

ferred. At the same time circumstances might render the selection of the second advisable.

The unanimity of the report and the good feeling which has characterized the whole movement is one of the most encouraging features of the case. We trust that the plan will be enacted into law by Congress at its coming session.

*REPORT OF THE BOARD OF VISITORS TO
THE UNITED STATES NAVAL OBSER-
VATORY, OCTOBER 2, 1899.*

WASHINGTON, D. C.,
October 2, 1899.

HON. JOHN D. LONG, *Secy. of the Navy.*

SIR: In compliance with the request contained in your letter of June 30, 1899, the undersigned have acted as a Board of Visitors to the United States Naval Observatory in Washington and now submit their report, including subdivisions as follows:

- I. Recommendations of the Board of Visitors.
- II. Circumstances leading to the appointment of the Board of Visitors.
- III. Cost of the Observatory.
- IV. Comparison with other Observatories.
- V. Present condition and methods of observatory work and the delay in printing its results.
- VI. Historical sketch of the Observatory.
- VII. Minutes of the proceedings of the Board of Visitors.
- VIII. Appendix.

The several portions of the report were put in form by the astronomers who are members of the Board. The recommendations are made unanimously.

Very respectfully,

WM. E. CHANDLER.
A. G. DAYTON,
EDWARD C. PICKERING.
GEO. C. COMSTOCK,
GEORGE E. HALE.

RECOMMENDATIONS OF THE BOARD OF
VISITORS.

In accordance with the instructions contained in the following letter all the mem-

bers of the Board of Visitors to the United States Naval Observatory therein named, met at the Observatory in Washington on Friday, June 30, 1899, and organized by the selection of William E. Chandler as Chairman, and George C. Comstock as Secretary.

NAVY DEPARTMENT,
Washington, June 30, 1899.

GENTLEMEN: In accordance with previous correspondence and oral conversations, you are hereby requested to act as a Board of Visitors at the United States Naval Observatory in Washington, convening there to-day, and to proceed to examine into the condition of that institution and to report to me your conclusions and recommendations.

Very respectfully,

JOHN D. LONG,
Secretary.

Hon. William E. Chandler,
Hon. Alston G. Dayton,
Professor Edward C. Pickering,
Professor George C. Comstock, and
Professor George E. Hale.

Captain Charles H. Davis, U. S. N., Superintendent of the Naval Observatory, presented to the Board an informal statement of circumstances leading to the appointment of the Board of Visitors and submitted correspondence relating thereto (Appendix, Exhibit A) and to a proposed reorganization of the Observatory (Appendix, Exhibit B). He also placed before the Board a list of professors of mathematics upon the active list of the navy (Appendix, Exhibit C) from which corps the staff of the observatory is largely drawn and a list of all persons performing duty at the observatory with their respective ranks (Appendix, Exhibit D).

At the request of Messrs. Chandler and Dayton there was submitted to the Board, by its other members, the correspondence conducted by them, as a Committee of the Second Annual Conference of Astronomers and Astrophysicists, for the purpose of obtain-

ing the views of American astronomers and physicists upon the organization and work of the Naval Observatory. Mr. Pickering submitted to the Board a statement regarding correspondence on the same subject conducted by a Committee of the American Association for the Advancement of Science.

In view of the facts brought before the Board at its several sessions and after the best consideration which it has been able to give to the subject, the Board of Visitors reports and recommends as follows :

The Naval Observatory, which was originally established as a scientific bureau, auxiliary to the needs of the naval service, has become through half a century of growth and through the expenditure of large sums of money, as authorized by law, an astronomical observatory of the first rank in respect of buildings, instruments and equipments. But by far the larger and more valuable part of its equipment has little or no reference to any direct requirement of the naval service and its existence can be justified only on the ground that Congress has intended to establish and maintain a national astronomical observatory. Under these changed circumstances its continued connection with the Navy Department has seemed to many of those whose views have been submitted to the Board of Visitors, illogical and undesirable. In view, however, of the absence of a national university, a Department of Science and Industries, or other department or bureau of the government especially suited to the conduct of such scientific work, and in view of the diversity of opinion among American astronomers upon the question to which existing department the observatory could be wisely transferred, we believe it to be inexpedient for us at the present time to further consider the subject of such transfer.

With reference to the organization of the Observatory under naval administration, the Board of Visitors disapproves of those

parts of the 'Proposed Organization of Naval Observatory' (Appendix, Exhibit B), submitted under date of September 7, 1897, by 'F. E. Chadwick, Chief of Bureau of Equipment and C. H. Davis, Superintendent United States Naval Observatory,' which requires the establishment of a formal observatory council with nominal functions and which by omission practically abolish the office of Astronomical director. We are by no means objecting to the assembling in conference of the astronomers engaged in the observatory work, but the proposed transfer of duties and responsibilities from a single director to a committee of five appears to us a step in the wrong direction; and when, as under the proposed scheme, an absolute power of veto upon all action by the council is lodged in the hands of one of its members, the usefulness of the body seems to approach the vanishing point. In the history of observatories we have been unable to find a case of successful administration without a competent astronomer in immediate supervision of the work, and we believe that the ideal conditions for the successful administration of an astronomical observatory are most nearly realized when a professional astronomer is made the responsible director of the work. This system which is adopted in every great national observatory, the Board of Visitors believes to be the one best suited to secure the astronomical efficiency of the Naval Observatory.

If the naval observatory as a shore-station charged with the performance of certain functions assumed to have a relation to the navy is to continue under the command of a line officer, we recommend that the astronomical staff of the Naval Observatory shall consist of an Astronomical Director, four astronomers, three assistant astronomers and such computers and other minor officers as may be provided by law. The Astronomical Directors and astronomers, whether professors of mathematics

or taken from civil life, and the assistant astronomers, should be appointed by the President, by and with the advice and consent of the Senate, to hold their offices until their successors are appointed.

The Nautical Almanac office, which was formerly a distinct bureau, is now administered by departmental regulations as a part of the Naval Observatory, and it appears from the evidence submitted to the Board of Visitors that the successful administration of the Observatory is much impeded by reason of imposing upon its astronomical director, the duties of Director of the Nautical Almanac. Each of these offices furnishes abundant employment for the entire time of an able astronomer, and we therefore recommend that there shall be a Director of the Nautical Almanac appointed by the President, by and with the advice and consent of the Senate, to hold office until his successor is appointed.

We also recommend that provision be made for the continuation of the admirable series of memoirs published under the title 'Professional Papers of the American Ephemeris and Nautical Almanac.'

A criticism, frequently and forcibly urged against the administration of the Naval Observatory, not limited to the present time, but covering almost the entire period of its existence, is that its astronomical work has not been prosecuted with that vigor and continuity of purpose which should be shown in a national observatory. The possibility of conducting well planned researches with unvarying regularity over long series of years should constitute the great advantage of a national observatory, an advantage which is not fully realized in the history of the Naval Observatory, where each principal astronomer seems to have been left to choose his own line of work and to alter it from time to time or abandon it. This is perhaps inevitable in a system which places at the head of an observatory an

officer who is not a technical expert in astronomical work; and therefore in order to secure continuity in the prosecution of work well chosen and coördinated with that of other observatories, and also to obtain for the observatory and the department advice and criticism which shall be both disinterested and responsible, we recommend the establishment of a permanent Board of Visitors substantially as follows:

There shall be appointed by the President, from persons not officers of the United States, a board of nine visitors to the Naval Observatory, six to be astronomers of high professional standing, and three to be eminent citizens of the United States. Appointments to this Board shall be made for periods of three years, but provision shall be made by initial appointments for shorter terms so that two astronomers and one member of the Board not an astronomer shall retire in each year. Members of this Board shall serve without compensation, but the Secretary of the Navy shall pay the actual expenses necessarily incurred by members of the Board in the discharge of such duties as are assigned them by the Secretary of the Navy, or are otherwise imposed upon them. The Board of Visitors shall make an annual visitation to the Naval Observatory at a date to be determined by the Secretary of the Navy and may make such other visitations, not exceeding two in number annually, by the full Board or by a duly appointed committee, as may be deemed needful or expedient by a majority of the Board.

The Board of Visitors shall report to the Secretary of the Navy at least once in each year the result of its examinations of the Naval Observatory as respects the condition of buildings, instruments and apparatus, and the efficiency with which its scientific work is prosecuted. The Board of Visitors shall prepare and submit to the Secretary of the Navy regulations prescribing the

scope of the astronomical and other researches of the Naval Observatory and the duties of its staff with reference thereto. When appointments or details are to be made to the office of Astronomical Director, Director of the Nautical Almanac, astronomer or assistant astronomer in the Naval Observatory, the Board of Visitors may recommend to the Secretary of the Navy suitable persons to fill such offices, but such recommendations shall be determined only by a majority vote of the members present at a regularly called meeting of the Board held in the city of Washington.

Special attention is at this point called to the fact that the appointment of a Board of Visitors to the Naval Observatory was recommended by Secretary Tracy in 1891, has been repeatedly urged by Superintendents of the Observatory, and is renewed by F. E. Chadwick, Chief of Bureau of Equipment, and C. H. Davis, Superintendent United States Naval Observatory, in the 'Proposed Organization of a Naval Observatory,' dated September 7, 1897 (Appendix, Exhibit B). The duties of the Board, as defined by these naval officers, would be in part as follows: "It lays down the general course of policy to be pursued for the coming year, including printing and publication of observations; fixes the estimates for the astronomical departments; nominates to fill vacancies in the astronomical staff (either by appointment or promotion); recommends as to repairs and acquisitions of new instruments.

If a permanent Board of Visitors as above recommended is established as a part of the administration of the Naval Observatory, it is evident that to it should be committed these questions of policy to be pursued in the conduct of the observatory which are contained in the memorandum (Appendix, Exhibit B), submitted to the present Board by the Secretary of the Navy, under date of June 28, 1899. We therefore abstain from

specific recommendations upon these subjects, many of which indeed call for a more prolonged and minute study of the situation than the members of the present Board have been able to give to it.

We heartily endorse the recommendation contained in your report as Secretary of the Navy for the year 1897, that "the statute authorizing the appointment of professors of mathematics be so amended that without disturbing those who now hold office, which would be unjust to them, no further appointments shall be made" to the staff of Naval Observatory (Appendix, Exhibit L). In addition to the reasons for this action which are urged by you in that report, we submit for your consideration, that the conditions under which astronomical work is done are so different from those which obtain in the naval service, that a fixed tenure of office with the certainty of a retiring pension in no way dependent upon the zeal or efficiency with which service has been rendered, may easily produce diminished diligence and a purely perfunctory discharge of duties. A more serious evil of the existing system of naval commissions for astronomers, and one which has been forcibly exemplified within the past decade, is the compulsory retirement at the age of sixty-two of astronomers, who are then in the maturity of their powers, and who under civilian appointments would continue to render to the observatory a service of undiminished efficiency, which they now transfer to other institutions. The reasons which impel the retirement of a naval officer from active service upon attaining a fixed age have no application in the case of an astronomer, and he should be placed upon the same footing with other officers of the government performing strictly civilian duties.

If astronomers are appointed to the Naval Observatory from civil life to succeed retiring professors of mathematics, the salaries provided should be sufficient,

as recommended by you in that report for 1897, "to make up for the refusal to them of the privilege of retirement, and also to secure men of high scientific attainments adequate to the demands of one of the most capable observatories in the world." To secure the services of the ablest astronomers the salaries provided should be slightly larger than those paid in the higher class of university observatories and account should be taken of the fact that university vacations are much longer than leaves of absence from the public service. The Board of Visitors recommends the following as a schedule of salaries which could be expected to attract astronomers of the class desired :

Astronomical Director.....	\$6000.
Director of Nautical Almanac	5000.
First Astronomer.....	4000.
Second "	3600.
Third "	3200.
Fourth "	2800.
First Assistant Astronomer.....	2400.
Second " "	2200.
Third " "	2000.

The experience of every great observatory shows that the efficiency of its staff is materially increased by the provision of quarters near the observing rooms for those persons who are engaged in work by night, and we recommend that there should be quarters provided upon the observatory grounds for all members of the astronomical staff regularly assigned to night work.

In concluding its recommendations, the Board of Visitors wishes earnestly to urge upon your consideration the necessity of making a success of the movement which you have begun, in order to improve the condition of the Naval Observatory, and to make its administration satisfactory to the great body of the astronomers of the country and to the public.

Some of our recommendations, if they meet your approval, can be carried into effect by departmental action, but the

changes which we regard as vital can only be obtained through legislation by Congress. If such legislation is withheld, the continuance of present conditions is sure to result in a renewed, persistent, and possibly acrimonious demand for the removal of the observatory from naval control. If, however, the legislation is enacted, and the improved system is given a fair trial, unquestionably much improvement will result, and it is not improbable that the observatory will attain and hold that high standing in the scientific world which should be required of such an institution.

To help bring about such a desirable consummation, we have complied with your request, although not made in pursuance of any law, that we should visit and investigate the observatory, and we have recommended specific measures which we hope will lead to those reforms in administration which are imperatively necessary if the observatory is to receive and retain the confidence and support of the astronomers and scientists of the world.

ADDRESS OF THE PRESIDENT OF THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. *

I.

IN his opening address to the members of the British Association at the Ipswich meeting, the President cast a retrospective glance at the progress that had taken place in the several branches of scientific inquiry from the time of the formation of the Association in 1831 down to 1895, the year in which were published the last two of the fifty volumes of reports containing the scientific results of the voyage of H.M.S. *Challenger*. In that very able and detailed review there is no reference whatever to the work of the numerous expeditions which had been fitted out by this and other countries for the exploration of the depths

* Dover, 1899.