another ground: does action follow the discussion? My experience is that, when specific technical problems are identified, they are solved by ESO in relatively short time. When a long-term action or a change in ESO policy are required, or when budget problems are involved, the Users Committee represents only one of a number of steps in the process, and things are obviously not so simple. In my opinion it is widely felt that the role of the U.C. in these circumstances could be better clarified.

In the past, some efforts have been made to improve the work of the U.C. and its effectiveness. It has become customary to have an informal gathering of the national representatives the day before the annual meeting. The issues raised by various members can be compared, and common and general problems can be more easily extracted and presented in the meeting after deeper consideration. Furthermore, it has been realized that pointing out a general problem in a wide, multinational community is often a slow process. Solving the problem can take a long time as well. The overall process can barely be followed if its typical timescale is longer than the turnover time of the members of the Committee. For this reason it was proposed, and approved by the Director General and by the Council, to extend to four years, that is to four meetings, the term of the members of the U.C.

Looking to the near future, one can foresee several changes in our way of working at the telescopes: key programmes imply a different way of scheduling and using them; the availability of both the 3.6-m and the NTT will permit more flexibility in the instrumentation; remote observing is becoming a real possibility; flexible scheduling is currently proposed, in various observatories, as a way of better exploiting optimum sky conditions. These examples, only a few from a longer list, show a strongly evolving situation. The users can play a critical role in it, providing essential inputs and acting as a feedback. The Users Committee could be an important link in this process. Or, in absence of a continuous pressure from the community of users, it could slip back to a not-very-interesting "safety valve for disgruntled astronomers". The choice is mostly up to us.

Tentative Time-table of Council Sessions and Committee Meetings in 1989

May 2	Users Committee
May 10–11	Finance Committee
May 18–19	Scientific Technical Committee
May 30–31	Observing Programmes Committee
June 5	Committee of Council
June 6	Council
Nov. 13–14	Scientific Technical Committee
Nov. 16–17	Finance Committee
Nov. 30–Dec. 1	Observing Programmes Committee
Dec. 4	Committee of Council
Dec. 5	Council

All meetings will take place at ESO in Garching.

ESO'S EARLY HISTORY, 1953–1975

II. SEARCHING FOR A SITE IN SOUTH AFRICA*

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Introduction

Over a time span of more than seven years, with several interruptions from late 1955 to the middle of 1963, young European astronomers and their assistants have been engaged in the search for a site in South Africa. By the end of that time, it became clear that the observatory would not be built on this continent; the South American Andes Mountains offered superior observing conditions.

Does it make sense, then, to devote a full chapter to the South African explorations? It does – not only because we want to do justice to the large effort made by many young astronomers and their assistants, but also because the South African venture was ESO's first exercise in European collaboration.

First Impressions

Already in January 1954, at the second meeting of the ESO Committee (henceforth to be denoted by EC), the question of the best site for the observatory was taken up. As I explained in the previous article, the southern part of Africa seemed a natural choice. However, the major observatories in South Africa were all located in, or near, major cities or communities: the Cape Observatory, the Union Observatory – originally only at Johannesburg but later having its field station at nearby Hartebeespoortdam –, the Boyden Observatory near Bloemfontein, and the Radcliffe Observatory near Pretoria. This latter observatory had been created rather recently, in the early 1930's, as a result of the transfer of facilities from Oxford; yet also in this case proximity to a major city had been chosen, even for the planned 74-inch telescope [1].

For ESO, vicinity of a major centre of civilization was not an important criterion, and so, the EC decided to start from scratch. Needed was, of course, a place with a minimum of cloudiness and as free as possible from smoke and sky illumination. Moreover, astronomers want good "seeing". By this they mean, that the image of a star as observed in a telescope should show minimum distortion due to turbulence in the earth's atmosphere. This question of "seeing" is explained in some more detail in the box accompanying this article.

"– – – observers are on duty from sunset till sunrise – – –."
From André Muller's instructions for the site tests, December 1960.

Apart from the experience collected over the years by the existing observatories, there was little the EC could go by. There was an interesting report by B.J. Bok of August 1953, dealing with a comparison of conditions at Harvard Observatory's Boyden Station in South Africa and its Agassiz Station in Massachusetts [2], in which Bok drew attention to what seemed to be a general characteristic: *"All over the High Veld of South-Africa, with its remarkably clear and pure skies, the seeing deteriorates often about midnight or shortly after, with no recovery before dawn – – –. The after-midnight deterioration of seeing happens as well at the Union Observatory in Johannesburg, at the Radcliffe Observatory near Pretoria*

* Article No. I appeared in the *Messenger* of December 1988.

and at the Lamont-Hussey Observatory on Naval Hill in Bloemfontein. – – –."

Also of historical interest is an extensive letter by Walter Baade to Oort of 1 November 1954 [3]. That Baade's opinion would carry much weight is obvious: his fundamental discovery of the different stellar populations had been possible by a combination of two special circumstances at Mt Wilson Observatory some time during World War II: a sky free of illumination by the neighbouring city of Pasadena, and exceptional seeing conditions at the 100-inch during the photographic exposures of the Andromeda Nebula and its satellites.

Baade's letter stressed the importance of local conditions: *"– – – I have no experience with the conditions on high plateaus such as that in South Africa but I am strongly inclined to believe that there, just as in Southern California, the seeing during the best observing season is largely determined by the air layers close to the ground – – –. Local topological conditions therefore must play a role – – –."* Baade also stressed the importance of correlating the rating of the seeing as judged in the test instrument with that observed in a large reflector, and suggested that the Haute-Provence Observatory, favoured with good seeing, might be a suitable place for such comparison.

At the request of the EC, meteorological data on South Africa were collected and discussed by Siedentopf of Tübingen [4]. He concluded that the High Veld, the semi-desert plateau stretching from Johannesburg to Bloemfontein and southward, should offer the most favourable over-all conditions. The EC meeting of November 1954 therefore decided to first explore the Pretoria-Johannesburg and Bloemfontein-Kimberley areas, with limited tests in the Beaufort West region located further south. In each of the first two a fixed observing post was to be chosen near the existing observatory, to serve as a reference point, and the surroundings were to be explored with a moving telescope.

At a meeting in March 1955 in Uccle, details of the project were discussed by Bourgeois, Danjon, Heckmann, Spencer Jones and Oort [5]. A classical method was chosen for the evaluation of the quality of stellar images: the appearance of the diffraction rings as observed in a small reflector. In the accompanying box we explain some of the ways in which the astronomer can evaluate the quality of the stellar images. The method selected had been described by Danjon and Couder in their textbook *Lunettes et Télescopes* of 1935 [6]. Four azimuthally mounted reflectors of 25 cm aperture were built for the project at the Paris Observatory. For the measurement of the atmospheric extinction, photo-electric observations were to be made at wavelengths about 4500 and 5300 Å, with small refractors. Moreover, of course, cloudiness, wind velocity and wind direction would have to be recorded.

The first observers left in October 1955 by boat: G. Courtès from France, J. Dommanget from Belgium, H. Elsässer from the German Federal Republic, and Ch. E. Heynekamp from the Netherlands. They arrived in Capetown on November 6. An extensive letter by Elsässer and Heynekamp to the spiritual father of the project, J.H. Oort, of 17 January 1956, reports on the beginning of their activities [7]. Elsässer described this early work in *Die Sterne* **33,** p. 3, 1957. First observations for intercomparison of all observers were made in the Bloemfontein area in December 1955. Subsequently, the work was divided over the northern (Johannesburg-Pretoria) area and the southern one (Bloemfontein).

On the basis of this first reconnaissance, the EC meeting of April 1956 decided to drop the Johannesburg-Pretoria area and concentrate further work on the region of Bloemfontein and farther southward down to the surroundings of the village Oudshoorn. This is located close to the Swartberg mountain range at the southern border of the Karroo semi-desert. J. Boulon from France replaced G. Courtès for this second phase, which was reported at the October 1956 meeting of the EC by Danjon and Siedentopf. The Karroo emerged more and more as the most promising region, so that the EC decided to extend testing there, in particular near the settlements Zeekoegat and De Aar-Koffiefontein. A new team of observers replaced those mentioned before: F. Bertiau from Belgium, and K. Rohlfs and J.W. Tripp from the FRG. They embarked upon a years' programme to be completed by September 1957. A joint interim report of March 23, 1957 submitted to the chairman of the EC [8] gives first observational results, but also reflects some concern about the problem of systematic differences between the results of different observers, the relevance of tests made with small telescopes for work done with large telescopes, the possible influence of local seeing-disturbing elements, etc. Nevertheless, the Zeekoegat area began to seem superior to the other ones investigated.

Astronomical "Seeing"

Under ideal atmospheric conditions, the image of a star as seen in a telescope consists of a bright central spot surrounded by a weak circle, the diffraction ring. This is due to the wave character of the light in combination with the fact that the telescope objective or mirror cannot but be of limited size. If the atmosphere is disturbed by turbulence, then (a) the ring is broken up and both it and the central spot loose their sharpness, and (b) the whole image of the star moves rapidly, in an erratic manner. The combination of these two effects determines the quality of the image, called *seeing* by the observer. The less turbulent the atmosphere, the better is the seeing. Hence, astronomers can judge seeing by the quality of the appearance of the diffraction ring, and by the degree of violence of the motion of the bright central spot, called the "image motion".

Estimates by the appearance of the diffraction ring are not easy to put on a quantitative basis; observers use a scale of ratings mutually agreed upon and to be checked regularly. The Danjon telescopes, equipped with mirrors of 25 cm, produced a suitable size of the diffraction ring and gathered sufficient light to make it well visible for bright stars. Normally, the estimates were not seriously hampered by the image motion.

Judging the seeing by the image motion has the advantage of allowing a quantitative measurement, for instance the average deviation of the central spot from its mean position. It has the disadvantage of requiring very stable mounting of the telescope. There is, however, a way around this: one fixes two telescopes on one sturdy mounting and by means of an optical device arranges for the two fields of view to be seen superposed on each other. Measurement of the relative displacement of the two central spots is then a measure of only the atmospheric effect because the shaking of the mounting affects the two in the same manner.

There is still a third method that helps measuring the seeing. In a turbulent atmosphere, we can distinguish turbulence cells, somewhat vaguely defined units which move with respect to the surrounding medium. Such cells differ slightly in temperature with respect to this medium. As a consequence, if one measures the temperature at a fixed point above ground level – for instance at the top of a fixed pole – then one will find rapid fluctuations as a consequence of the successive passages of the cells and the surrounding medium. The more turbulent the atmosphere, the more violent the temperature fluctuations. Experiments have shown that the degree of violence is closely correlated to the rating of the seeing by the diffraction ring method or by the image motion. Conversely, measures of the temperature fluctuations can tell us whether we may expect to observe with good, or with bad seeing.

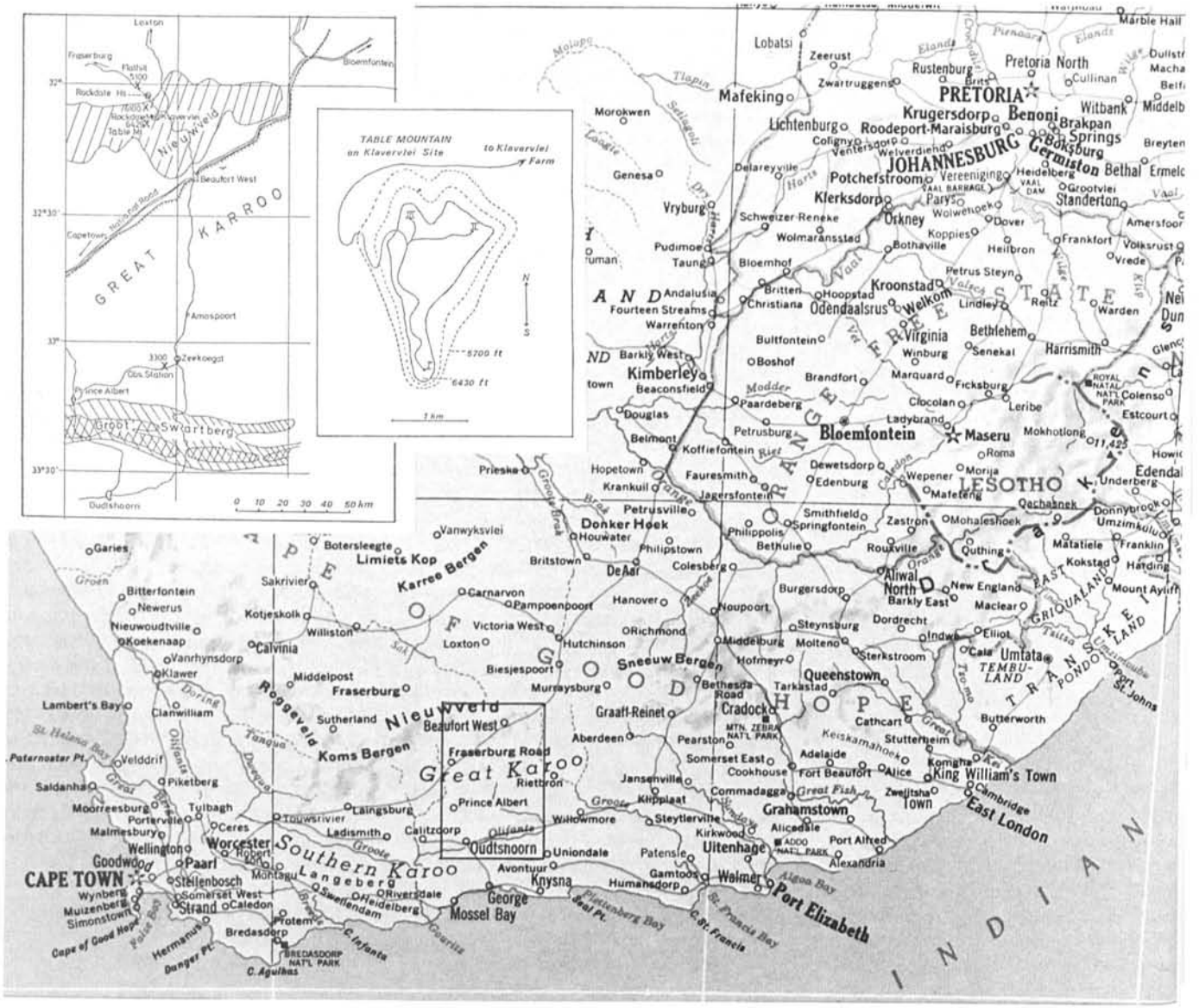
After the completion of this mission in September 1957, the work done over the years 1955–1957 was reviewed in a meeting on 9–11 January 1958 at the Paris Observatory by a group consisting of Danjon, Heckmann, Fehrenbach, Couder, Dommanget, Guinot and Tripp [9], which led to a re-analysis of the data by Tripp [10]. This was first prepared for the July 1958 meeting of the EC and, in more complete form, for its October/November meeting. It confirmed the favourable impression of the Zeekoegat site, with Tafelkopje, a hill near Bloemfontein, as a close second. However, as the report pointed out, the analysis suffered from systematic differences between the evaluations obtained by different observers at different places and between observations made with different telescopes, notwithstanding the careful measures taken to eliminate these effects. An independent analysis was published by Dommanget [11].

Adding Some "Real" Astronomy

A new phase of more rigorous investigation in the Karroo developed in the second half of 1958. It envisaged, apart from continuation of work with the Danjon and photo-electric telescopes, some real research programmes. A suggestion for such broadening had been made by Danjon at the July 1958 meeting of the EC. Doing "real" astronomy would help testing the site and make it more attractive for young astronomers to become involved in the work. Two projects presented themselves for this purpose.

The Marseilles Observatory, directed by Fehrenbach, had developed plans for the erection in South Africa of a duplicate of the objective-prism refractor of 40 cm aperture of the HPO, the so-called GPO (Grand Prism Objective) for determining radial velocities [12]. Initially, a location near the village Prince Albert had been considered, but now an alternative was contemplated: one of the possible sites for the ESO project. The operation would become more expensive for logistic reasons; the additional costs might then be absorbed by the site testing project [13]. The solution also would strengthen the effort for integration of France in the ESO project. At this time the French participation in ESO was still quite uncertain.

A second suggestion had been made by myself on behalf of the Kapteyn Laboratory: it proposed photo-electric



Map of South Africa. The ESO site tests over the years 1955–1963 covered the area from around Pretoria-Johannesburg to the Great Karroo near the south coast, and during the last years concentrated on the region marked with the rectangle. This region is shown in blow-up in the upper left corner, adapted from the report by Ursula Mayer mentioned in the text. The site testing station near Zeekoegat and the three on Klavervlei Farm: Table Mt., Rockdale Mt. and Flathill are marked by crosses. The blow-up of Table Mt. on Klavervlei Site shows the three locations investigated by the Quick-Look expedition in early 1961.

The Zeekoegat Site.
Above: *In spring 1959: members of the "Technical Group" with the owner of Sunny Side Farm; from left to right, Fehrenbach, Haffner, Miss Oosthuizen, Hooghoudt. Photograph by the author.*
Below: *ESO's "Zeekoegat Station" in 1962, in the background ESO buildings and houses. Photograph by D. Beintema.*

The Klavervlei Site.
Above: *Table Mountain (middle, background) and in front of it the Klavervlei Farm Settlement. Photograph by the author, 1959.*
Below: *Klavervlei Farm Settlement seen from the air; the large dark-roofed house in the lower left housed the ESO observers. Photograph by D. Beintema, 1962.*

photometry of moderately faint stars, providing information on the photometric quality of the site as a by-product. As it turned out later, this project could not be realized, but a similar one was done by the Tübingen programme of Siedentopf described below.

These suggestions were submitted to the October/November 1958 meeting of the EC [14], at which also another step was taken up: an evaluation of building costs, technical expertise, acquisition of water and power supply, etc. in South Africa. These were to be investigated by a "technical" group consisting of the engineer B.G. Hooghoudt (responsible for technical developments of radio astronomy in the Netherlands), Fehrenbach and myself, together with the German astronomer H. Haffner who at that time resided at the Boyden Observatory. The group arrived in South Africa on 16 March 1959 and stayed for about five weeks, after which it reported to the EC meeting of May 1959 [15].

The report led to a somewhat modified approach. Further testing of the Zeekoegat area was recommended, but attention was also to be given to sites at considerably higher elevation than those explored so far. Such sites were to be found on the Nieuwveld Plateau northwest of the village Beaufort West. On the other hand, no further testing of the region around Bloemfontein was to be done. Reasons for its exclusion were the fear for growing disturbance by city lights, and seasonal effects in the climate which are unfavourable for observing the Magellanic Clouds.

Henceforth, interest focussed mainly on two possible locations: the vast territory of Klavervlei Farm on the Nieuwveld Plateau, where contacts with the owner, R. Köster, had been established by the "technical" group; and Zeekoegat, where the same had been done with the owner Miss M.E.Z. Oosthuizen of the Farm Sunnyside. Klavervlei Farm was located about 35 km northwest of Beaufort West, and Zeekoegat about 80 km south of this town. Ultimately, three montain spots on Klavervlei Farm became the subject of intensive tests: Table Mountain at elevation about 1,970 m, Rockdale Mt. at 1,860 m, and Flathill at 1,490 m. They are indicated on the accompanying map.

The Zeekoegat site was located at elevation about 1,000 m, only slightly above the surrounding plane. In a way, the two kinds of sites represented two different philosophies: in the Klavervlei area, the mountain-top concept embodied by the Californian observatories; at Zeekoegat the concept of the French Haute-Provence Observatory – only slightly elevated above its surroundings – which reminds us of the description at the end of the chapter on image quality in Danjon and Couder's *Lunettes et Télescopes* referred to before: *"D'une manière générale, il convient de rechercher de préférence les plateaux secs d'altitude moyenne, loin de la mer ou des grandes vallées, couloirs de vent. Il est superflu d'avoir un horizon dégagé, car un observatoire astronomique n'est pas un point de vue. – – –".*

The Quick-Look Expedition

In order to get a first impression of the Nieuwveld Plateau, one of the Klavervlei sites, Table Mt. was explored by a three-month "Quick-Look" expedition. However, whereas the earlier tests had been limited to well accessible loca-

tions, for the Klavervlei sites road construction was a first requirement. It was achieved through the intermediary of the owner of the farm, so that in September 1959 access to Table Mt. was possible. 11 km of roads suitable for four-wheel-drive vehicles were constructed, leading to the three observing locations numbered I, II, and III on Table Mt., marked on the accompanying map.

The Quick-Look expedition was carried out by André Muller in collaboration with the Swedish geodesist C. Ulff. André Muller was one of my associates at the Kapteyn Laboratory and had previously conducted observations at the Leiden Observatory Station on the premises of the Union Observatory at Johannesburg. He was, therefore, well acquainted with South Africa. In November 1959, on the way to South Africa, Muller and Ulff spent a week at the Haute-Provence Observatory in order to gain experience with the use of a Danjon telescope in consultation with the staff of the HPO. They completed the Quick Look per 1 April 1960 after three months of seeing tests and climate monitoring, and Muller reported at the July 1960 meeting of the EC [16].

Letters of Muller to myself in the period December 1959 to March 1960 [17] describe delays in the transport of the telescopes and the rather primitive living conditions under which the Quick Look had to be executed (for shelter during the night a tent was borrowed from the Dutch organization ZWO), and troubles with the instruments, among which a lack of stability of the mounting of the Danjon telescopes under the sometimes very strong (and cold!) winds on Table Mt. For the follow-up of the Quick Look, therefore, new mountings were made at the Kapteyn Laboratory. The first impression of the site on Klavervlei Farm was sufficiently encouraging to make the EC decide on a more thorough comparison with the Zeekoegat area. Besides Table Mt., some other sites on Klavervlei Farm with somewhat different local characteristics were to be investigated: Rockdale Mt. and Flathill mentioned before. Of the three sites on Table Mt. only the most southern one was to be kept. For the new programme, the Danjon telescopes were returned to Paris for thorough overhaul. By the beginning of 1961 they were available again on the sites.

Meanwhile, in the course of 1960, plans for Fehrenbach's GPO project had advanced so far that a search for a suitable location became desirable. As we shall see in article IV, it also was at about this time that the EC agreed in principle to incorporate the GPO into the "initial programme" of telescopes mentioned in the Convention. For the preparation of the many logistic measures connected with it as well as with the Klavervlei testing (erection of GPO housing, satisfactory living quarters for the observers, water and power supply, etc), Fehrenbach, Couder and Blaauw visited South Africa from mid-November to mid-December 1960. They reported on their visit at the January 1961 meeting of the EC [18]. As one of the results of the mission, the choice for the location of the GPO fell on the site near Zeekoegat.

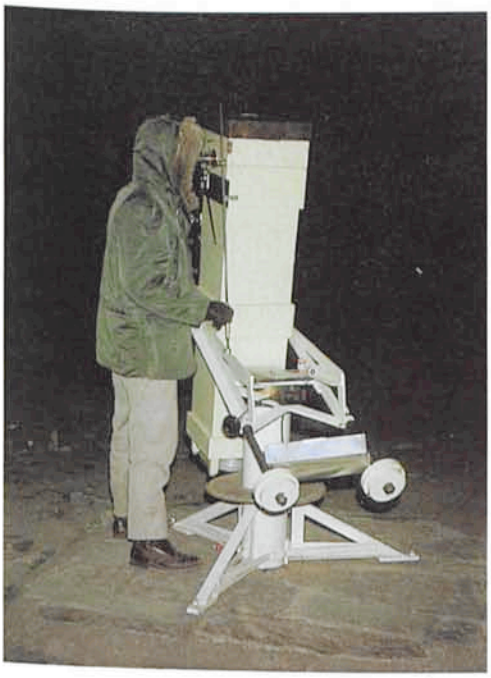
The Comprehensive Programme, 1961–1963

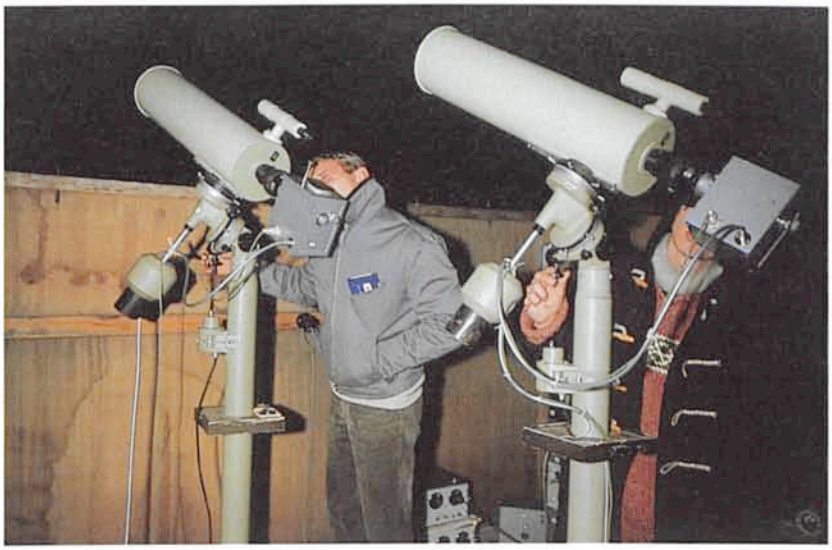
The final, comprehensive programme was planned to run for at least a full year but would, in fact, be concluded only in the course of 1963. It was supervised by a succession of astronomers, the first one being again André Muller. The simultaneous monitoring of the four sites required a larger staff than had been engaged before, but we realized that it would by no means be necessary for all of these to be astronomers. What we rather needed was: willingness to spend long periods at isolated spots in the desert in primitive housing; handiness in technical matters; a gift of improvisation and elementary cooking; and, last but not least, readiness to perform over extended periods the routine work of the testing . . .

How to find such people? It occurred to me that all this sounded like the interests of an ambitious boy-scout, so we advertized our wishes in a Dutch journal of boy-scout leaders. The result was rewarding: among the applicants were Albert Bosker and Jan Doornenbal, both of whom later became employees of ESO. Among the team that started the work in March 1961 we also encounter the two young German astronomers D. Messerschmidt and W. Schlosser, and

At the Zeekoegat Station, January 1962.
Above: *André Muller with Bert Bosker, adjusting the mounting of a Danjon telescope, in front of the rondavel that housed the instrumentation.*
Below: *at left, the "Abri" housing the Marseilles GPO; middle and right, houses of the observers. Photographs by the author.*

At Rockdale Station on Klavervlei Farm, January 1962.
Above: *B. van Geelen of ZWO, at left, talking to observers of the Tübingen photometric project J. Pfleiderer, U. Haug and Kopp in Rockdale farmhouse.*
Below: *Rockdale farmhouse on Klavervlei Farm. Photographs by the author.*





Site testing in the "Comprehensive Program" in 1962. *Left: with the Danjon telescope for image quality. Right: with photometric telescopes for extinction measures; here: intercomparison check of two telescopes. Photographs by D. Beintema, 1962.*

G. Bilius, a geodesist from Sweden who took over the local supervision in May 1961. He was succeeded in this capacity by H. Lindén from Sweden over the period from August 1961 to April 1962, and by L. Petterson from Sweden from May to October 1962, after which André Muller took over again. Others who over certain periods collaborated in the site tests were P. McSharry, a geodesist from South Africa, and the young astronomers K. Kopp, W. Seufert, W. Weber and M. Grewing from the GFR, and D. Beintema from the Netherlands.

A working scheme for the operations had been drawn up by Muller in December 1960 [19]. From it we quote:

"– – – Irrespective of weather conditions, the observers and their assistants are on duty from sunset till sunrise to do meteorological and astronomical observations at regular times.

– – – Observers and assistants have to work during 25 consecutive nights and after this period have to take leave of 5 consecutive nights. These 5 nights, covering a period of nearly 6 days, can be spent anywhere in the Union of South Africa and special provisions are made to meet extra expenses. With the exception of these 5 nights, there will be no opportunity for outings, whatsoever.

The groups of observers and assistants will be shifted from one station to the other at regular times, to ensure a good comparison between the different stations.

– – – The observers and assistants do organize their own housekeeping [which] includes foraging in Beaufort West, Zeekoegat or Prince Albert – – –."

An interim report on the new tests was submitted by Muller and Blaauw to the March 1962 meeting of the EC [20]. They had just returned from a visit to the activities in South Africa in December and January made jointly with B. van Geelen who, as an associate of J.H. Bannier of the Dutch organization ZWO, took care of the many financial, administrative and personnel matters connected with the site testing. Their report [21] describes in detail the structure of the site tests at that epoch. The routine monitoring of image quality and climatic conditions proceeded satisfactorily at the four sites. Of the three on Klavervlei Farm, Flathill seemed to emerge as the most favourable one; of the other two, about equal in quality, it was decided to lower the priority for Rockdale Mt. The meeting decided that regular observations should continue till about March 1963, so that the period on which final judgement was to be based should contain two complete runs of the normally most favourable season from November through March.

Muller reported again at the June and October 1962 meetings of the EC, after returning from visits to South Africa. By October the image quality tests on Rockdale Mt. had been stopped (as was the photometric project of Tübingen on that site, described below). With the termination of all tests in sight, the EC appointed a small group to study the results in preparation for the decision on the site, to be chaired by Siedentopf and further consisting of Dommanget, Fehrenbach, Muller and E. Holmberg from Sweden, thus having representatives of the five participating countries.

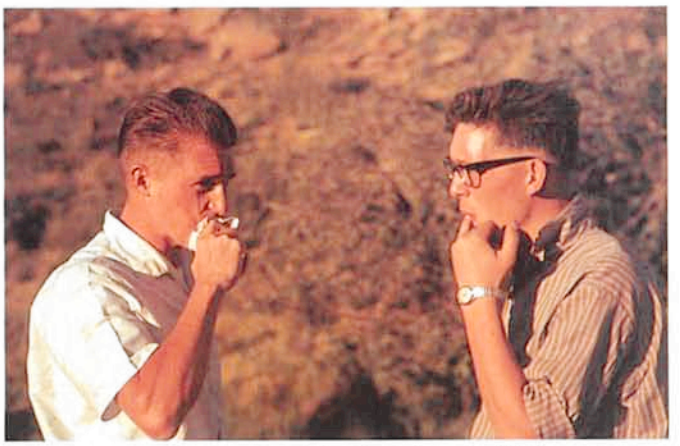
By the time of this EC meeting of October 19 and 20, 1962 the ESO Convention had just been signed (October 5) and the EC took two important measures. One was the appointment of Otto Heckmann as acting Director of ESO, per 1 November 1962 (to be confirmed after the ratification). Heckmann had visited the ESO activities in South Africa together with Fehrenbach in August and September, 1962. Furthermore, by this time the interest of ESO in the site tests in South America had led to a mission of Muller and McSharry to Chile, to join the American group under J. Stock; McSharry was already on his way at the time of the October 1962 meeting and Muller was to follow him shortly thereafter. Their findings will be reported in the next article.

The routine observations of image quality and of climatic conditions terminated, as had been planned, around March 1963. At its February 1963 meeting the EC decided to continue the work in South Africa only for the purpose of an intercomparison of the Danjon telescope tests with telemeter observations as they had been used by Stock's group in the Andes; for this purpose one of their telemeters was shipped to South Africa. This final programme was carried out by McSharry under supervision of Muller.

Last Tests in South Africa: the Siedentopf Experiment

Towards the end of the activities in South Africa, a new kind of test was introduced that had been developed over the past years by Siedentopf and Mayer at Tübingen. It used measurements of the rapid temperature fluctuations which accompany the turbulence in the atmosphere and which, in turn,

One of the Danjon telescopes, provided in the last stage of the tests with a mask for experiments by A. B. Muller simulating a double beam telescope for measuring image motion. Photograph by D. Beintema, 1962.



From boy-scout leaders to ESO site testers to ESO employees: Jan Doornenbal, left, and Bert Bosker. Photograph by D. Beintema, 1962.

are correlated to the image quality; see also the description in the accompanying box. For the measurement of these temperature fluctuations, thermocouples and resistance thermometers of small time constant were used. By mounting the instruments on masts at different heights, the dependence of temperature fluctuation on elevation above ground level could be measured and, hence, the dependence of turbulence on height. These experiments have played an important role in the decisions taken later with respect to the level at which the telescopes on La Silla were to be mounted.

Applications of the method in ESO context were made by F. Unz in the period July 17 to September 1, 1963 at Zeekoegat and Flathill. After verbal provisional accounts by Siedentopf this work was reported in an ESO publication in 1964 by (the late) Siedentopf and Unz [22]. Simultaneously with these measurements, wind velocity was monitored, and the quality of the seeing was estimated by the measures of image motion with the double-beam telemeters. Two important results were found: the amplitude of the temperature fluctuations decreased rapidly with increasing height within the range of 3.5 to 24 meters, and the difference between the amplitudes at low and high levels was strongly correlated with the amplitude of the image motion. These results immediately led to the conclusion that mounting the telescopes at high level above the ground should eliminate most of the image motion, and hence improve the seeing. A more extensive report was published by Unz in 1970 [23].

The Tübingen Photometric Project

The Tübingen photometric project on Rockdale Mt. ran from August 1961 to November 1962. It was carried out with a 3-colour photometer on a 40-cm telescope by members of the staff of Siedentopf: J. Pfleiderer, Miss U. Mayer, J. Pesch, U. Haug, and J. Dachs. Also, surface photometry was done of the Milky Way and of the Zodiacal Light in blue and red. Siedentopf reported at the October 1962 meeting of the EC on provisional results. The Rockdale Mt. observations would become part of the data later used by the Site-Selection Committee. Full reports on the Tübingen project were published in 1966 by Dachs, Haug and Pfleiderer [24] and by Pfleiderer, Dachs and Haug [25].

The Marseilles GPO Project

Fehrenbach's objective-prism radial velocity project at Zeekoegat became fully operational about the middle of 1961, after delays in the construction phase. It extended in time considerably beyond the termination of the monitoring of image-quality and climatic conditions, until well in the year 1966, after which the GPO was moved to La Silla.

In the first issue of the *ESO Bulletin*, of November 1966 (the Bulletins were a series of ESO publications terminated in 1975), Fehrenbach describes the history of the GPO work at Zeekoegat. Over the years, altogether some thirteen collaborators of which several with their families, most of them from the Marseilles staff, had worked on the project. It produced a large number of GPO plates, most of them on the Magellanic Clouds. However, the observational conditions, although not unsatisfactory, proved to be inferior to those encountered soon afterward on La Silla.

One of the disturbing factors were the strong daily temperature variations at the Zeekoegat site. Moreover, the GPO had been mounted at Zeekoegat at ground level, and one of the measures taken to obtain better image quality at La Silla was placing the telescope at high level. For an early progress report on the project, see, for instance, the *Information Bulletin of the Southern Hemisphere*, No. 2, Sept. 1962, p. 22.

The Comprehensive Reports on the South African Tests

We finally arrive at the reports which sum up the total of the ESO efforts in South Africa. A final report has been published as an ESO publication in 1967, long after the decision on the choice of the site had been taken. It was compiled at the request of the Director of ESO by Ursula Mayer of Tübingen who had participated in some of the activities in South Africa, and under the auspices of ESO's Site Evaluation Committee. It carries the title Astronomical Site Testing in South Africa and contains contributions by many of the people who had participated or had been actively involved in the tests.

The report systematically surveys studies of the meteorological conditions, matters of organization, and the seeing tests and their results in chronological order. Although the report, in this form, has not played a role in the decision on the site, it remains an interesting document, not just for historical reasons, but also because in its concise, yet sufficiently detailed presentation it may serve for other purposes of meteorological and astronomical nature. The booklet is in the ESO Library (and probably in many institute libraries) and also forms part of the ESO Historical Archives [26].

The decisive comparison between conditions in Chile and South Africa was based on provisional reports, but on virtually the same data as those used for the final document just mentioned. This comparison was prepared by Siedentopf for the EC Meeting of 15 November 1963; it was published in 1966, in the first issue of the *ESO Bulletin*. Sieden-

topf used the data collected at Zeekoegat, Flathill and Rockdale Mt., and those collected in Chile by Stock and by Muller and McSharry. We shall return to it in the next article and mention here only that the report confirmed what had been strongly suspected: that the sites in the Andes Mountains around La Serena were to be preferred on several grounds: the number of clear nights, the image quality, and the surprisingly low temperature drop during the night. It was at this meeting, 15 November 1963, that the EC decided in favour of South America.

In the beginning of this article I referred to the deterioration of seeing in the course of the night in the northern part of South Africa, mentioned by Bok. Such systematic change is not explicitly discussed in the reports on the ESO tests. However, while preparing this article, I am informed by André Muller that also on the Klavervlei and Zeekoegat sites this phenomenon was definitely noted and the deterioration was closely related to the decrease of temperature in the course of the night. In fact, according to Muller, this relation provides a strong first indication of the quality of a potential site: the smaller the drop in temperature, the better the site.

Finally, we note that in the course of the tests, the rating of image quality by means of the diffraction rings only was felt more and more as an unfortunate limitation. Nights with "good" rings but appreciable image motion did occur and were of little use for practical work like stellar spectroscopy, as was in fact experienced by observers at the GPO. This was pointed out, for instance, in the report of February 1962 referred to under footnote [21] but it did not lead to drastic modifications of the techniques of observation.

At the End, Bewilderment and Consent

The rather sudden switch from South Africa to Chile did not pass without bewilderment to the young astronomers and their collaborators still at work in South Africa. Had years of effort been waisted? Some disappointment was undeniable. Heckmann was aware of this and expressed it in a letter to me which, unfortunately, I have not been able to recover but of which I do remember the first words: "Mich drückt das Bewußtsein . . .". Disappointment would soon make room for the conviction that the decision had been right.

The Benevolent Environment

In the description of ESO's earliest history we encountered first of all the astronomers and their immediate collaborators. But their work would not have been possible without strong administrative support in Europe and the logistic services and hospitality of South African institutes.

Throughout the pre-ratification phase, the efforts toward ESO relied heavily on the moral support from the part of individuals in government departments or in science funding organizations. For France, the authorities concerned were in the Ministry of Science and Education and, ultimately, in the Ministry of Foreign Affairs; for the German Federal Republic and Belgium, in those dealing with science and education or technical development. For the Netherlands and Sweden they belonged to the science supporting organization ZWO and the Swedish Natural Science Research Council, respectively. These structural differences also determined the nature of the sources for the provisional funding of the site tests.

Particularly meritorious for ESO's early development was the Director of the Dutch organization ZWO, J.H. Bannier. From the moment of his appointment as Treasurer of the ESO Committee (at its October 1957 meeting) Bannier firmly took in hand the financial management. His task was not only budgeting and bookkeeping, but also the continuous effort to persuade the authorities in the partner countries to provide, on the necessarily *ad hoc* basis, the required funds. Bannier's authority allowed him, when necessary, to take initiatives in funding measures which made it easier for the partner countries to cross the financial bridge. From early 1959, Bannier made his associate Dr. B. van Geelen, a young chemist, available for services including personnel matters, preparation of travel, insurance, etc. – without frowning upon the bill of a water diviner in South Africa [27].

On the South African side, throughout the site testing there was strong interest and support from the part of the President of the Council for Scientific and Industrial Research, Dr. S.M. Naudé. CSIR provided know-how on technical matters required for setting up the testing stations and made vehicles and measuring instruments available for ESO's rather demanding use. Responsible for these services was from 1956 CSIR's Director for International Scientific Relations, Dr. C.G. Hide.

Essential was, of course, the collaboration and support experienced throughout the work from the part of the owner of Klavervlei Farm, the Köster family, and of Mrs. Oosthuizen of Sunnyside Farm at Zeekoegat.

Last but not least, there was the generous hospitality extended to the ESO teams by the South African observatories. With the testing activities gradually shifting to the Karroo, ESO relied more and more on the counsel and support provided by the staff of the Cape Observatory. The outstanding hospitality offered by its Director, R.H. Stoy and Mrs. Stoy, and by his associate David Evans and Mrs. Evans is warmly remembered by all those who participated in ESO's South African venture.

References and Notes

Abbreviations used:
EHA = ESO Historical Archives (see the description in the previous issue of the *Messenger*).
FHA = Files belonging to the Office of the Head of Administration at ESO Headquarters.
EC = ESO Committee (the committee that preceded the Council); for a list of the meetings of the EC, see the previous article.
Heckmann Sterne = O. Heckmann, *Sterne, Kosmos, Weltmodelle*, Verlag Piper & Co., München, Zürich, 1976.

[1] See the report on the site selection by W.H. Stevenson and H. Knox-Shaw in *Monthly Notices R.A.S.*, Vol. 95, p. 447, 1935.
[2] In EHA-I.A.1.3. A paper presented at the *Flagstaff* Conference on Photo-electric Problems, Techniques, and Instrumentation, Aug.-Sept. 1952.
[3] In EHA-I.A.1.3.
[4] H. Siedentopf: *Climate of the Union of South Africa*, Astron. Inst. of the Univ. of Tübingen, 1955, in EHA-I.A.1.3.
[5] Memo of this meeting in EHA-I.A.1.3.
[6] A. Danjon and A. Couder, *Lunettes et Télescopes*, Paris 1935, Chapitre V. See also *Comptes Rendus* No. 183, 1032, 1926 for the calibrations.
[7] EHA-I.A.1.3. A long report by Elsässer to Heckmann, Siedentopf and Unsöld accompanies this letter.
[8] See I.A.1.5. and I.B.3.
[9] See I.C.2.3.a.
[10] EHA-I.C.2.3.d.
[11] *Comm. Obs. de Belgique* (Uccle), No. 141, 1958.
[12] See minutes of a discussion on 25 July 1958 following the 8th EC Meeting in EHA-I.A.1.7.
[13] See minutes EC Meeting of July 1958, item 13 in EHA-I.A.1.7.
[14] See letter of J.H. Oort to the EC of Oct. 21, 1958 in EHA-I.C.2.3.
[15] This report in EHA-I.B.11. and I.C.2.5.b.
[16] See the minutes of this (12th) meeting of the EC. The report by Muller seems to be missing from the EHA.
[17] In EHA-I.C.2.5.d.
[18] The report is contained in the minutes of the meeting.
[19] In EHA-I.C.2.2.a.
[20] In EHA-I.B.11.
[21] See map EHA-I.A.1.16.
[22] EHA-I.C.2.7.b., H. Siedentopf and F. Unz, Temperature Fluctuations in the Atmospheric Ground Layer observed at Zeekoegat and Flathill (South Africa), March 1964.
[23] F. Unz, Mitteilungen Tübingen No. 116 = *Meteorol. Rundschau* 23, p. 87, 1970.
[24] J. Dachs, U. Haug and J. Pfleiderer, *Mitt. Tübingen* No. 87 = *J. Atm. Terr. Phys.* **28,** p. 637, 1966.
[25] J. Pfleiderer, J. Dachs and U. Haug, *Mitt. Tübingen* No. 88 = *Zeitschr. für Astroph.* **64,** p. 116, 1966.
[26] In EHA-I.C.2.7.b.
[27] See letter van Geelen to Blaauw of 11 November 1960 in EHA-I.C.2.8.d.