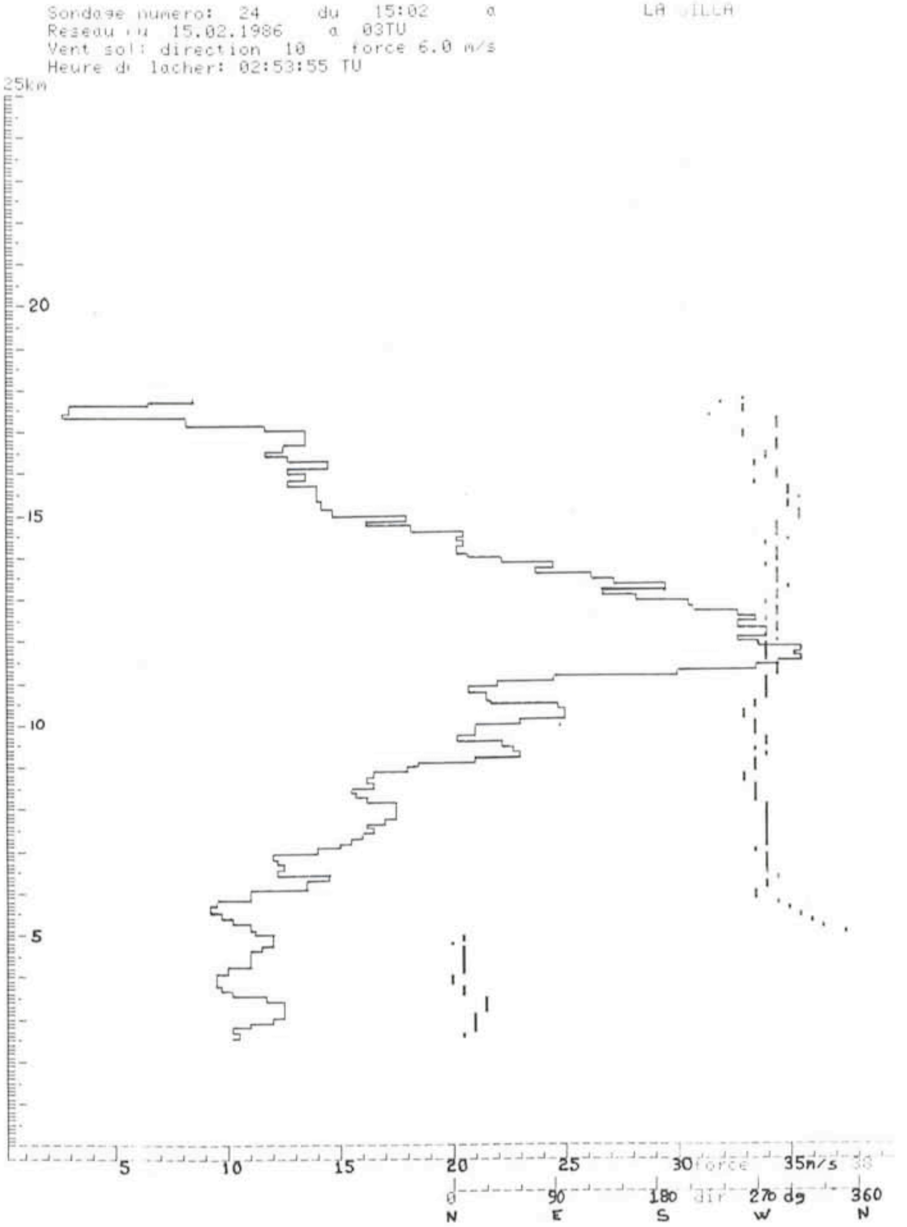


Figure 4: *Tropospheric sounding output in presence of the jet stream.*

methods and are of prime importance for the development of adaptive optics systems foreseen for the VLT.

Speckle lifetime, isoplanatic patch, image size with and without image motion were simultaneously monitored by G. Weigelt, G. Baier and P. Koller at the 2.2-m telescope. Thousands of speckle interferograms from single and double stars have been recorded using ICCD or a movie camera.

From the 1.52-m ESO telescope, J. Vernin and M. Azouit have been observing the scintillation characteristics of the same stellar sources with the SCIDAR technique (Scintillation Detection and Ranging). They could derive the vertical profiles of refractive index inhomogeneities from 1 km up to 10 or even 30 km over the site, according to double star angular separation.

Last but not least, the shearing interferometer of F. and C. Roddier was installed at the focus of the 50-cm ESO telescope. This device is considered as an absolute calibrator for the determination of the atmospheric point spread function since it is not sensitive to telescope optical aberrations or misfocusing.

Processing data and delivering conclusions is not the smallest part of the work but preliminary results allow us to hope that the analysis will be complete by the end of the year. Besides the increase in the knowledge of our observing environment, these measurements will allow some estimation of dome seeing. They also have been of great help for the calibration of the site testing seeing monitor, scheduled to start routine operation in August.

Very Large Telescope: Recent Developments

D. ENARD, ESO

Readers may feel badly informed about the development of the Very Large Telescope project, since no article appeared in the *Messenger* after December 1983 – a time when the VLT concept was still wide open. Since then, a concept – the linear array – has been presented at the IAU Conference in April 1984 at Garching. The internal study group was firmly established and began a thorough investigation of the array concept towards the end of 1984. Quite a number of studies – most of them feasibility studies of critical aspects – have been performed and a synthesis report of this initial phase, roughly equivalent to the phase A of space projects, has recently been issued.

The ESO base-line concept, called the linear array, consists of 4 independent 8-metre telescopes, with alt-azimuth mounts, operating in the open air but protected, when not observing, by removable shelters. The maximum operating wind speed in the free flow has been provisionally set to 9 m/sec which corresponds to about two thirds of the night time conditions at La Silla. For stronger winds, a wind screen is erected and reduces the average wind velocity in the region of the telescope by about 50 %. Because strong winds in Chile are effectively blowing from the same direction (north-south) the wind screen can be fixed independent of the telescope. An aerodynamic numerical analysis has shown that a promising concept would consist of a platform covering the space between the wind screen and the telescope and located at about 10 metres above the ground. Low air layers are captured beneath the platform thus creating a depression behind the wind screen. The result, illustrated by Figure 1, shows that the wind load on the telescope and particularly in the region of the primary mirror is greatly reduced, whereas the air stream is accel-

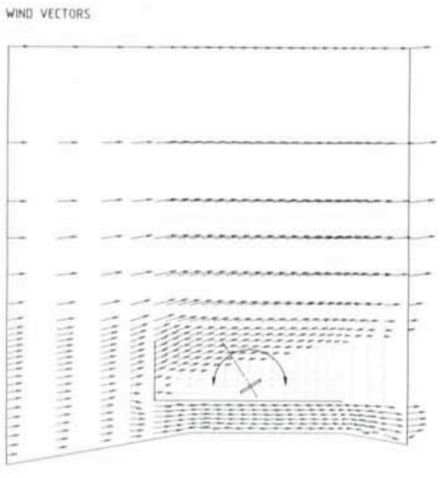


Figure 1: *Wind flow simulation of the proposed VLT building concept, obtained with a 2-dimensional fluid flow finite element model. A wind screen reduces the wind speed on the telescope structure and the primary mirror. A large part of the air flow is captured under the platform which surrounds the telescope up to the wind screen.*

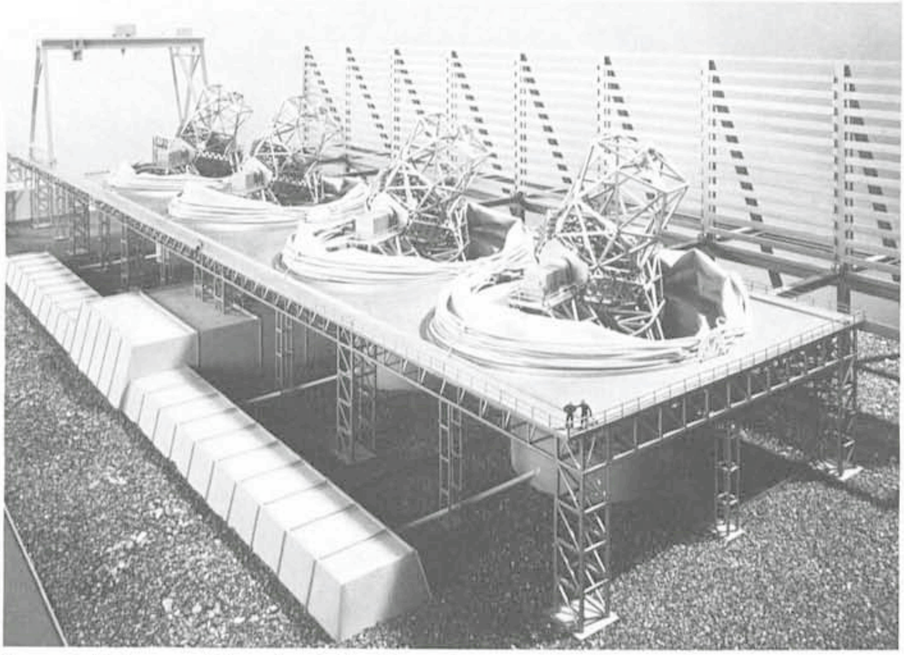


Figure 2: *VLT concept based on inflatable shelters and 2-position wind screen (here in down position for wind speed inferior to 9 m/sec).*

erated beneath the platform. A great improvement of local seeing conditions is expected of this approach.

Figures 2, 3 and 4 show models of two possible concepts for the building and the telescope structure. It is evident from the pictures that both concepts make a large place to innovation. For instance the solution for the shelters of Figure 2 is based on a high-strength double-wall plastic fabric supported by light-weight metallic hoops and inflated so that the effective wind load is always compensated by the internal pressure. The concept of Figure 4, based on metallic movable shelters, is more traditional but provides a safe, although less original, solution.

The coudé light beams transit through the tubes joining the telescope bases. The beam combination is effected either in a central "Combined Coudé Laboratory" for incoherent combination or for the purpose of interferometry in a long building parallel to the array.

The definitive configuration for the 4 telescopes has not yet been finalized and depends largely upon interferometry and on site constraints. The scientific working group on interferometry is very active in trying to define a realistic optimum configuration. The concept of Figure 2 is based on a compact and redundant linear arrangement whereas that of Figure 4 considers a 25–75–50 m arrangement which would provide 6 different base lines. The mechanical structure of the unit 8-m telescopes should be conceived for compactness, high rigidity, and for minimizing the wind load and the thermal inertia. The present analysis shows that it seems possible to conceive a telescope structure (Figures 2 and 3 show two examples) able to sustain an open air operation.

The crucial question of the primary mirror technology is actively investigated. One of the best materials for mirror blanks is Zerodur, a nearly zero expansion glass-ceramic. The presently available Zerodur technology cannot provide blanks larger than about 4 metres, but new technologies could become available within a few years to make 8-metre Zerodur blanks. Alternatives such as metal are also considered. Figure 5 represents an experimental light-weight steel blank recently manufactured. The process with which this blank has been produced seems perfectly extendable up to almost any size. The initial results look quite encouraging. Structure print-through looks less critical than anticipated and the quality of polish does not seem to be inferior to that of glass. Thermal warping and stability is being investigated.

The primary mirrors of the VLT will be active, which means that the mirror figure is corrected in real time. A wavefront analyzer is locked on a reference star and provides information for the mirror correction possibly at a frequency of a few Hertz. This rather high frequency may be necessary to correct for wind buffets. It has been shown that bright enough reference stars will be easily available in the 30-arcminute field of view of the unit telescopes. Indepen-

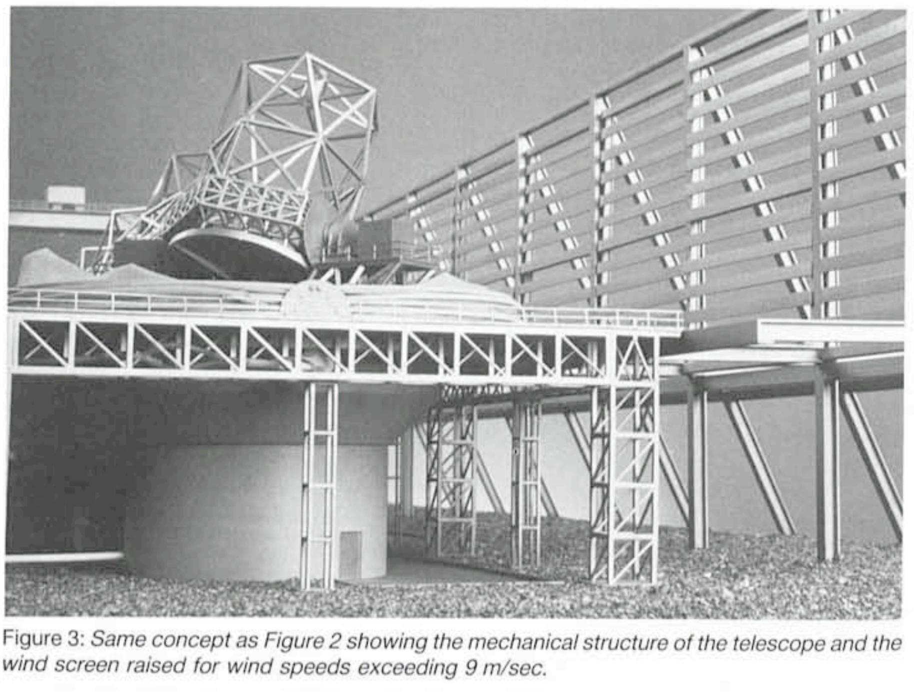


Figure 3: *Same concept as Figure 2 showing the mechanical structure of the telescope and the wind screen raised for wind speeds exceeding 9 m/sec.*

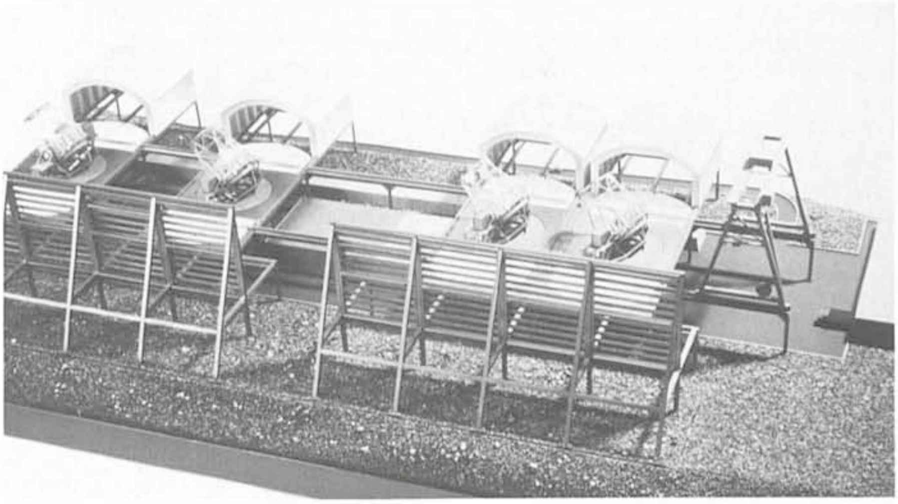


Figure 4: *VLT concept with movable shelters and a non-redundant configuration for interferometry. The 2 shelter doors are hinged on the platform so that the air flow can pass through the opened shelter with little disturbance.*

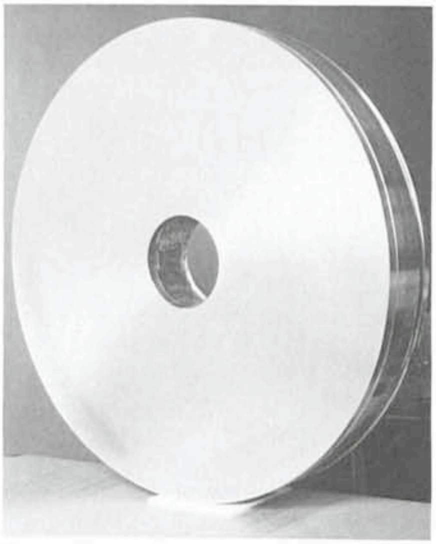
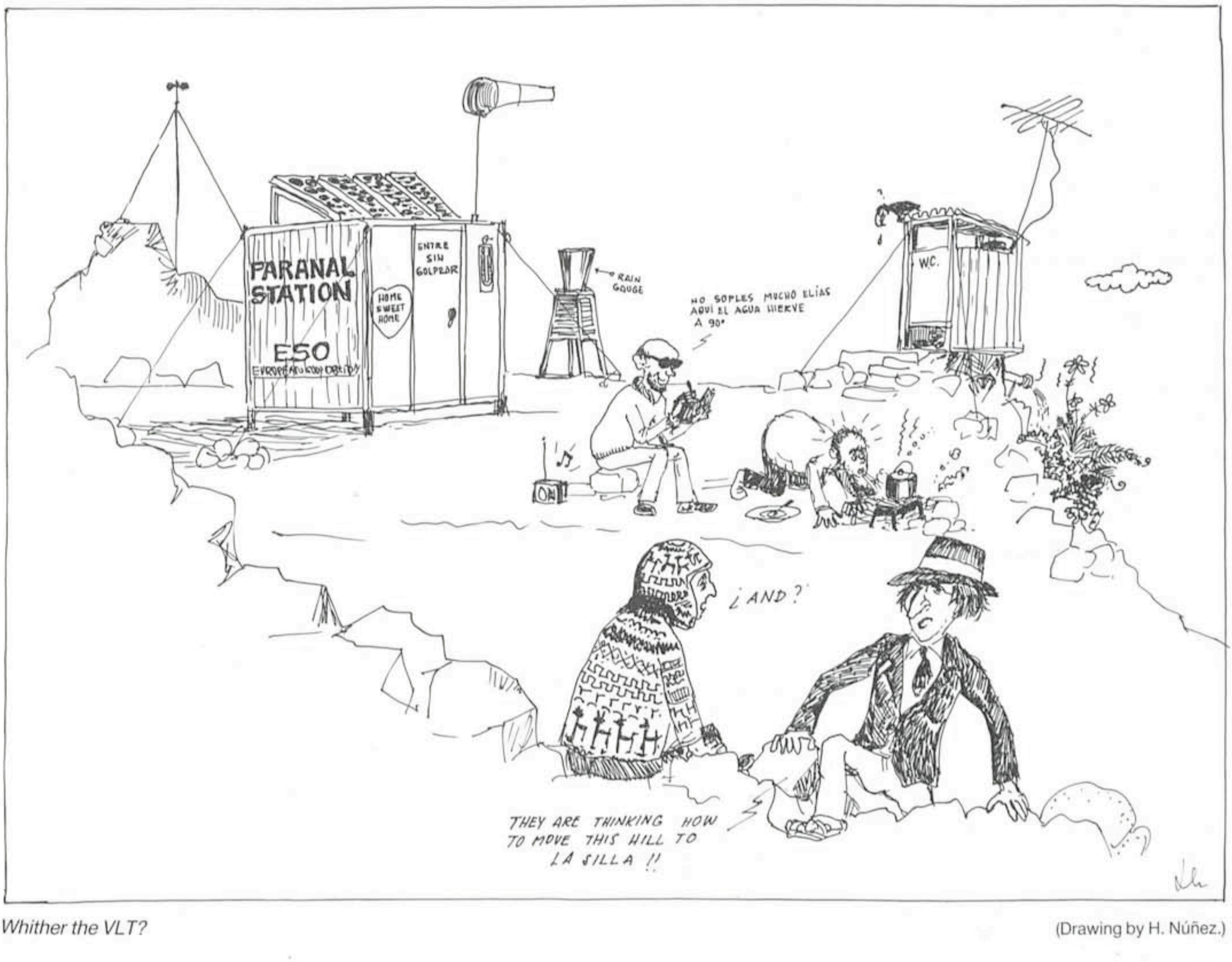


Figure 5: *An experimental steel mirror blank. Although in principle not an ideal material, stainless steel can be polished directly, and has a better thermal conductivity than glass. An active correction system would compensate for thermal and possible long-term warping.*

dently of the correction for wind load, an active mirror is viewed as the only way to obtain a very high imaging performance, whilst keeping the cost and lead time for the production of the mirror within reasonable limits. As an example, it is envisaged to relax considerably the tolerance on low spatial frequency deformations such as astigmatism and to correct it *in situ* with the active system. An active system leaves also the possibility to correct for thermal gradients and long-term warping and thus allows the use of non-zero expansion materials.

The correction of atmospheric phase disturbances with an adaptive smaller mirror is also investigated and small-scale experiments could start in 1987.



Whither the VLT?

(Drawing by H. Núñez.)

Perhaps the most crucial question for the moment is the development of an adequate facility for the optical figuring and polishing of the 8-m mirrors; this is likely to determine the project lead time.

The priority activities for the next two years will be the detailed analysis of the telescope dynamic behaviour and the definition of the active primary mirror and of its support system.

Parallel to the technical investigations, scientific working groups pursue the analysis of the VLT concept with respect to its various observing goals. They are expected to give their final recommendation by July 1986 before a VLT workshop to be held next October.

Catálogo de ESO de publicaciones y fotografías disponible

A partir de mediados de julio de 1986 estará disponible un catálogo de libros, publicaciones, posters, diapositivas, etc. que se podrán obtener de ESO. Rogamos enviar sus pedidos por escrito al Servicio Informativo y Fotográfico de ESO (ver dirección en esta página).

Exhibiciones ESO

Durante buena parte del paso visible del cometa Halley por los cielos de Chile, la ESO contribuyó a una mejor información del público interesado, ofreciendo sendas exhibiciones en importantes centros culturales de Santiago y La Serena. En la Galería Azul de la Biblioteca Nacional (Santiago), nuestra exposición permaneció abierta entre mediados de febrero y mediados de abril, recibiendo la visita de aproximadamente 15600 personas. Dicha muestra se encuentra actualmente exhibiéndose en Punta Arenas, iniciando un itinerario que la llevará a las principales ciudades del país. Al mismo tiempo, el Museo Arqueológico de La Serena expuso una segunda colección de fotos y explicaciones entre noviembre de 1985 y mayo de este año, siendo admirada por aproximadamente 19500 personas.

R. Huidobro

Libro de ESO aparecerá en 1987

Fué decidido que el libro de ESO titulado "Visiones del cielo austral" (ver *El Mensajero* N° 43, pág. 36) será publicado en 1987 con ocasión del 25° aniversario de la ESO.

Se están finalizando las negociaciones por un contrato de publicación con una de las editoras más importantes de Europa.

Contents

ESO, the European Southern Observatory, was created in 1962 to . . . establish and operate an astronomical observatory in the southern hemisphere, equipped with powerful instruments, with the aim of furthering and organizing collaboration in astronomy . . . It is supported by eight countries: Belgium, Denmark, France, the Federal Republic of Germany, Italy, the Netherlands, Sweden and Switzerland. It operates the La Silla observatory in the Atacama desert, 600 km north of Santiago de Chile, at 2,400 m altitude, where thirteen telescopes with apertures up to 3.6 m are presently in operation. A 3.5-m New Technology Telescope (NTT) is being constructed and also a 15-m radio telescope (SEST). A giant telescope (VLT = Very Large Telescope), consisting of four 8-m telescopes (equivalent aperture = 16 m) is being planned for the 1990's. Six hundred scientists make proposals each year for the use of the telescopes at La Silla. The ESO Headquarters are located in Garching, near Munich, FRG. It is the scientific-technical and administrative centre of ESO, where technical development programmes are carried out to provide the La Silla observatory with the newest instruments. There are also extensive facilities which enable the scientists to analyze their data. In Europe ESO employs about 150 international Staff members, Fellows and Associates; at La Silla about 40 and, in addition, 150 local Staff members.

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