned in the previous issue of *The Messenger,* the first thing to do was the re-aluminisation of the secondary mirror. Unfortunately, although the re-aluminisation went well (reflectivity of 89.7 per cent) and performed within the time limits allocated to this task, bad weather and high winds prohibited the testing of the alignment of the system. Since the re-aluminisation was done without removing M2 from its cell, any misalignment resulting from its removal from the telescope should be small and recoverable. The decision was made to proceed with the planned activities rather than delay. The tertiary mirror will be coated in November when the whole telescope is scheduled to undergo alignment tests. These tests aim to determine whether the image elongation that sometimes is seen on the NTT is due to a misalignment and also to test the VLT alignment device and procedures.

At the time of writing, the primary mirror of the NTT is in the aluminising tank at the 3.6-m awaiting transport back to the NTT. The coating achieved on the primary seems excellent with a reflectivity of 90.1 per cent and a micro-roughness of 10 Å.

Many other activities have already been completed since the beginning of July. A large number of control subsystems have been installed and undergone preliminary testing. The fundamentals of the system look good but a significant amount of work still remains to be done. The control of the building and telescope tracking axes has been tested for basic functionality. The adapter functions (guide probes, reference unit, etc.) on side A have also undergone functionality testing. There is quite some way to go before we have tested all submodules and begin to integrate the complete system. It should be noted that the entire NTT electronics is undergoing modifications, and for some units substantial re-wiring is taking place. All signals from motors, amplifiers and limit switches are being checked and cross-checked against the documentation. In this context the master NTT documentation has been moved from paper drawings with notes added to them to OR-CAD and AUTOCAD. This new system can be accessed from an HTML document which then allows us to access the documentation from anywhere in the NTT or the electronics lab without confusion. As we modify parts of the system, significant effort is being put into updating the documentation and producing the critical 'as built' drawings and tables.

A number of modifications and maintenance operations have also been undertaken during the first few weeks of this phase of the project. The auto-guider and other cameras in both adapters have been upgraded to VLT standard technical CCDs. This has been a non-trivial operation involving significant modifications not only to the mounts of the old cameras but also to the cable ducts to allow for plumbing of CCD heat exchange fluid. In addition the cooling of the electronics racks in the base of the telescope has undergone substantial modifications and the primary mirror cover has been refurbished. The EMMI red camera has been sent to Italy to fix a loose lens and the two silver gratings are in Garching being cleaned.

The most obvious change that visitors to the NTT notice is the furniture in the control room. The old laboratory style console has been removed along with approximately 4 kilometres of cable required to run the old displays. The new furniture which is in the same style as the NTT remote control room has been installed along with a substantial part of the computer architecture necessary for the VLT operations scheme. In this context, the four workstations involved in the operation of the NTT and associated instrumentation are now installed and running.

As has been stated many times already, one of the aims of the NTT project is to beta test the VLT control system. In this context we have in the past weeks had eight VLT staff present on La Silla learning not only about the behaviour of the control system in a real telescope environment but also in the case of some of the newer recruits to ESO the difficulties of working in remote locations and the fun of working with real hardware.

The Immediate Future

A few days after the deadline for submission of this article, we expect that most critical subsystems of the telescope shall have undergone functional tests and the integration of the system shall begin while the remaining subsystems are brought on-line. In the same period we expect that the new EMMI and SUSI software will also begin functional testing.

Around October, ESO shall be informing the members of the community who have applied and been awarded service observing time about the probability that the system can be brought to a sufficiently reliable state to start doing science in February/March 1997. The first observations shall be performed in service mode only and shall be strictly shared risks. Phase II proposal preparation tools are being finalised at this time and we hope to be delivering our first data from the new NTT in the first quarter of 1997. These observations will be performed on a best-effort basis.

The New Operations Model

In the last issue of *The Messenger* you will have seen the article by Peter Quinn describing the VLT data flow and the basics of the operations scheme. The NTT will provide the community the first opportunity to interact with the system and give feedback. The NTT project welcomes comments and suggestions by the community regarding the operations scheme and we believe that we are providing a great opportunity to the users of the VLT to influence the evolution of the system.

As opposed to conventional observing, in the new NTT we will have in addition to the telescope operator, an instrument operator assisting the observer with the details of the observing. The astronomer – whether as a visitor (classical observing) or an NTT staff member (in the case of service observing) – is then freed to worry about the decisions requiring his/her scientific expertise. As mentioned in the previous issue of *The Messenger,* a separate workstation is present in the control room to allow the astronomer to work with her/his data with the data reduction system of choice without fear of interfering with the process of data taking.

For the VLT operations scheme to be implemented on the NTT, a substantial number of new operations procedures need to be defined and coded. This work is going on mostly within the NTT team. Pipeline data reduction procedures are being written and observing templates are being specified. Observing templates form the basis for reliable and predictable operations in the new scheme. The observing template is in fact a pre-defined sequence of operations involving any combination of telescope, instrument and detector actions. The astronomer defines the parameters of this sequence and the marriage of the parameter file, and the sequence of instructions implies that as much as possible exactly what was specified will in fact be executed.

Combinations of such sequences can be grouped together in an entity called an observation block. Any given night's schedule can be expected to contain a number of observing blocks from different observing programmes but which require a similar instrumentation set-up and atmospheric conditions. A single target is observed within an observation block but there is no restriction on how many sequences are present therein. Of course, it should be obvious that if a particular observation block requires exceptional seeing and has a large number of long sequences embedded within, it will have a low probability of being successfully completed. Most observing programmes are expected to be broken down into a number of observing blocks.

The first observing blocks built and executed may well require quite some interaction between the applicants and the operations/user support teams. As mentioned above, this will provide the users with the best way of providing feedback to ESO before we try the same scheme on the VLT. Every improvement suggested for the NTT will be directly transmitted to the VLT. This beta testing is the essence of the NTT upgrade. We aim to produce a system that is transparent to all users of the telescope whether in service or in classical mode.

Staff Movements

Two new members are welcomed to the NTT team. Erich Wenderoth, our new instrument operator, and Ricardo Schmutzer, on loan from the VLT software group until the end of the year, are our new arrivals. Jari Roennback, who as a fellow in Garching provided support for the remote control operations and also managed the NTT WWW pages, finished his fellowship and has now left ESO. Many thanks and good luck Jari.

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La Silla – a group of small telescopes busy at work under the summer night sky.

Photograph: H. Heyer, February 1996