1862–3.

VICTORIA.

THIRD REPORT

OF THE

BOARD OF VISITORS TO THE OBSERVATORY,

WITH THE

ANNUAL REPORT OF THE GOVERNMENT ASTRONOMER;

AND

TWO DESPATCHES,

FROM HIS GRACE THE SECRETARY OF STATE FOR THE COLONIES,

COVERING REPORTS FROM THE ROYAL SOCIETY OF LONDON AND THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ON THE

ERECTION OF A TELESCOPE OF LARGE OPTICAL POWER AT MELBOURNE.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND.

By Authority:
JOHN FERRES, GOVERNMENT PRINTER, MELBOURNE.
No. 86.

REPORT OF THE BOARD OF VISITORS TO THE OBSERVATORY.

To His Excellency Sir Henry Barkly, K.C.B., Captain-General and Governor-in-Chief of the Colony of Victoria, and Vice-Admiral of the same, &c., &c., &c.

MAY IT PLEASE YOUR EXCELLENCY,

Since the date of the last annual Report the chief portions of the new Observatory have been completed in accordance with the recommendation of the Board of Visitors.

The Government Astronomer was formally put in possession on the 1st June, and the instruments have been removed from Williamstown and are now mounted and in working order.

Two new instruments have been added to the Observatory—an excellent small Equatoreal, by Messrs. Troughton and Simms; and a prime Vertical Transit Instrument, by Ertel of Munich, one of the finest instruments of its class yet constructed.

So far as can be ascertained in the short time during which observations have been taken at the new Observatory, the steadiness of the instruments fully justifies the expectations of the Board as to the advantages to be derived from the change of site.

Professor Neumayer, who has had charge of the Magnetical and Meteorological Observations carried on formerly at the Flagstaff Hill, and more recently at the new Observatory, being on the point of departure to Europe, the two establishments have been consolidated and placed under the direction of the Government Astronomer.

A considerable reduction in the expense of maintaining the establishments will result from this change, and the Board has reason to believe that this saving will take place without any sacrifice of efficiency.

The five-year series of hourly magnetical and meteorological observations having been completed, as originally intended, these hourly observations have been discontinued, and replaced by a series at longer intervals.

In reporting this reduction in the number of observations in these departments taken daily, the Board desires to remark that when the great mass of observations now accumulated shall have been fully discussed and published the results deduced from them may probably indicate advantages to science to be derived from a further series with the improved self-registering instruments now in use at Kew.

The Legislature has voted the amount requisite for printing these observations, and Professor Neumayer is now busily engaged in preparing them for the press.

During the past year the Astronomical Observatory has rendered an important service to science by its contribution to the organised system of observations carried on in various parts of the world for obtaining a more accurate determination of the distance of the sun, by observations of the planet Mars at his recent opposition.

Of the Observatories which have taken part in this work the four which have been mentioned as furnishing the best results are Greenwich and Pulkowa in the north, and the

Cape of Good Hope and Melbourne in the south, and this Observatory has been reported as having furnished a very fine series of observations.

Steps are being taken, in conjunction with the telegraph establishments of this and the neighboring colonies, to extend still further the usefulness of the Observatory by establishing a system of coast signals, giving warning of the approach of foul weather, as is now being done by Admiral Fitzroy in England.

The attention of the Board having been drawn to the advantages which would result to astronomical science from a systematic observation of the Nebulæ and Double Stars of the Southern Hemisphere with a telescope of large optical power, His Excellency the Governor, at the request of the Board, obtained through the Secretary of State for the Colonies, reports on the subject from the Councils of the Royal Society of London and of the British Association for the Advancement of Science.

From these documents, which are appended to this Report, it will be seen that this object has long occupied the attention of scientific men in England, that discoveries of a most important character are expected to result from it, that the plans for the construction of the telescope are fully matured, and that the estimate of the cost (£4500) may be relied on; and the fact that the matter has been taken up in Victoria is hailed with satisfaction both in England and on the Continent of Europe.

The Board of Visitors ventures to express a hope that the Legislature will exhibit the same liberality in this case which it has hitherto shown to all departments of science, and that provision will be made on the Estimates for aiding in carrying out this great work.

The ground on which the Observatory is built has as yet been only temporarily set apart for the purpose. The Board recommends that the reserve should be made a permanent one, and the land vested in the Board of Visitors, or others, as Trustees.

HENRY BARKLY,
Chairman.

W. P. WILSON,
Secretary.

19th August, 1863.

REPORT OF THE GOVERNMENT ASTRONOMER TO THE BOARD OF VISITORS TO THE OBSERVATORY.

READ AT ANNUAL VISITATION, 22ND JUNE, 1863.

The annual visit of the Board, as the members are aware, has been deferred to this late date to enable me to complete the mounting and arrangement of the various instruments at the new Observatory, but this undertaking has been more tedious than was at first expected, and although the transit circle, chronographic apparatus, and equatoreal are mounted, and in good working order, yet the erection of the prime vertical instrument and many of the minor arrangements are not so complete as I should have desired.

I have now the honor to lay before you this my fourth annual report on the progress of the Observatory since the last visitation, as well as of its present state:—

On the beginning of last month I received notification from the Department of Public Works that the new Observatory was completed, and I immediately dismounted the instruments at Williamstown, and moved them, with the furniture and books, to the new building. This work was accomplished in about a week, without a single accident; and on the 9th June the Williamstown Observatory ceased, and the "Melbourne Observatory" commenced, its existence.

The new Observatory is a most substantially-constructed building, presenting a well-finished and somewhat picturesque exterior, and in no way detracts from the beautiful site on which it stands. It contains twelve rooms, two under ground, eight on the ground floor, and two above. The two rooms underground, each fifteen feet long by nine feet broad, are intended for depositing chronometers for testing and rating, the comparisons of standard weights and measures, barometers, &c. The eight rooms on the ground floor consist of the transit room, library, computing room, receiving room, prime vertical room, laboratory, lamp room, and strong room. The transit room forms an eastern wing to the building, and is twenty-two feet long by eighteen feet broad and sixteen feet high, and has a meridian opening from horizon to horizon. The roof opening is closed by one long shutter, opened by a crank connected by means of a long rod with a lever apparatus fixed on the west wall. The shutter is so counterpoised at each end, that it is easily lifted or shut by the lever, which is placed in a position to be comfortably reached. The north and south portions of the openings are closed by vertically-sliding shutters. The piers for the transit circle and collimators are of bluestone, resting on substantial foundations of the same material, set in Portland cement. The chronographic apparatus, with the "telegraph line register" and "key," occupy a table on the N.E. portion of this room. The new sidereal clock is placed on the west wall.

The library, which forms also the astronomer's office and board room, occupies the N.W. angle of the building: it is twenty-two feet long by eighteen feet broad. In this room is a door leading into a chamber, formed by the basement of the equatoreal tower, which is used as a strong room for depositing our observations, record books, &c.

The prime vertical room forms the south end of the building: it is thirteen feet square. The double pier for the instrument rests upon a square foundation of masonry, four feet by five feet, occupying the centre of the room. The roof has two openings closed by shutters, in the direction of the prime vertical. The apparatus for opening and closing these is not yet constructed.

The computing room, as it is called, is really the assistant astronomer's room, and occupies the centre of the south wing. The mean time clock and the second sidereal clock are placed in this room, on piers erected in two of its angles.

The receiving room forms the junior assistant's office. It is fifteen feet long, by ten feet wide.

The laboratory is a room of the same size, and looks into the court-yard at the back.

The lamp room is a small chamber between the transit room and library, and is lit by a glass-panelled door, opening into the lobby.

The equatoreal and meteorological rooms are on an upper story. The equatoreal room, which forms the upper part of a round tower, on the north side of the building, is a circular chamber of ten feet diameter, surmounted by a revolving hemispherical dome. The equatoreal, with its pier and revolving platform, occupies this room.

The meteorological room forms the upper chamber of a square tower, of which the base is the computing room, and is used at present as the office of the meteorological assistant. It is intended to place the registering dial of an *anemometer* in this room, as the apex of its roof is pierced for making the requisite fittings in mounting such an instrument.

Some small additions to the building are now being made, and will soon be complete. A wall, to enclose a court-yard at the back, which will serve to contain a workshop and store-room, forms one of these. Another and most important one is the supplying with gas, which I believe is to be shortly completed. This will enable me to carry out several arrangements, both as regards testing chronometers and standard measures, and also a "night time-signal" as proposed in my last report, more satisfactorily.

The site of the new Observatory is in all respects excellent: it is away from any disturbance from traffic or otherwise, and free from dust or smoke of the city; it is much higher than the vicinity, commands an almost uninterrupted view of the horizon, is in full view

of the shipping, and stands on a formation admirably suited for stable foundations. The fence about the grounds forms an ellipse, containing over five acres: within it, on the S.E., a portion is occupied by the meteorological instruments; on the south side the magnetical horary room is situated, while the room for absolute determinations is situated on the west of the Observatory. The grounds are being partially planted with trees and shrubs.

The old Observatory at Williamstown has been handed over to the Inspector-General of Public Works. The lighthouse is still used as a time-ball tower.

The *Personal establishment* is the same as at the date of my last report, and consists of *Astronomer*, *Assistant astronomer*, and *Junior Assistant*. I have found it requisite to get occasional temporary clerical assistance, in reducing and tabulating some of the observations.

Instruments.—The transit circle, described in my last report, has continued in good working order; the addition of the small setting circle, and the introduction of a system of close interval wires, have proved great acquisitions. The removal of the establishment to the new Observatory having been pending, I did not consider it advisable to undertake a second and thorough examination of the division of the circle until it was remounted in its permanent position, as the removal would render a fresh examination necessary; that operation has, therefore, been deferred, but I hope to accomplish it very shortly. A few days before dismounting it, previous to removal, I made an examination of the apparatus for illumination of the wires in a dark field, which in my last report I alluded to as being unsatisfactory, and I find that a more powerful light than that given by the oil lamp used is required, for when a more brilliant light was substituted the illumination was far more satisfactory. The apparatus itself appeared to be in good order and adjustment.

In last December I received from Messrs. Troughton and Simms an apparatus for testing the form of the pivots. This has not yet been used; but since the instrument has been re-erected, an examination of the pivots, by means of the large striding level mentioned in my last report, was made by Mr. White, no error, however, in form or equality was discernible. I intend soon to test them again thoroughly with the new apparatus. In remounting the instrument on its piers in the new Observatory, I had all the plugs fixed into the stone with lead, as the plaster of paris with which they had been previously fixed did not seem to exhibit sufficient stability for holding the microscopes and other fittings on to the sides of the piers. By using some simple appliances for keeping the plugs in position and perpendicular to the faces of the pier whilst the molten lead was poured in, the whole of them were expeditiously and very accurately fixed. The screws can now be turned home without any fear of drawing the plugs, an accident that once or twice occurred while they were fixed with plaster of paris.

With regard to the stability of the transit circle in its new position, I am able to report most satisfactorily, so far as can be ascertained with the short experience we have had. The uninterrupted meridian here available forms a most favorable contrast with Williamstown, where low altitudes were shut out by buildings both to the north and south, and the facilities which present themselves here for obtaining good meridian marks form a most important acquisition. As soon as the Observatory is supplied with gas, I propose to use it for the illumination of this instrument, and have no doubt that the difficulty of getting a good dark field illuminator will be thus overcome. In the observations for obtaining the Nadir point by the aid of quicksilver, we find far less tremor than at Williamstown.

The Zenith Sector was in regular use until dismounted for removing; and as it was considered to be more of a field instrument, no accommodation was made for it in the erection of the new Observatory: it therefore remains packed in its cases in the storeroom. I intend erecting it within the reserve as soon as other arrangements are completed. The results given by this instrument in a long series of observations of standard zenith stars are highly satisfactory, and scarcely to be surpassed by instruments of higher pretensions and power.

In September last we received our equatoreal from Messrs. Troughton and Simms, and on the 24th of that month it was mounted and in working order. This instrument has a telescope of five feet focal length, with a clear aperture of $4\frac{1}{2}$ inches; it is supplied with a very useful set of eyepieces, a position micrometer, and a ring-micrometer. The telescope is mounted on the Fraunhofer plan, and has an hour circle of twelve inches diameter reading to seconds of time, and a declination circle of the same dimensions reading to 10″ by means of verniers. The driving clock is a very superior one; it is regulated by a conical pendulum, controlled by friction, applied in a very convenient manner by means of a micrometer screw; it carries the telescope with great steadiness and regularity. The hour circle is moveable on the Polar axis, and is divided on both edges, having a pair of verniers for each set of divisions. This is a very great convenience; for, in driving the telescope, one set of verniers will indicate sidereal time, while the other indicates the right ascension of the object to which the telescope is directed, and, moreover, obviates many inconveniences attendant upon a fixed hour circle.

We had ample opportunity of testing this instrument on the observations of Comet II., 1863, and during the opposition of Mars; and although of no great pretensions as regards size or power, it is an admirably constructed instrument. The object glass I consider very good, as I have on several occasions divided some double stars, forming very severe tests to its defining and penetrating powers. The stability of its mounting, too, renders it an extremely useful instrument in really good differential measures. It is now mounted in the dome, where I have much pleasure in inviting the board to inspect it.

In May last the prime vertical instrument alluded to in my first report to the board arrived. As this building was then scarcely completed, I merely had the cases opened to see that no mischief from damp or oxydation was going on, and screwed up again.

Four weeks ago the mounting it on its piers was commenced. This has turned out so troublesome an operation, principally on account of the peculiar construction of this class of instrument, that we have not yet satisfactorily completed it.

This instrument, which I shall have much pleasure in orally describing to the board when under inspection, was constructed by Messrs. Ertel and Sons, of Munich. It has a telescope of eight feet focal length 6·5 inches aperture, with powers of 132, 198, and 285; lifting and reversing apparatus, levels, &c. When in proper adjustment and working order, I have no doubt I shall find every reason to be satisfied with this great instrument, but the difficulty now presenting itself to the proper working of the apparatus is the trouble in getting it to drop into its bearing when lowered with the complete precision and quietness necessary, but I think we shall shortly overcome this.

With respect to our *chronographic* and *telegraphic arrangements*, they remained in much the same condition as at the time of the last visit of the board until the removal to this building; but in October last, after some experiments, I adopted altogether a new battery for our observatory train, instead of the *Daniel's* hitherto used, and I have had good reason to be satisfied with the change. Its superiority for such purposes as we require will be evident when I inform the board that, when once charged, this battery produces a steady and constant current for eight months together, without any replenishing except a few crystals of sulphate of copper occasionally. It requires no cleaning, and the destruction of the elements is very small. So fully am I convinced of the superiority of this battery for observatory purposes that I wrote to the Astronomer Royal at Greenwich, recommending them for his adoption. The elements are zinc and copper, excited by a solution of sulphate of magnesia, and fed by crystals of sulphate of copper in a way which admits of only just sufficient copper being in solution at the one time. This battery is known as the Sulphate of Magnesia Battery, and is patented by Messrs. Oppenheimer, of Manchester.

Some slight modifications in our circuits became necessary in completing our arrangements here; but in the main they are very similar to those described in my last report at Williamstown; the only addition being an alarm bell, which serves the double purpose of indicating any requirements on the main telegraphic lines with which we are in communication, and also serves the purpose of a call bell, by being connected with a key in the astronomer's room.

The wire connecting the Observatory with the Chief Telegraph Office in Melbourne was erected a little time prior to moving the instruments. Our three clocks continue to give satisfaction in their performance. The new clock by Frodsham is used as our standard sidereal clock. The other clock by the same maker is placed in the computing room, but not yet connected with the galvanic currents. The mean-time clock is used as hitherto for sending the daily time signals, which it does with all satisfactory precision and regularity.

Time Signals.—These are the same as mentioned in my last report. They consist of the time ball on the Lighthouse Tower, Williamstown; the time ball on the Telegraph Office in Melbourne; the time ball on the Telegraph Office in Geelong; and the time ball on the Telegraph Flagstaff at Queenscliff, which was erected a few months since, and is now dropped daily by means of the Observatory signal.

The time ball on the Lighthouse has been dropped regularly, until the time the Observatory was removed to Melbourne, when several interruptions unavoidably occurred, owing principally to the telegraph connections being at first of a temporary nature and somewhat incomplete. This was felt as a great inconvenience to commanders of vessels, and several complaints arose in consequence; latterly, however, the ball has dropped with its accustomed regularity.

The drop of the ball in Melbourne and Williamstown can now be observed from the Observatory, and the actual times of drop are recorded on the chronograph. As a rule, they both drop with considerable precision; should any error occur, it is noticed in the daily papers as heretofore.

The method of sending the signals for the drop is the same as described in my last report. I mentioned in my last report my intention of endeavouring to institute a night time signal by means of a lime or some other brilliant light, but I deferred carrying this project into practice until after the removal to their new site; and as soon as time will allow I purpose to make some trials as to the best means of doing this.

It is also proposed to use a time gun at one o'clock. This mode of time signal has been found of the utmost convenience to the general public in Edinburgh and other places. It does not perhaps afford the means of getting the time so accurately as the drop of the time ball, unless the flash can be observed, but the explosion being audible over a very large area admirably serves the purpose of a universal time signal, which I have no doubt will be thoroughly appreciated by the public. The audible signal can also be rendered very exact by taking into account the distance, and when arrangements are complete, I propose to adopt the plan of Professor Smyth, of Edinburgh, and get distance circles printed on an outline map of Melbourne and the suburbs. Colonel Anderson has kindly offered me any assistance that I may require in carrying this proposal into practice.

Library.—No very extensive addition has been made to this portion of the Observatory since my last report. There have been presented copies of the "Greenwich Observations and their results for 1860," and "Annales de l'Observatoire Physique Central de Russie," 2 vols.; and several useful and standard works have been purchased. A complete set of the Memoirs and Notices of the Royal Astronomical Society have been ordered.

Observations.—By far the most important series of observations made during the past year were those for the determination of the parallax of Mars, in connection with Greenwich and Pulkowa, concerning which I received communications from the Astronomer Royal in June. This series extended from 20th August, till 16th November, a period of eighty-eight nights, in accordance with a plan of observation proposed by Dr. Winnecke, of St. Petersburg. Out of this number, Mars was successfully observed on sixty-five nights.

In June last I received a letter from the Astronomer Royal, acknowledging the receipt of our Mars observations, and stating that from them, and the corresponding ones at Greenwich, the parallax of the sun had been computed, and gave 8·932″ as the amount. The comparison of a similar series of observations at Pulkowa and the Cape gave 8·93″; the previously accepted parallax was 8·57. Monsieur le Verrier had already adopted 8.95, resulting from the combination of certain lunar observations with data furnished by the theories of precession and nutation. The monthly notices of 10th April, 1863, contain a short paper by Mr. Stone (first assistant at Greenwich) of the Greenwich and Williamstown observations for this determination.

Since the completion of the Mars determinations, no fresh series of observations was entered upon, pending the removal of the instruments. The numbers of observations made with the transit circle are as follows:—

R. A. Obsns.	...	...	...	... 1838
P. D. Obsns.	...	...	...	... 1564

The observations for 1862 are now nearly all reduced and tabulated, and as there is a sum voted for printing the results, I trust our first volume will soon be in the press.

Since the last visit of the board we have concluded a long series of observations for determination of our longitude. In this undertaking I have been much indebted to the Astronomer Royal, and to Sir Thomas Maclear, the Astronomer Royal at the Cape, and to M. Quetelez of Brussels, for their courtesy in regularly furnishing me with their corresponding observations. The result arrived at from the discussion of this series differs considerably from the longitude previously assumed from observations whose results depended on the accuracy of Burckhardt's lunar tables, which are known to be erroneous to an amount which would affect the longitude as much as 15s.

Altogether we have ninety-seven comparisons with Greenwich, and forty with the Cape. These determinations are perhaps more than usually accordant. The longitude of the Williamstown Observatory therefore may be considered as determined with great precision, and safely assumed as 9h. 39m. 39s., being the mean of 137 comparisons, with a probable error of 0·20s., which makes that of the lighthouse 9h. 39m. 39·7s., and this I am informed by Captain Cox has already been adopted by the Admiralty.

Most of the lighthouses and principal headlands along our coast having been connected with the trigonometrical survey, their longitudes from this determination are, therefore, now very accurately known. The position of the new Observatory, which has been determined by triangulation from Williamstown, is, longitude, 9h. 39m. 54·8s., latitude, 37° 49′ 53″.

The comet No. 2, 1863, was observed with our five-feet equatoreal on several nights, both with a ring-micrometer and band-micrometer, and at the present moment we have the comparison stars under observation, in order to determine their places, and from them the places of the comet.

During the opposition of Mars, a series of measures of its disc with the position micrometer were made, and several sketches of the appearance of the planet obtained; one particularly I consider of interest, as it exhibits a phase of its appearance I have never yet seen noticed—namely a distinct, isolated, roundish, dark spot, surrounded by a bright ring like space, situated near its equator. I observed this on several nights, and on one occasion throughout a quarter of a revolution of the planet.

Having thus far spoken of what has been done in the Observatory since your last visitation, gentlemen, it is desirable you should know what it is intended shall be done after our arrangements here are completed. Besides the regular observations with the transit circle, it is contemplated to select a few stars which pass near our zenith for regular observation with the prime vertical. The equatoreal will be employed in occultations, eclipses of Jupiter's satellites, and if time will allow in the measurements of the double stars around about the pole.

In a late address to the Royal Astronomical Society by its Council, the attention of the Society was drawn to the desirability of a survey of the southern hemisphere of stars, undertaken by British means, on a scale similar to that of the northern hemisphere, which is in hand at Bonn, under Dr. Argelander, and suggesting the expediency of taking advantage of the Government Observatories in Melbourne, Sydney, and the Cape, for this purpose. Two mails since I wrote to the society stating my willingness to take a share in this national work. Should my offer be taken, our work will be cut out for some time to come, and even if this survey is not attempted as a work emanating from the Royal Astronomical Society, I think it will be highly advisable to do what we can towards this most desirable object.

It is with great pleasure I see that the proposal emanating from the board for the erection of a large reflecting telescope in the Observatory grounds has met with warm support, both from our own Government and the Imperial Government, as well as from the principal scientific bodies at home. I trust, therefore, there is some chance of this proposal being carried into effect.

The transfer of the meteorological and magnetic portion of this Observatory to my charge I understood was to have taken place at the end of June, but I have had no official intimation concerning it up to the present time.

The residences for myself and assistant, for which the sum of £1500 has been voted, are not yet commenced, but I trust from the urgent necessity there exists for residence near to the Observatory, no great delay will occur in their erection.

ROB. L. J. ELLERY,
Government Astronomer.

APPENDICES.

VICTORIA, No. 2.

Downing street,
24th January, 1863.

SIR,

I have the honor to acknowledge the receipt of your despatch, No. 83, of the 23rd of July, on the subject of the erection of a telescope at Melbourne, of greater power than any previously used in the Southern hemisphere.

I requested the assistance of the Royal Society and of the British Association for the Advancement of Science in furtherance of the object you have in view, and I now transmit to you a copy of a communication from the Royal Society, with a report, which has been concurred in by their Council. 23rd Dec. 1862

No report has as yet been received from the British Association.

I have, &c.,

Governor Sir H. Barkly, K.C.B., &c., &c., &c,

NEWCASTLE.

Apartments of the Royal Society,
Burlington House, 23rd December, 1862.

MY LORD DUKE,

In reference to Mr. Elliott's letter of 10th October, transmitting the copy of a despatch from the Governor of Victoria respecting the erection at Melbourne of a telescope of greater power than any previously used in the Southern hemisphere, and requesting that the Royal Society would furnish a report upon the subject, I have the honor, in compliance with your Grace's request, to enclose a report, which has been concurred in by the Council of the Royal Society.

I have, &c.,

EDWARD SABINE, M.G.,
Presdt. of the Royal Society.

His Grace the Duke of Newcastle, K.G., &c., &c., &c.

REPORT OF THE PRESIDENT AND COUNCIL OF THE ROYAL SOCIETY RESPECTING THE PROPOSAL OF ERECTING IN MELBOURNE A TELESCOPE OF GREATER OPTICAL POWER THAN ANY PREVIOUSLY USED IN THE SOUTHERN HEMISPHERE.

1. The President and Council learn with pleasure that the Board of Visitors of the Melbourne Observatory have proposed resolutions, indicating their sense of the importance of erecting at Melbourne an equatorially-mounted telescope of great optical power, and that the proposal is favorably regarded by Sir Henry Barkly, Governor of Victoria, and by his Grace the Secretary of State for the Colonies. In respect to the importance which the President and Council attach to such an undertaking, they need do no more than refer to the fact that, in the year 1850, the Royal Society and the British Association for the Advancement of Science presented a joint memorial to Her Majesty's Government, in which they urged the establishment of such a telescope at some suitable place in the southern hemisphere. The scientific objects to be attained thereby are so clearly stated in that memorial, of which a copy is enclosed, and in the resolutions of the Board of Visitors of the Melbourne Observatory, in July, 1862, that the President and Council feel it unnecessary to do more than refer to these documents.

2. Since the presentation of the memorial of 1850, an equatorially-mounted telescope of greater optical power than that then recommended has actually been constructed by Mr. Lassell, at his own expense, in England, and erected in Malta, where he is now occupied in making observations with it; we have now, therefore, in addition to our previous knowledge, the benefit of his experience. In referring to Mr. Lassell's telescope, the President and Council wish it, however, to be understood that they do not conceive that it should necessarily be copied in all respects; and that, for the present, they think it best to leave the details of construction in many respects open to farther consideration.

3. When the subject was previously under consideration, letters were written to some of the most eminent practical astronomers of Great Britain and Ireland, requesting them to state their opinions as to the best mode of construction, and a correspondence ensued, of which a printed copy is sent herewith. After receiving the communication from the Colonial Office of the 10th of last October, the President wrote to the four gentlemen who were appointed as a committee on the former occasion to superintend the construction of the instrument (in case the Government should accede to the request), and also to Sir John Herschel, enclosing a copy of the former correspondence, and asking whether their views had in any way changed in the interval. The answers received from each have been circulated among the others, as was done on the former occasion, and have in most cases elicited additional remarks.

4. Availing themselves of the information thus so kindly afforded them, the President and Council have to recommend as follows regarding the construction of the instrument contemplated:—

(*a*) That the telescope be a reflector, with an aperture of not less than four feet. This is essential, as no refractor would have the power required.

(*b*) That the large mirror be of speculum metal. Such mirrors can be constructed with certainty of success, and at a cost which can be foretold; whereas the recently introduced plan of glass silvered by a chemical process has not yet been sufficiently tried on so large a scale as that contemplated.

(*c*) That the tube be constructed of open work, and of metal. Lord Rosse has recently changed the tube of his three-foot altazimuth from a close to an open or skeleton one, and it is understood that he intends doing the same with his great telescope. Mr. Lassell's tube is also an open one, which his experience leads decidedly to prefer.

(*d*) The telescope should be furnished with a clock movement, in right ascension.

(*e*) Apparatus for re-polishing the speculum should be provided.

(*f*) With respect to the form of reflector to be adopted, some difference of opinion exists, as the Newtonian and Cassegrainian have each some advantages not possessed by the other. On this point further correspondence appears desirable; but as the main features of the scheme are the same in both cases, there does not appear to be any occasion to wait till this point shall have been finally decided.

5. With respect to the cost, something must depend on the solidity of the construction, and the perfection of the workmanship, but if it be assumed that the workmanship shall be of the best description, and the instrument furnished, as seems desirable, with polishing apparatus, and a second speculum for using while the other is being polished, it is probable that the cost will not fall much short of £5000.

6. It is estimated that the construction of the instrument will occupy about eighteen months.

7. It seems highly desirable that the future observer should come to England during a part at least of the time occuped in the construction of the instrument, in order that he may become thoroughly acquainted with all its details, and especially with the mode of repolishing; and also that he may personally acquaint himself with the working arrangements followed at the observatories of Lord Rosse and Mr. Lassell, who have expressed their willingness to afford him every facility.

[Copy.]

The following Memorial was drawn up by the Rev. Dr. Robinson, President of the British Association, with the concurrence of the Earl of Rosse, President of the Royal Society, and was presented to Lord John Russell:—

My Lord,

At the last meeting of the British Association for the Advancement of Science, that assembly came to a resolution which has been adopted by the Royal Society, and which therefore I am directed, conjointly with the President of that illustrious body, to lay before your lordship.

The purpose is that the Government be requested to, establish, in some fitting part of Her Majesty's dominions, a powerful reflecting telescope (not less than three feet aperture) and to appoint an observer charged with the duty of employing it in a review of the Nebulæ of the southern hemisphere.

In evidence of the high importance of such an investigation, it is sufficient to refer to the way in which its proposal was welcomed by the British Association. That assembly, comprising upwards of 1500 persons, among whom were found every British name of scientific renown, and of whom all are more or less devoted to the pursuit of physical knowledge, may not unfairly be considered an exponent of the national mind on such an occasion; and I have never seen it admit any similar resolution with a more enthusiastic approval. For the department of Nebular Astronomy is that which at present has the most powerful hold on public attention, and stands most in need of public assistance. Others are worked out by the pen and in the closet, or by instruments of easy attainment, and in establishments already fully organised; the only results which they can now yield are uninteresting, except to a few, and are valued by the mass only from an instinctive perception of the glory which they confer on human intellect. But it is far otherwise with this; the mysterious forms on which it is employed are at present objects of universal curiosity from their position (outworks as it were of the universe), their evident analogy to the system of which we are a part, and which we may hope to study in them, and the dynamic questions which the marvellous arrangements of many of them suggest. I may add that in its origin it is almost exclusively ours; the fame which will reward its completion should be ours also.

The history may be very briefly given. About sixty-eight Nebulæ had been ill seen and worse described when the elder Herschel was led to explore them by the encouragement and aid of his sovereign George III. To those previously known he not only added 2500 more, but by classing them, by clear and methodical description, and directing attention to the relations which connect them with other portions of the universe, he gave this branch of astronomy its powerful vitality. His no less distinguished son, following his example with even greater success, has not merely extended the list of northern Nebulæ to an amount which would have ennobled any other name, but has given the whole work complete precision by an accurate determination of the position of all contained in his own and his father's lists, thus placing fully within the reach of subsequent observers. Not content with this, he transported to the other hemisphere those instruments which had rendered such good service in our own, and has thus enriched astronomy with 1600 more equally well observed, but beyond the reach of European astronomers.

Yet powerful as these instruments were, a much nearer approach to the extreme limit of useful optical power has been made by Lord Rosse. It was, therefore, to be expected that his telescope would add considerably to our knowledge of the Nebulæ, and this has been fully realised. It was, in fact, a communication of some results obtained by him which directed the attention of the British Association to this subject, and excited a desire of having the same work performed for the southern sky which he is accomplishing in our own.

That work implies a minute re-examination of at least all the brighter Nebulæ of Sir John Herschel's catalogues, embodied in drawings, based on micrometer measures, and so correct that each of them may be referred to without doubt by future astronomers as an authentic record of the original's appearance at a given epoch. Of such drawings we at present possess very few; most of the sketches given by the Herschels are stated by them to be made merely by eye, and even those that were more accurately taken by them are found to require amendment when compared with the appearances in more powerful telescopes.

A task of this kind can only be wrought out by severe and long-continued labor, and the instrumental means required are such as very few individuals can obtain by their private resources.

Even in Europe there are but three telescopes known to exist which are capable of making any great additions to the discoveries of the Herschels, and those three are in the British Islands. This field of research is therefore still exclusively our own, and I trust your Lordship will share my feeling, that the nation's honor will be sullied if we let it be pre-occupied in its most interesting portion by the energy and liberality of any other people. In submitting to your Lordship this request of the British Association, I feel it my duty to give with it some approximative estimate of the sum which might be required for its accomplishment.

First, as to the instrument. It has been proved by the experience of Lord Rosse, Mr. Lassells, and others, that one of sufficient power can be constructed with certainty and at no overwhelming cost.

I have made enquiries of an artist (with whose abilities in this line I am practically acquainted),

and have come to the conclusion that a telescope, similar to the smaller of Lord Rosse's three-feet apertures and twenty-seven feet focal length, might be constructed for £2000.

This would include an equatorial mounting; clock-work, to make the telescope travel with a star; apparatus for supporting the observer; and a machine for polishing the speculum, when that operation may be required.

If a second speculum were supplied (which seems almost essential in case of accident), it would add about £500 more. Of course, some latitude must be allowed in this, but it need not be wide. The work could not be completed in less than a year, possibly would employ two. As telescopes so gigantic are erected in the open air, no outlay would be necessary for any building, except the observer's dwelling.

Secondly, the observer need not possess very high mathematical attainments, acute sight and skill as a draughtsman being his most important requisites; and his staff need not consist of more than two or three laborers, one of whom should be a practical mechanic.

I am quite aware that there are some persons who will consider the sum that I have named above, and the moderate annual expenditure which would be required for a few years, a very unprofitable waste of public money.

I feel also assured that your lordship is not of their number; no man can be who has ever drunk of the fountain of knowledge, or added to the domain of intellect. I feel confident that the public itself is not with them, and that it would resent, as an insult, the imputation of valuing at a mere market price the only true elements of personal dignity or national glory. If the spirit of the age be such, that the most despotic sovereigns of Europe feel that they cannot avoid the necessity of encouraging physical science, much more does it belong to the rulers of the freest and most enlightened nation of the world, and it is due to your lordship and your colleagues to say that we have always found you to carry out in the fullest extent the requirements of science.

In hopes that in this instance, also, our appeal may not be in vain.

I have, &c.,

31st July, 1850. T. R. ROBINSON.

VICTORIA, No. 29.

Downing street,
14th May, 1863.

SIR,

With respect to my despatch, No. 2, of the 24th of January, I transmit for your information the copy of a letter from the President of the British Association for the Advancement of Science, expressing the concurrence of that body in the report which was adopted by the Council of the Royal Society, respecting the telescope which it is proposed should be erected at Melbourne. 27th April, 1863.

I have, &c.,

Governor Sir H. Barkly, K.C.B., &c., &c., &c. NEWCASTLE.

[COPY.]

23 York Terrace, Regent's Park, London,
27th April, 1863.

MY LORD DUKE,

A copy of a despatch from the Governor of Victoria, respecting the erection in Melbourne of a telescope, was by your Grace's direction laid before the Council of the British Association for the Advancement of Science (of which I have the honor to be President) at their last meeting, accompanied by a request that they would furnish a report upon the subject. No. 83. 23rd July, 1862.

At the same meeting, an admirable report on the same subject, prepared in consequence of the same despatch, having been similarly submitted, by your Grace's direction, to the Council of the Royal Society, was presented and read to the Council of the British Association by General Sabine, the President of the Royal Society.

It was then resolved,—"That the British Association having on previous occasions acted, with reference to this question, in harmony with the Royal Society, the Council is glad to express its concurrence in the report adopted by the Council of the Royal Society."

I am requested, on the part of the Council, to transmit this resolution to your Grace, accompanied by the assurance of the cordial interest felt by that body in the object to which the report refers; and have, &c.,

ROBERT WILLIS.

His Grace the Duke of Newcastle, K.G.

By Authority: JOHN FERRES, Government Printer, Melbourne.