

THE AMERICAN NEPTUNE

A QUARTERLY JOURNAL OF MARITIME HISTORY



Volume XLVII, No. 3

Summer 1987

COPYRIGHT 1987 BY THE PEABODY MUSEUM OF SALEM
SALEM, MASSACHUSETTS

Table of Contents

Editor's Comments	156
Byzantine and Moslem Shipping in the Mediterranean, 500-1250, by ARCHIBALD R. LEWIS	157
"Doing Business in the Smuggling Way," Yankee Contraband in the Río de la Plata, by JERRY W. COONEY	162
"Mad Jack" Percival in Vietnam: First American Hostilities, May 1845, by DAVID F. LONG	169
The U.S. Light-House Board: Progress through Process, by JOHN O. SANDS	174
The Maritime Enterprises of James J. Hill, by DON L. HOF SOMMER	193
Maritime Studies at Sea Semester, by JAMES MILLINGER	206
Book Reviews	211

The U.S. Light-House Board: Progress through Process

JOHN O. SANDS

THE nineteenth century saw, in America, the development of what was to become the best system of navigational aids in the world. As with many other endeavors of the period, the lighthouse service started the century with lackadaisical management and relatively primitive equipment. By the end of the century, the service was rigidly professional and technologically mature. Through judicious administration, carefully conceived and executed programs of experimentation, and a systematic exchange of knowledge with the lighthouse establishments of Europe, the United States was able to remedy what had been a national disgrace. The primary instrument of this change was the Light-House Board, a body that steadily pursued its goal of providing the best possible system of lights for the mariner, at a reasonable cost to the country. Until its reorganization in 1910, the Light-House Board was the strong hand that molded the U.S. lighthouse service into an organization commanding worldwide respect.

The provision of lighthouses by a governmental agency for the benefit and protection of mariners was not an idea new to the nineteenth century. In fact, there were a number of lights in colonial America, maintained by the individual colonies, though in many cases indifferently and intermittently. Congress early recognized the federal responsibility to provide for the safe navigation of the country's waterways, and by an act of 7 August 1789, a centralized lighthouse service was created in the Treasury Department. During the first years of its existence, the lighthouse service was managed by the president and the secretary of the treasury, but increasing size and responsibilities made the delegation of authority necessary. In 1820 the management of the lighthouse service was assigned to the fifth auditor of the treasury, Stephen Pleasonton.

Pleasanton was an administrator, far from expert in

matters relating to lighthouses and navigation. His primary interest lay in seeing that the public dollar was not squandered, while attempting to provide an adequate service. During the thirty-two years of his administration, the number of lights increased dramatically, but the quality of those lights and their positioning continued to be a matter of controversy. Because of his lack of experience in the technical aspects of the field, Pleasonton was forced to rely upon advisors, most of whom were drawn from the ranks of contractors who ultimately benefited from the business of the government. Although no direct evidence of collusion has been demonstrated, the arrangement certainly resulted in the hindrance of progress that might otherwise have been expected.

The most obvious of these situations involved the lighting apparatus itself, central to the quality of the light produced. In 1822 Augustin Fresnel, a Frenchman, had invented a prismatic lens capable of concentrating the scattered rays of light produced by a lamp and directing them in a flat horizontal beam. This resulted in a much more efficient utilization of available foot candles than did the earlier parabolic reflectors. In spite of the relatively high cost of installing Fresnel lenses, they soon became the standard in French and English lighthouses of any importance. However, Pleasonton's principal advisor on lighting matters, in fact on all lighthouse matters, was a manufacturer of parabolic reflector lamps. As a result, the American service continued to use reflector lamps long after the superiority of the Fresnel lens had been demonstrated.

Congress began to suspect that the stream of complaints leveled at the American service might be justified, and therefore contemplated forcing the introduction of the Fresnel lens. For this reason, in 1840, Capt. Matthew C. Perry, later of Japanese fame, was dis-

patched to Europe to procure two of the French lenses for testing. His report stated, in part:

A question is now presented whether the French lenticular apparatus or the improved English parabolic reflectors are to be preferred. I made it my duty to examine into the operation and effect of both of these plans, and the result of my observations, added to the best information I could obtain, decided me in favor of the French system. The brilliancy of both, however, is so remarkable, compared with the dimness of the American lights, that no one can avoid noticing the difference, although in the United States, the parabolic reflector, if such it can be called, is universally in use. The imperfection of its form and the inferiority of its construction, as to material and workmanship, are so apparent that it has always been a matter of surprise among nautical men why the evil has been so long permitted to exist, while in most other respects we have taken the lead in practical improvements.

Captain Perry saw more than a simple technological gap between the British and the American systems. Rather, he perceived a malaise that cut to the heart of the national attitude:

It is a peculiarity of the people of this country, that a proper regard to the preservation of human life enters too little into the concerns of the every-day transactions of the community. We are constantly hearing the most melancholy disasters on board of steamers and in vessels approaching the coast, by which numerous lives are sacrificed, not so much to the inscrutable chances of ill-fortune proceeding from inevitable causes, as from the unpardonable negligence of those whose duty it should be to guard against these catastrophes. And so in regard to the care of lights which are established to guide the anxious seaman along the dangerous coast or into the distant port. How responsible is the trust of those who undertake the charge, and yet how little is the trust regarded!¹

In spite of Captain Perry's persuasive plea for professionalism, the Fresnel lens was not immediately introduced into regular use in the country.

If there is one virtue that Congress possesses above all others, it is the capacity for deliberate action. In 1845 Lieutenants Thornton A. Jenkins and Richard Bache, both of the U.S. Navy, were dispatched to undertake a further investigation of the lighthouse systems in Great Britain, Belgium, and France. Their report, published in 1846, echoed in resounding tones the vote of support that Perry had given the Fresnel system, and was equally vocal in condemning the present American system. Even so, it was not until 1851 that a full-scale investiga-

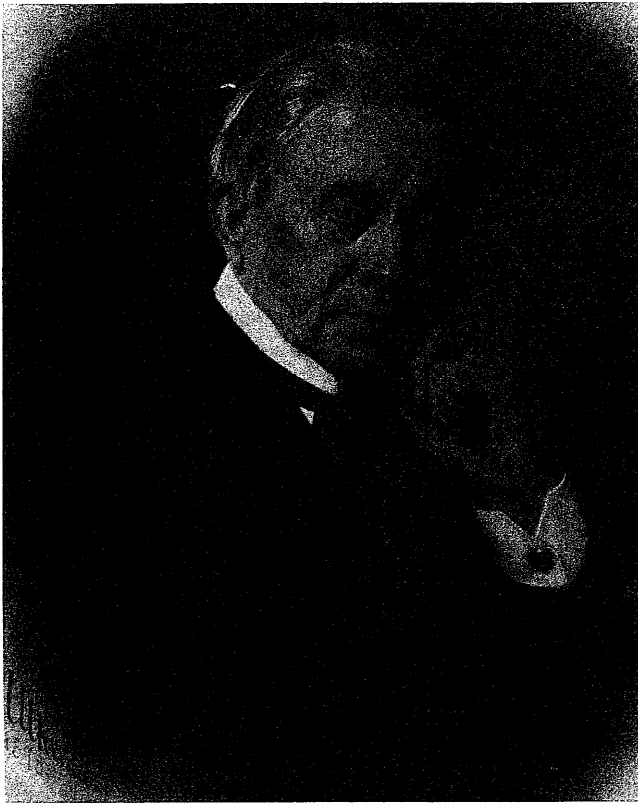
tion of the American lighthouse service was ordered, to be conducted by a board of examiners created for the purpose. Composed of both military men and civilians, this board undertook an exhaustive examination of the entire system. Its extensive report dealt with many technical aspects of the system, but the basic conclusion was that it was impossible to continue to operate the service under the present administrative structure. They recommended, and Congress established, an independent managing board, under the Treasury Department, solely concerned with lighthouse matters. In the legislation authorizing the Light-House Board, passed 9 October 1852, it was specifically ordered that Fresnel lenses be adopted in all new lighthouse structures. The board included two officers each from the navy and army, two civilian scientists, and two secretaries, one navy and one army; the secretary of the treasury served ex-officio. Only the two secretaries, one of whom was Thornton Jenkins, served full time, and only they were compensated for their services.²

The newly organized board went immediately to work on the problem of improving the American navigational system. In addition to implementing the suggestions that had been made by the examining board, whose members largely duplicated those of the new board, they also sought to gather comparative data on the lighthouses of other nations. For this reason, in 1855, the board dispatched a request to Great Britain, asking for "such information, documents instructions form of accounts etc. etc. as the Board of Trade of Great Britain may be pleased to communicate in relation to the present management of the Lighthouse Establishment of Great Britain."³ The British establishment had itself recently been put under the control of the Board of Trade, in the hope of achieving some uniformity between the three administrations of England, Scotland, and Ireland. This request for information by the American Light-House Board was to become one of a long series of international contacts between the American, French, and British lighthouse establishments.

2. Francis R. Holland, *America's Lighthouses: Their Illustrated History Since 1716* (Brattleboro, Vermont: Stephen Greene Press, 1972). This work provides an excellent overview of the early development of the lighthouse service, and served as the basis of much of the introductory material in this paper.

3. U.S. National Archives, Record Group 26, Records of the Light-House Board, Journals of Meetings, vol. 2, fol. 233. Hereafter U.S.L.H.B. Journals.

1. Matthew C. Perry, *Light-Houses of Great Britain and France*, Sen. Doc. no. 619, 26th Cong., 1st Sess. (Washington: Government Printing Office, 1840), pp. 3-4.



More than any other single person, Joseph Henry must be credited with professionalizing the U.S. lighthouse service. He served on the Light-House Board from its founding in 1852 until his death in 1878, the year this portrait was executed by Henry Ulke. (Photograph courtesy of National Archives, U.S. Coast Guard Collection.)

The exchange of technical reports across the Atlantic came to be almost routine.

In 1858, the U.S. Light-House Board sent a report of its activities to Great Britain, requesting in return copies of similar reports exchanged by the British and the French.⁴ Later, a major inquiry into the condition of British lights was ordered by Parliament, and the report, submitted in 1861, was made available in this country. It contained not only a full inquiry into the status of the Lighthouse Establishment of Great Britain, but also a detailed comparison with that of France, the model of excellence during the nineteenth century. This report

4. The American report of 1858 was produced in response to a Senate resolution, and was later published in U.S. Light-House Board, *Papers on the Comparative Merits of the Catoptric and Dioptric or Cata-dioptric Systems of Light-House Illumination and other Subjects relating to Aids to Navigation* (Washington: Government Printing Office, 1861), pp. 252-71.

was considered sufficiently important by the U.S. Board that an abridged version was printed in this country, though not until 1871.⁵ The early 1870s saw the American publication of several works on lighthouses. Among these was the *Memoir* of Leonce Reynaud, originally published in French in 1864; two chapters were translated and published in 1871, and almost the entire work was brought out in 1876. Written by the head of the French lighthouse service, the *Memoir* was a complete report on the French system, including methods of construction, the types of lights employed, and the technical advances that had been made.⁶ Through such exchanges of information, the various lighthouse establishments of the major maritime nations were able to stay abreast of developments elsewhere.

The improvement effected in the U.S. lighthouse service was dramatic. From the mismanaged and antiquated establishment they had inherited in 1852, the Light-House Board had molded a service of which they could write in 1870:

The light-houses, and light-vessels, (so far as the exhibition of efficient lights is concerned,) are, it is believed, equal to any in the world, and those beacons and buoys actually in position are efficient day-marks to guide clear of the obstructions for which they were established.⁷

That the service had been vastly improved is unquestionable; that this had been accomplished by a board composed largely of volunteers is truly remarkable. Such a vigorous program of self-reform in such a brief period has few parallels.

JOSEPH HENRY AND THE COMMITTEE ON EXPERIMENTS

None of the lighthouse services was content to simply absorb the information made available by other countries; in fact, all of them remained strangely distrustful of studies conducted elsewhere. The result was that in what was outwardly a world community of scientists, each benefiting from the work of the others, there was a surprising duplication of effort in even the most routine

5. U.S. Light-House Board, *Extracts From the Report of Her Britannic Majesty's Commissioners, Appointed to Inquire into The Condition and Management of Lights, Buoys and Beacons. Submitted March 5, 1861, and Presented to Both Houses of Parliament By Command of Her Majesty* (Washington: Government Printing Office, 1871).

6. Leonce Reynaud, *Memoir upon the Illumination and Beaconage of the Coasts of France*, trans. by Maj. Peter C. Haines (Washington: Government Printing Office, 1876).

7. U.S. Light-House Board, *Annual Report* (Washington: Government Printing Office, 1870). Hereafter U.S.L.H.B. *Annual Report*.

experiments. From its inception, the U.S. Light-House Board had included two civilians of "high scientific attainment." One of these was to head the standing Committee on Experiments, which would:

when required, test the value of oils and other illuminating materials and accessories, and of lighting apparatus; investigate the relative value of signals by sound or sight; the ventilation of light-houses and light vessels, and their protection from lightning; the modes of preventing corrosion or decay of materials used in the light house service; and make experiments or observations to determine the value, application, or economy in all other matters which the Board, from time to time, may require.⁸

When the members of the Light-House Board were appointed in 1852, the only significant change from the earlier examining board was the addition of Prof. Joseph Henry as one of the civilian scientists.

One of the most renowned physical scientists of his day, Henry had been a professor at Princeton until the founding of the Smithsonian Institution, of which he became the first secretary in 1846. He had until that time been deeply involved in research into electricity, especially electromagnetism. He appears to have independently discovered the principle of the induced current, a principle announced by Michael Faraday in 1831. Although he acknowledged Faraday's priority, the modern unit of induction is called the henry in recognition of his contribution. As secretary of the Smithsonian, Henry had less time to devote to his own research, but he continued to be vitally interested in scientific development. It was his feeling that the Smithsonian should devote itself primarily to the support of scientific research, rather than the maintenance of a library or museum facility. It is not clear what motivated the choice of Henry for the Light-House Board, but it is possible that his association with Faraday was a factor. That eminent scientist had served for many years as advisor to Trinity House, the English lighthouse establishment. Further, Henry was a close personal friend of Alexander Dallas Bache, of the Coast Survey, who was the other scientist on the board. In any event, it proved a wise choice.

Although the Committee on Experiments was often requested to test some invention sent to the board for its examination, this was not its most significant activity.

8. U.S. Light-House Board, *Laws and Regulations Relating to the Light-House and Light-Vessel Keepers of the United States* (Washington: Government Printing Office, 1880), p. 37.

Henry was soon able to establish what amounted to a systematic research program in certain areas. The first series of experiments was let out on a contract basis to an independent investigator, J. H. Alexander, of the University of Maryland. He undertook studies of the various fuels available for use in lamps, in search of the one most suitable for widespread adoption. He also attempted to develop a reliable field method whereby the composition and quality of the oil could be determined.

Submitting three reports between June 1855 and January 1856, Alexander outlined a system for the analysis of oils and reported on the use of various oils as fuels. Though the service had previously used sperm oil, its decreasing availability and rising price made it imperative that a substitute be found. They determined to follow the lead of the French establishment and use rape-seed oil, called colza, once it had been tested by Alexander. Unfortunately, the farmers of America could not be persuaded to grow the plant in sufficient quantity, and the board was forced to return to whale oil.

Alexander also undertook experiments on a system for distinguishing between lighthouses, originally developed by Charles Babbage, and more importantly, on steam-operated fog signals. Concerned with finding a practical method for making the most noise for the least possible cost, Alexander tested several devices. He did not make the progress that he had anticipated, due to the fact that he was working in the heart of Baltimore:

Experiments like these would already have been tried, under the authority presumed from your general instructions, except for the inconveniences of circumstances. . . . As it was, our experiments at the works were disturbed, and I confess, not without reason, by the interference of the municipal police. The disturbances, to be sure, did not amount to anything; for, in anticipation of some such consequence from the fearful noises accompanying the experiments, they were so programmatized as to allow, at various intervals, of a cessation, and thus to manifest all becoming respect to the authorities.⁹

One can but imagine the interchange. This was not the last time the Light-House Board would find the public less than enchanted by the use of fog signals in urban areas.

Apparently, Henry's continuing involvement with the activities of the board stirred his interest in the research possibilities it represented. Consequently, when the

9. John Henry Alexander, "Report on Fog-Signals by Steam," *Experiments on Mr. Babbage's Method of Distinguishing Light-Houses, Reported to a Committee of the United States Light-House Board* (Washington: Government Printing Office, 1861), p. 116.

failure to introduce colza oil into the service reopened the question of a cheap and practical illuminant, Henry himself undertook a series of experiments. As a result of this work, the board began to use lard oil in all of its large lamps after 1867, a change that led to considerable economy of operation.¹⁰ Another series of experiments conducted by Henry led to a recommendation in 1875 for the gradual adoption of mineral oil, or kerosene, because of its cheapness. This change took a number of years to institute, as it also required the use of a new lamp.¹¹

Of considerably more personal interest to Henry was the study of fog signals that he took up following Alexander's abortive efforts. In 1865 Henry began a lengthy examination of various instruments, including whistles, bells, gongs, trumpets, and sirens. Although appointed chairman of the Light-House Board in 1871, Henry continued to serve in his capacity as head of the Committee on Experiments. He persevered with his work on fog signals, and tests to determine the relative efficiencies of the devices were performed in 1873 and 1874. Henry gradually became less interested in the mechanical devices themselves than in the scientific phenomenon of sound itself. His studies turned to the mechanics of sound, its transmission over water, and a peculiar effect that resulted in null zones at certain points. In his studies of 1876 and 1877, he was increasingly concerned with the study of these "aerial echoes," and continued to submit extensive reports on his work.¹²

Interest in Henry's experiments, especially those with fog signals, was high on the other side of the Atlantic. Trinity House sent a delegation to this country to observe the experiments and gather as much information as possible on the operation of the signals. In return, an invitation was tendered to the Light-House Board, offering to open the British lighthouses for inspection by an American. For this purpose, the engineering secretary of the Light-House Board, Maj. George Elliot, was chosen. He was directed to:

particularly investigate the value of English made Lenses, as compared with the French, also, the advisability of special Lenses for great elevations, and will if the investigation should

make it advisable, order one English and one French lens, for testing the use of such lenses in this country.¹³

Elliot spent most of the spring and summer of 1873 in Europe, and visited not only the British lights, but also those of the French and the Austrians. He submitted an exhaustive report to the Light-House Board, which saw it immediately published.

Elliot's principal concern was with the improvements of the lighting apparatus that the British and the French had effected:

Within the last five or six years improvements have been made from time to time in lenticular apparatus, but they are of trifling importance when contrasted with the great increase of power and concurrent decrease of expense of sea coast lights as compared with the system in use in Europe a few years ago, and with ours of the present time.

These vast ameliorations have been produced by:

1st. The introduction of mineral oil for light-house illuminants.

2d. The improvements in 'burners' for lamps, resulting from experiments made to determine the best form of lamps for burning mineral oil in light-houses, which improvements apply equally to lamps burning oil of a mineral, animal, or vegetable origin.¹⁴

Elliot outlined in some detail the procedures used for employing mineral oil and described the improved lamps. He further reported at considerable length on the use of electric and gas lights, recommending that they be adopted for those situations where a high-powered and reliable lamp was vital. He advised the immediate adoption of mineral oil in U.S. lights, a recommendation that was approved, but only after Henry had undertaken an elaborate series of confirming experiments.

This duplication of experiments was not a phenomenon limited to the Light-House Board. Elliot reported an extensive series of tests being conducted by Professor Faraday's replacement as scientific advisor to Trinity House, Prof. John Tyndall. Having sent a delegation to observe the U.S. tests on fog-signals, the British determined to pursue the same study themselves. Armed with Henry's procedures, and even with several American devices, they attempted to test the comparative efficiencies of the various units. The methods employed,

10. U.S.L.H.B., *Annual Report* (1874), p. 10.

11. U.S.L.H.B., *Annual Report* (1875), pp. 86-103; *Annual Report* (1877), p. 5.

12. U.S.L.H.B., *Annual Reports* of 1874, 1875, and 1877 all contain reports.

13. U.S.L.H.B. Journals, vol. 5, fol. 200.

14. George H. Elliot, *Report of a Tour of Inspection of European Light-House Establishments, Made in 1873*, Sen. Exec. Doc. no. 54, 43rd Cong., 1st Sess. (Washington: Government Printing Office, 1874), p. 19.

and the results achieved, as reported by Elliot, were decidedly inferior to Henry's work.¹⁵

Faced with this seemingly wasteful duplication of effort, it is fair to ask whether the free and open transfer of knowledge that appears to have prevailed during this period actually had a major effect on the actual state of the art in any individual country. Certainly, in the U.S., it did not reduce the expense of carrying on experiments, repetitive or not. By 1879, of a budget of just over \$3 million, \$50,000 were allocated to the Committee on Experiments for "Experiments with Illuminants."¹⁶

There is little doubt that Henry came to find these experiments personally rewarding in themselves, over and above any value they may have had for the improvement of the lighthouse service. Certainly, he devoted a very considerable amount of his time and energy to this work, especially in view of his deteriorating personal health. In refusing an invitation to visit Rochester, New York, in August of 1876, he wrote:

When your letter was received I was in the midst of my duties as one of the judges of the centennial and so affected by the heat that I was obliged to defer my decision as to the meeting until I [might] ascertain the state of my health at the time I should be required to start. When my duties were ended I found myself so [reduced] in strength by an affliction of the bowels that I was obliged to stay in the country near Philadelphia for about a week in a state of intense inactivity. At the end of that time I came to this place [New London, Connecticut] and was so much improved in health that I concluded I would start for Buffalo in time to give you the promised visit at Rochester. The intervening days to be devoted to research on sound in connection with fog signals. I have been actively engaged in these researches, but unfortunately the setting in of another heated term has induced me, very reluctantly, to comply with the solicitations of my family to give up going to Buffalo and to postpone my visit to Rochester until the cooler temperature of the autumn.

I know it is more important that we should live well than that we should live long but I think it a duty which I owe my family myself and my country that I should keep my lamp alive as long as it is capable of radiating any light which may be of importance and therefore I must cherish the flame and be careful not to expose it to any rude blast. I have spent all my vacations for several summers on the seacoast among the Light-Houses and this although I have been constantly hard at work has given me strength, efficiently to discharge the duties of the Institution during the other parts of the years.¹⁷

15. *Ibid.*, pp. 22-66.

16. U.S.L.H.B., *Annual Report* (1879).

17. University of Rochester, Rush Rhees Library, Joseph Henry to Lewis H. Morgan, 16 August 1876; copy in the Smithsonian Institution, Papers of Joseph Henry, no. 5099.

Joseph Henry died on 13 May 1878, still serving as chairman of the Light-House Board and secretary of the Smithsonian Institution.

Henry's involvement with the theoretical aspects of the experiments can only be fully appreciated when his work is compared to that of his successor as head of the Committee on Experiments, Henry Morton, of the Stevens Institute of Technology. The first report that Morton submitted, in 1879, dealt with electric light. While he gave a very complete and competent report, his interest lay in collecting the work of others and considering the practical applications of these devices to the lighthouse field. He was less the theoretical scientist, and the studies of the board were henceforth confined to the relatively mundane and technical.¹⁸

It may reasonably be asked what it was that motivated a man like Henry to devote such a large amount of his time and thought to the Light-House Board, a position for which he received no remuneration and little recognition outside the professional circle. It is the more surprising when the involvement of Professor Faraday with Trinity House is considered. Although he was paid for his work, the examining board of 1861 noted that adequate use was not being made of his services, and hoped that he would become more involved in studies of the lighthouse establishment.¹⁹ It can only be assumed that it was precisely because he was able to pursue those tangential avenues of inquiry that happened to interest him that Henry was willing to devote so much of his attention to the lighthouse service.

The influence Henry exerted on the Light-House Board is unmistakable; rigorously applying scientific methods himself, he demanded the same level of professionalism from the rest of the service. It was this very professionalism that was to become the hallmark of the U.S. Lighthouse Service.

LIGHTHOUSES ON PARADE: THE CENTENNIAL EXHIBITION

During the summer of 1876 the United States celebrated its centennial anniversary with a major exhibition in Philadelphia. Privately sponsored, it included exhibits from across the United States and around the world. Because it was such an important national event, it was extraordinarily well documented. As a stop-

18. U.S.L.H.B., *Annual Report* (1880).

19. U.S.H.L.B., *Extracts From the Report of Her Britannic Majesty's . . .*, p. 52.



The grounds of the Centennial Exhibition offered many enticing prospects for the visitor in 1876. The large structure behind the lake, with the flag on its cupola, is the Government Building. Outside, to the right, is the temporarily erected lighthouse; in front of the lake is the torch from the Statue of Liberty. (Photograph by the Centennial Photographic Company, courtesy of the Philadelphia Free Library.)

action picture, it provides both a gauge of the overall national temperament and a relatively clear and accurate picture of the situation in 1876 of each of the exhibitors. The image they chose to project, the material they chose to exhibit, and their public reception all reflect the status of the exhibitors, whether private or public. The participation of the U.S. government in its own birthday celebration was expected, and among the government exhibits was one contributed by the Light-House Board.

In January 1874, the president created a board to

coordinate the activities of the federal government at the centennial. When this board met for the first time in April 1874, it included not only its chairman, Col. Stephen C. Lyford of the War Department, but also representatives from the Interior Department, the U.S. Post Office, the Department of Agriculture, and the Smithsonian Institution. Lyford had already recommended a year before that a separate building for the display of the military hardware of the United States be established. No action had been taken, however, and no specific provisions were made in the executive order.

When the board finally went to Philadelphia to examine the site, it was already November 1874, and no concrete plans had been formulated for housing the government exhibit.²⁰

The cold reality of the wide open spaces of Fairmount Park apparently sparked prompt action, and potential exhibitors were soon contacted. The Journal of the Light-House Board records on 18 November 1874:

The Naval Secretary presented a letter from the first Comptroller of the Treasury, dated Nov. 10th, enclosing a letter from Col. Lyford, Chairman of the Centennial Board, in regard to the quantity and character of space required by the Light-House Board at the Centennial Exhibition to be held in Philadelphia in 1876. Referred to the two Secretaries for answer.²¹

This request for information had come to the board through the Honorable R. W. Tayler, who was first comptroller of the treasury and responsible for the centennial exhibits of the various treasury departments, including the Light-House Board. If Lyford's board had finally realized the immediacy and scope of the problem that faced the executive departments, the same cannot be said of the Light-House Board. The question was referred to the board's only full-time staff, and their reply was perfunctory at best. The naval secretary wrote on 28 November that "the Board would be glad to have a paralelogram about 50 x 20 feet, in which, to place such apparatus as may be thought desirable."²²

While Colonel Lyford and his committee lobbied Congress for appropriations, no action was taken on the lighthouse display. Though Lyford was unable to persuade Congress to appropriate funds for the construction of a separate building, he was able to divert some funds from those granted for the purpose of gathering displays from the various departments. With this \$150,000, construction began on an independent Government Building designed by James H. Windrim, a Philadelphia architect. Because of the extreme financial shortage, the architect was forced to forego much of the superficial ornamentation in which he might otherwise have indulged. The result was a cross-shaped wooden building, of a not displeasing simplicity; at the intersec-

tion of the cross was a cupola drum. The structure, well suited to its task of housing a wide variety of display materials, was completed in February 1876.²³

During the extended hearings that Congress held concerning appropriations for the participation of the government in the centennial, the Light-House Board finally recognized its opportunity and began to prepare. It was apparent from the start that a minor exhibit such as had been sent to Vienna in 1873 would be inadequate. A small collection of photographs and publications would hardly be suitable for this major event in American history.²⁴ Nor could the board expect to repeat the interesting but inconsequential exhibit that had been placed in the New York Crystal Palace Exhibition. Two Fresnel lenses, even though one of them was of the first (and largest) order, would hardly suffice.²⁵ Not only had the lighthouse establishment itself grown during the succeeding two decades, but public interest in things mechanical had blossomed as well.

Therefore, the board resolved on 21 April 1875:

On motion of Capt. Davis, it was- Resolved, that a Committee of three, consisting of the Chairman and the two Secretaries of the Board, take into its consideration, and report how the Light-House Board and its operations should be represented at the Centennial Exposition, to be held in 1876, at Philadelphia.

On motion of Capt. Davis, it was further- Resolved, that the Light-House Establishment send to the Centennial Exposition to be held in Philadelphia, in 1876, specimens of the oldest lamps, reflectors, etc., used in the country; specimens of the lamps, illuminating apparatus, etc., now in use; and such other apparatus, models, and drawings, as will best indicate the advance made by this country in Light-House affairs during the last century.²⁶

Though one might have questioned the wisdom of placing this added responsibility on Joseph Henry, already burdened with other duties, at least some positive and concerted action had been taken. Obviously, Captain Davis was concerned that the exhibit might be put aside in the press of the chairman's other business, and therefore sought to establish a general philosophy. There was little doubt, in any event, that the advances of the last century had all taken place during the last quarter century, since the advent of the Light-House Board.

20. H. Craig Miner, "The United States Government Building at the Centennial Exhibition, 1874-1877," *Prologue* (Winter 1972), p. 204.

21. U.S.L.H.B., Journals, vol. 6, fol. 295.

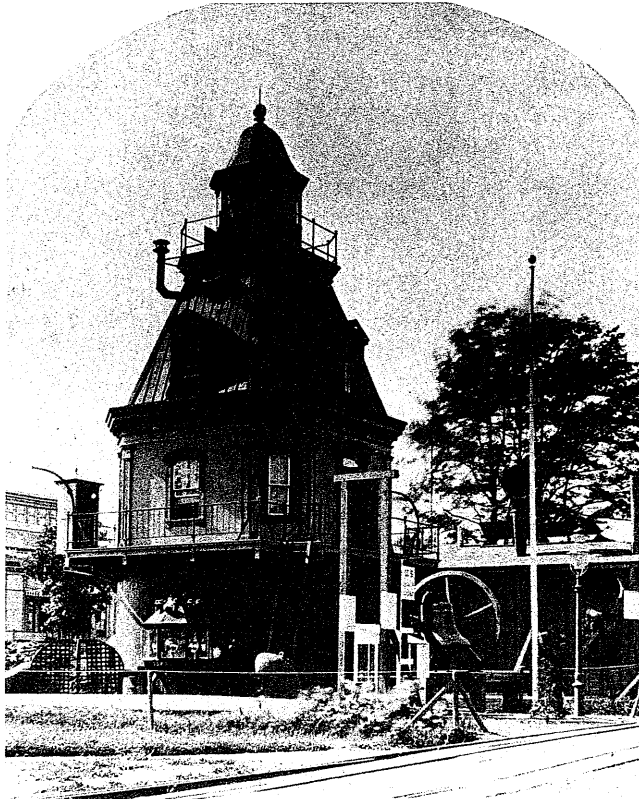
22. U.S. National Archives, Record Group 56, Exposition Records, R. W. Tayler Correspondence Received, 28 November 1874. Hereafter Tayler Correspondence.

23. Miner, "Government Building," pp. 204-7.

24. U.S.L.H.B. Journals, vol. 5, fol. 213. Elliot, *Report*, p. 266.

25. Goodrich, Charles R. and Silliman, Benjamin, ed., *The Illustrated Weekly Record of the New York Exhibition of the industry of all nations* (New York: G. P. Putnam, 1853).

26. U.S.L.H.B. Journals, vol. 6, fols. 490, 491.



The outdoor display of the Light-House Board included not only a cast-iron lighthouse but also, to the right, the infamous steam-operated fog signals, the Stevens fog bell, and a set of parabolic reflector lamps. (Photograph by the Centennial Photographic Company, courtesy of the Department of Cultural History, Smithsonian Institution.)

It was not until September of 1875 that the Light-House Board was formally requested to submit a budget for its display within the Government Building. To formulate a realistic cost estimate, the board had to come to some conclusion as to the exact contents of its exhibit. The engineer secretary replied that \$6,000 would be sufficient to exhibit not only various engineering models and drawings, views of structures then in use, and other small miscellany, but also:

Specimens of each kind and order of lenses in use for the illumination of light-houses, with some old reflectors which were formerly used will be presented. These will exhibit the progress that has been made in the subject of illuminating light-houses.

Specimens of all kinds of material and implements employed in light house illumination, all kinds of lamps, wicks, chimneys, &c., will be sent. It is proposed to have one

lens of the first order, flashing at intervals of ten seconds, in operation a large part of the time. This should be exhibited in some prominent place, as it will be an object of marked interest. A specimen of the most approved fog-signal, called, by us, the siren will also be exhibited. This should be operated at certain times to show its powers. For this purpose it should be set up outside of the main building.²⁷

The board was sensitive to the fact that what it had to display, particularly the models and drawings, was not the stuff of great drama. It was more than willing to capitalize on those few items in its arsenal that would have some major impact. Though Professor Henry had a personal interest in the fog siren, as a result of his experiments leading to its development, he must have been conscious of its audiovisual effect, especially in combination with a flashing light.

The first comptroller may have been somewhat taken aback by the inclusion of this rather bizarre material in what he had assumed would be a relatively simple and static exhibit. However, he was willing to try anything that might give life to the treasury section, up against some stiff competition from the military and the Smithsonian. He therefore wrote to the Light-House Board and requested further details on the apparatus. The engineer secretary replied with the suggestion that the lens could best be placed at the crossing of the two aisles, where it would be visible from the entire building. Should this space be taken, it could be placed "on the section allotted to the Treasury Department," a circular space twenty feet in diameter seeming adequate. As to the fog signal, it "should be placed outside of the building, as it will have a steam engine, and will make a great noise. A temporary shed is all that will be required for it."²⁸

At the same time that this letter was being written, another suggestion was forthcoming. Adm. Thornton A. Jenkins was the navy representative on Colonel Lyford's centennial board, but he had some years before served as naval secretary to the Light-House Board. He was therefore knowledgeable concerning lighthouses, and proposed that the Fresnel lens might be accommodated in the cupola of the Government Building, thus relieving the tedium of the building and giving maximum play to the light. The engineer secretary replied on behalf of the board that the problems of maintenance in this inaccessible location were considerable, but even

27. Tayler Correspondence, 10 September 1875.

28. *Ibid.*, 17 September 1875.

more disturbing was the loss of visual impact that would be incurred. As the lens could not rotate, it would not flash, and the lightbeams concentrated by the prismatic lens would shine out over the heads of the visitors, being most visible not in Fairmount Park but Bala-Cynwyd.²⁹

This project was abandoned, but the interest and enthusiasm of the Light-House Board had finally been sparked. On 23 September 1875, the engineer secretary wrote to Tayler to inform him that the board had decided to mount a larger exhibit than originally planned. They had decided to display full-size floating aids to navigation, especially buoys, rather than mere models. This necessitated an increase in allotted space to three thousand square feet, and an appropriation of \$15,000. As the Light-House Board saw its role in the centennial beginning to develop, it decided that someone should be placed in charge of activities there. Therefore, on 29 September 1875, Capt. J. L. Davis, who had earlier expressed such interest in the project, was given the task.³⁰

Evidently, the Light-House Board was not the only section of the Treasury Department with expansionist tendencies, and the first comptroller was fast discovering that the appropriated funds were woefully inadequate. He therefore petitioned Colonel Lyford on 1 November 1875, requesting that his budget be increased from \$5,000 to \$44,000, a sum that included the request of the Light-House Board for \$15,000. No action seems to have been taken, and Tayler again wrote on 25 March 1876, requesting additional funds. He reported that:

The materials on hand are abundant for an exhibition that would redound to our advantage and honor.

The Light-House Board has models of light-houses and towers, and has lens, fog-signals, &c., equal to those used by other nations; our coast, served with lights, is more extensive, and the various articles, instruments, &c., on hand would enable the board to make a gratifying display, if sufficient funds were supplied.³¹

In spite of these appeals, Colonel Lyford was apparently unable to grant the full request for funds; his budget was severely strained as a result of having financed the building out of the exhibition appropriation. However,

29. *Ibid.*, 18 September 1875; 24 September 1875.

30. *Ibid.*, 23 September 1875. U.S.L.H.B. Journals, vol. 6, fol. 597.

31. "Additional Appropriation for the Executive Departments of the United States at the Centennial Exhibition," House of Representatives Exec. Doc. no. 148, 44th Cong., 1st Sess. (Washington: Government Printing Office, 1876), p. 17.

the funding for the Light-House Board was finally increased to \$6,000; any expenditure above that figure had to be made up out of the board's own budget.³²

Although the size of the appropriation was not settled until April 1876, the Light-House Board had gone ahead with its preparations. Theirs was the boundless faith of the bureaucrat that the budget can always be stretched, that funds are bound to materialize from somewhere. Far from intimidated by the small appropriation, the board seems to have ignored the situation entirely. Very soon after Captain Davis was appointed to handle the preparations for the centennial, the board dropped its biggest bombshell.

Colonel Lyford had finally come to grips with the question of the lens and the fog siren by September 1875, but he was far behind the Light-House Board, as he soon came to realize. In a letter of 18 November 1875, he informed Tayler that he had "incidentally learned that it is the intention of the Light House Board to erect a Light House Structure upon the Government grounds at the Exhibition." He wanted to know whether this was, in fact, the case, and if so, how much space would be required.³³

The rumor Lyford had heard was correct; the Light-House Board was seriously considering the erection of a full-size lighthouse on the exhibition grounds. In a letter of 19 November 1875, Joseph Henry wrote:

In behalf of the Light House Board of the United States, I write to ask whether the space at the intersection of Belmont Avenue and the avenue running through Horticultural Hall in front of the Government building, may be assigned to the Board for the erection of a screw pile light house, having a height of focal plane of 105 feet if the structure can be furnished in time, if not, a tower of 60 feet in height; from either of which lights will be nightly exhibited which will serve to illuminate a considerable portion of the grounds.

Besides exhibiting a structure intended for Florida reef, the tower will be ornamental and elicit prominent interest, especially in visitors from the interior of the country.³⁴

Hardened by now to anything, Colonel Lyford requested further details.

The screw pile lighthouse that Henry referred to in his letter was apparently intended for Fowey Rocks, to replace the Cape Florida Light. The Cape Florida tower had the singular distinction of having been besieged by

32. Tayler Correspondence, 29 July 1876.

33. *Ibid.*, 18 November 1875.

34. *Ibid.*, 19 November 1875.

the Seminole Indians in 1836, resulting in considerable damage to both the structure and the assistant keeper. Moreover, the tower had been improperly constructed when it was first erected around 1825; the walls, supposed to have been solid brick five feet thick, were hollow. After continued difficulty with the light, it was decided to replace it with an iron tower offshore, on Fowey Rocks. The tower as built was a skeletal iron framework, with the keeper's dwelling suspended in the center; the focal plane of the light was 110 feet above low water.³⁵

Surviving plans indicate that the structure was built with driven piles rather than screw piles, but this modification could have been made at any time before construction actually started. The structure is of particular interest because of its design. Built of iron members, the lighthouse could be completely prefabricated and then erected on the site. This was a system employed by the French for towers to be placed in remote areas, and was well adapted to American geography. One need only compare this structure with the standard wooden screw pile lighthouse erected during this period in the Chesapeake Bay area to discover the substantial advantages gained from this mode of construction. The date of establishment for the light at Fowey Rocks is usually given as 15 June 1878, and it must be presumed that the tower was not completed in time to be exhibited at the centennial. Had it been, it would have made an impressive exhibit.

The fact that the Fowey Rocks tower could not be exhibited did not discourage the Light-House Board, which had apparently been aware of this possibility from the beginning. Another light under construction was chosen. Located at the entrance to New Haven harbor, in Connecticut, the South West Ledge light was another example of prefabrication, though on a somewhat smaller scale. The structure consisted of an iron caisson built onto a rock ledge about twelve feet below the water's surface. The caisson was filled with concrete and surrounded with riprap, resulting in a monolithic base well protected against ice movement. On this foundation, a combination dwelling and light could be erected, also built of cast iron. Though of interest because of its prefabrication, this type of structure was of particular importance because of its tubular founda-

35. Holland, *America's Lighthouses*, pp. 134-39.

tion, which was highly resistant to the pressures of ice floes, a constant hazard in offshore stations.³⁶

In addition to the lighthouse structure, the board was still actively engaged in gathering materials to be exhibited inside the Government Building. As often happens, several private individuals attempted to utilize the government exhibition to promote their own products. On 28 March 1876, the Light-House Board considered a letter from John R. Wigham, of Dublin, Ireland, concerning the possibility of displaying his invention, the "triform gas-light." Captain Davis replied that the board "had determined to exhibit nothing at the Centennial not used by the Light House Establishment."³⁷ Mr. Wigham, an independent Irish inventor, had persuaded the Irish Lighthouse Establishment to adopt his device, but had been unable to convince Trinity House to use it. Numerous experiments were undertaken to determine its effectiveness as compared with the lamps then in use, resulting in widespread controversy. John Tyndall, then scientific advisor to Trinity House, came to believe in the device, and recommended it for use in England's lights. However, the issue became confused with the debate over the Irish question as a whole, and the dispute continued until 1881, when Tyndall resigned his post. The American Light-House Board was aware of this complicated and difficult situation, and wisely decided not to become involved.³⁸

Somewhat less controversial, but still a problem to the board, was the fog-bell manufactured by George M. Stevens & Co., of Boston. On 28 March 1876, Stevens wrote to R. W. Tayler:

Some time ago we were offered space in the centennial by the Light House Board through Capt. Davis for the exhibition of our fog-bell striking apparatus. In accordance with the offer, we have made preparation to exhibit this machine and a bell of 3000 lbs. We now have a letter from the Clerk of the L.H. Board saying they have had no space allotted to them as yet and advising us to apply to the Centennial Committee- Applying at Philadelphia we are referred to you. We have been at a considerable expense to get our apparatus ready and have been assured of a space until this last moment. Can you let us have the space- We need only about 10 feet (ten) square. The apparatus has been extensively used by the L.H. Board and is

36. Arnold B. Johnson, *The Modern Light-House Service* (Washington: Government Printing Office, 1890), pp. 38, 39.

37. U.S.H.L.B. Journals, vol. 7, fols. 147, 175.

38. Roy M. MacLeod, "Science and Government in Victorian England: Lighthouse Illumination and the Board of Trade, 1866-1886," *Isis*, LX, 1 (Spring 1969), 4-38.

for fog-bell purposes only. We shall of course be somewhat disappointed if our arrangements fall through as we had no idea of exhibiting until we received a communication from the Board saying they should be glad to have us exhibit. We shall be glad to hear from you in regard to the matter.³⁹

If Stevens had been correctly informed, the Light-House Board had as yet been allocated no space in an exhibit due to open on 10 May 1876, less than two months away. It seems distinctly possible that Taylor delayed as long as possible the installation of the Treasury Department displays in an effort to extract a larger appropriation from Lyford. If so, he was unsuccessful. Lyford wrote on 24 April to inform him that none of the Treasury Department material had been installed, and that should the space still be empty on 5 May, it might prove necessary to reassign the area to other exhibitors.⁴⁰ This dashed any hopes for an increased budget, and the exhibits of the Treasury Department and the Light-House Board were installed in the Government Building in time for the opening.

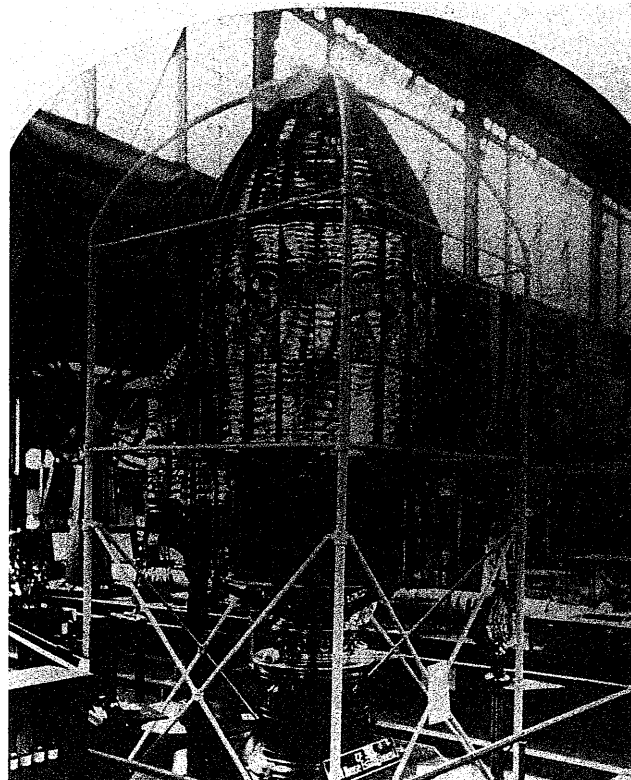
The exhibit staged by the Light-House Board certainly had difficult and strong competition. In a fair dominated by exotica from across the country and around the world, such a prosaic subject was at an automatic disadvantage. In the field of mechanical engineering, symbolized by the great Corliss Engine, a more efficient oil lamp seemed trifling at best. The Government Building itself was a huge structure, dominated by massive displays of military might, filled beyond capacity with artifacts and specimens of every conceivable description. In a building containing over 100,000 square feet, how could a space of only 30 by 40 feet ever amount to anything? The board was further handicapped by its very small budget; with only \$6,000 to spend, there was little room for showmanship:

Peculiar difficulties were encountered by the Light-House Board in preparing its exhibit. The funds allowed for the purpose were only sufficient to meet the necessary expenses of the transportation and arrangement of articles exhibited. Nothing could be allowed for the preparation of new models of existing works or for the purchase of any articles. Nothing was shown, therefore, but apparatus, articles taken from the stock on hand, and models which had been constructed for the actual use of the Board.⁴¹

39. Taylor Correspondence, 28 March 1876.

40. *Ibid.*, 24 April 1876.

41. Board on Behalf of United States Executive Departments at the International Exhibition, Held at Philadelphia, 1876, *Report*, House of Representatives Misc. Doc. 20, Part 2, 47th Cong., 2nd Sess. (Washington: Government Printing Office, 1883), p. 98.



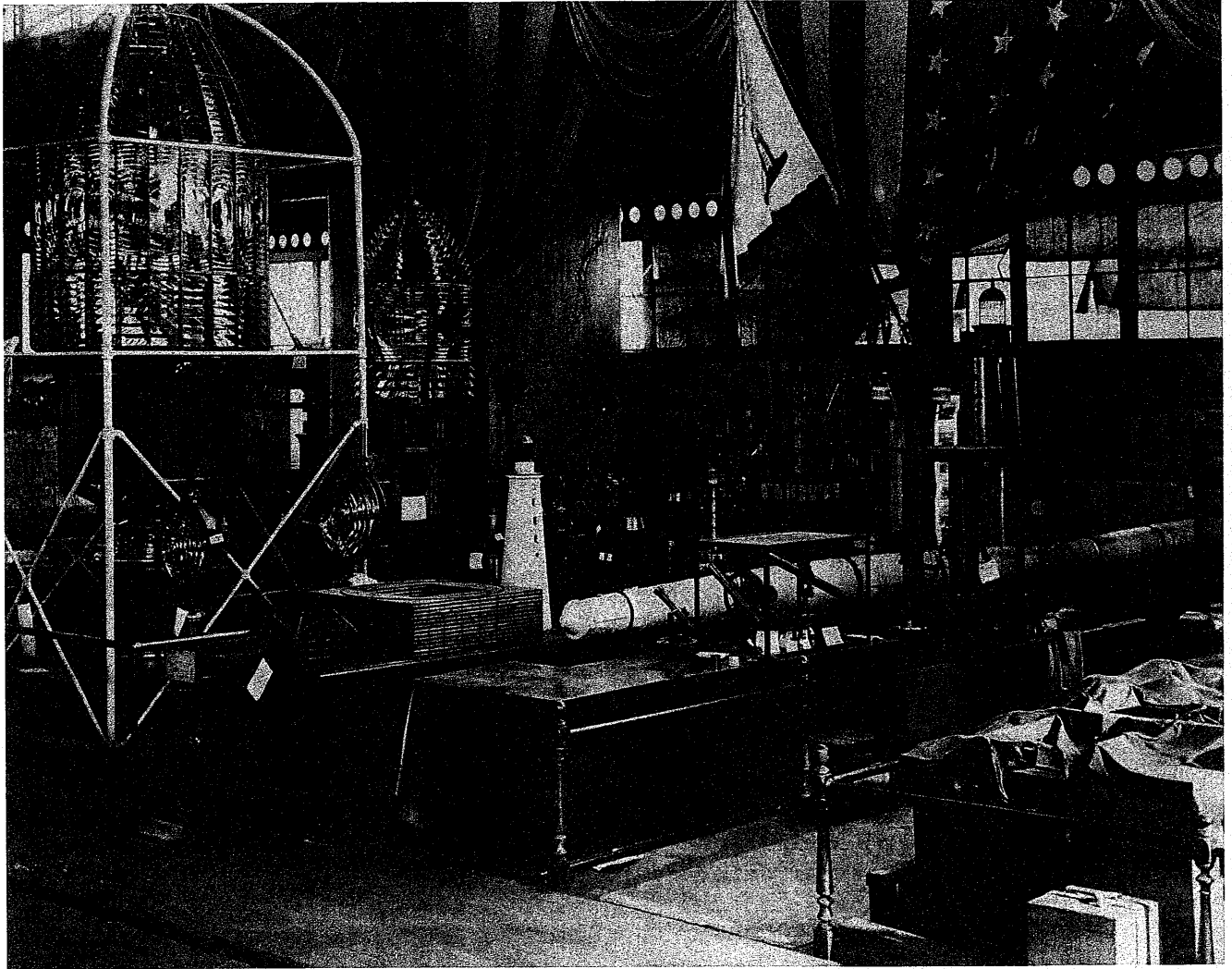
This massive first-order Fresnel lens served as a beacon drawing visitors to the display of the U.S. Light-House Board in the Government Building. Unfortunately, it was not set up to revolve as called for in the original exhibit design. (Photograph by the Centennial Photographic Company, courtesy of the Department of Cultural History, Smithsonian Institution.)

Operating under these severe limitations, the lighthouse exhibit ran a high risk of total failure.

This was not for lack of effort on the part of the Light-House Board, however. They were more than willing to use their most attractive artifacts as drawing cards for the remainder of the exhibit. One could hardly pass by the area without noticing the lighted first-order lens:

Here is a large rotary lantern, one of the most striking objects to be seen within the building. This beautiful piece of workmanship stands over fifteen feet from the floor, and is covered with prisms which gleam like the fabled gems of the Orient. But these pretty pieces of crystal are not placed in the lantern for ornament. . . . The effect is, of course, to give forth a gleam which no sailor near a dangerous coast could fail to see, and which, warning him in time, must be often blessed as the halo above the forehead of a guardian angel.⁴²

42. James D. McCabe, *The Illustrated History of the Centennial Exhibition* (Philadelphia: National Publishing Co., 1876), p. 566.



The display of the U.S. Light-House Board was dominated by Fresnel lenses from the largest size down to the small but innovative range lights. Behind the spar buoys lying on their sides can be seen several models of skeletal iron towers. On the back wall is a map of lights throughout the U.S., and pictures of important lighthouses. (Photograph by the Centennial Photographic Co., courtesy of National Archives, U.S. War Department General Staff Collection.)

Because of the limited space available, the lens apparently did not revolve as originally planned. Immediately behind the large lens was a series of smaller lenses that served to draw the visitor into the display area, though none of them was lighted.

A new concept was represented by the two range lights located next to the first-order lens. Placed in pairs on a river channel, they make it possible to stay in the channel by keeping the two lights aligned. The lenses are so formed that the light, instead of being concentrated into a flat sheet, is formed into a narrow beam that can be accurately matched with its mate. Though

commonplace today, these lights were only beginning to be installed on the Delaware River at the time of the centennial, and represented a major advance in river navigation. Although the most attractive and popular part of the exhibit, the lenses had, in reality, little to do with American accomplishments in the field. Light-house lenses continued to be imported from France and England throughout the nineteenth century.

More representative of American developments were lamps and engineering structures. Among the dozen lamps shown, representing those used over the past twenty-five years, the bulk of the early models were of

European design. However, the most common lamp in the U.S. service at the time of the centennial was one designed by Joseph Funck, the chief lampist stationed at the Staten Island Depot. Its flow regulated by a float valve, this lamp was considerably more economical of fuel than its predecessors. Several of the burners of the lamps, holding the actual wicks, were equipped with full-size photographs of the flame produced, to enable a comparison of the power of the various sizes of lamp.

The presentation of the engineering structures, as shown in models and drawings, concentrated principally on "light-houses of peculiar or difficult construction."⁴³ Although several masonry structures were illustrated, it was not in these that the strength of American ingenuity was demonstrated. The British were past masters at engineering marvels such as Eddystone and Bell Rock Lights, both built where no manmade structure should ever have been, and built for the ages. Two models represented the only towers of this type to have been built in the U.S., Minots Ledge near Boston and Spectacle Reef in Lake Huron, both special problems.

The American lighthouse service was faced less often with overwhelming forces of nature than with treacherous shifting sands, less with a need for beauty and permanence than with a need for an immediate solution. The scope of the American problem could best be realized by looking at the map hanging on the wall at the back of the exhibit. Produced especially for the centennial by Charles E. Gorham, of Philadelphia, the chart illustrated the position of each of the 832 lights maintained in 1876 by the Light-House Board.⁴⁴ This number was considerably in excess of that maintained by either France or England, and explains the need for an economical structure. The answer lay in a prefabricated iron frame that would provide a high, strong, and cheap tower in a minimum of time. Such a structure was certainly in the mainstream of the development of the new American architecture, as it grew beyond the cast-iron facade to the building built of structural steel. Though far from attractive, these towers were eminently practical, and they were widely used.

That the public might not be misled into believing that the Light-House Board was a static organization whose principal job was to keep its lenses clean and its

lamps lit, two items of experimental apparatus were displayed. The first was a photometer, used to test the efficacy of various illuminants. A spermacetti candle and the illuminant to be tested were burned, their light cast on either side of a screen placed between them. The screen was moved until the light on both sides had been equalized; in this fashion, it was possible to compare the intensity of various oils against the candle, a relatively constant standard. Presumably, this unit was employed during the long series of fuel and lamp tests the Light-House Board had conducted. The other experimental apparatus was one designed by Joseph Henry for his work on the transmission of sound. Consisting of a conical trumpet with a membrane stretched over the small end, grains of sand placed on the membrane could be seen to move if sound were received. Once again, this represented an advance in the application of an unvarying standard to what had heretofore been largely personal judgment.

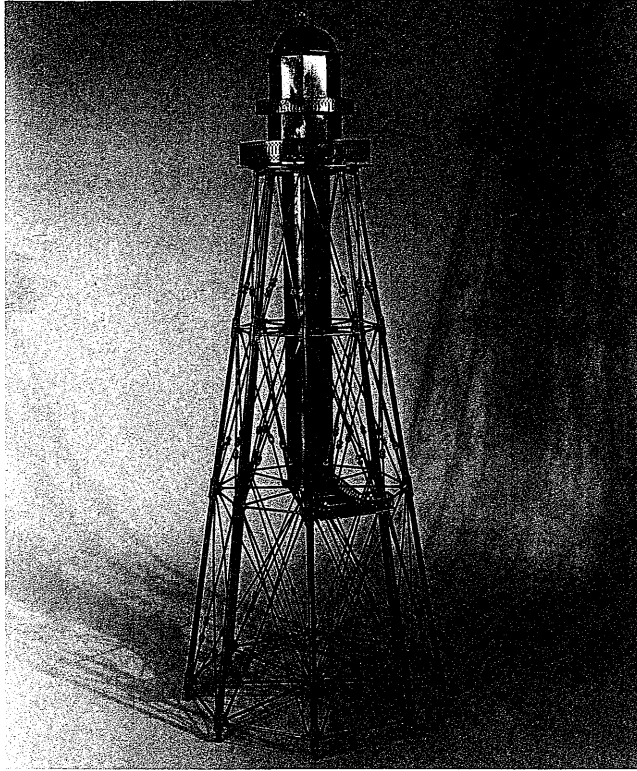
The board had quantities of minutiae on display, all vital to the operation of a lighthouse, but probably only of interest to professionals and fanatics. Similarly, they had available plans, charts, experimental results, and several publications, some to be distributed on request. Presumably little of this came to the attention of the general visiting public.

More likely to have captured the eye and the imagination of the average visitor was the full-sized lighthouse that had been erected outside the building. Equipped with a red-and-white flashing fourth-order lens, lighted every evening, the structure must have been an impressive sight in the landscaped grounds of the centennial. It was, unfortunately, impossible to have the building completed for the opening of the exhibition, and the light was first displayed on 4 July 1876. As a public display, the light was undoubtedly popular; as an exhibition of technical engineering, it was less successful:

It was the desire of the board to exhibit by full sized model, or by temporary use of some actual construction, a complete lighthouse, embodying some important *engineering* model, such, for instance, as one of our great iron skeletal lighthouses. Want of money prevented carrying out this design, but advantage was taken of the existence of parts of intended iron lighthouse structures to make an exhibit, which, if but an imperfect realization of the idea, enabled the board at least to exhibit an actual lighthouse. A wooden cylindrical substructure representing so much of the really important (in an engineering point of view) tubular member of the South West Ledge lighthouse as appears above the water was made, and on this the

43. U.S.L.H.B. *Annual Report* (1876) published in the *Annual Report of the Treasury Department* (Washington: Government Printing Office, 1877), p. 746.

44. Tayler Correspondence, 19 May 1876.



This model of a skeleton tower for the Florida reefs was displayed at the Centennial Exhibition. The board had originally hoped to display the full-sized tower, but its 110-foot height proved overwhelming. (Courtesy of The Mariners' Museum, Newport News, Virginia.)

real superstructure, comprising the keeper's dwelling and store rooms, surmounted by the lens with its lantern, was erected. The light was shown on the 4th of July, and from that date was maintained until the close of the Exhibition, with the same regularity and under the same rules as if it had been an actual seacoast light, the keeper residing in the structure. But the real engineering significance of the kind of construction of which this exhibit was the type was quite undeveloped, the *tubes* which form their principal member being specifically designed for sub-aqueous rocks covered by considerable depths of water.⁴⁵

The fact that a professional engineer found shortcomings in the exhibit did not detract from its appeal as a public display. The criticism that the display did not make clear the tubular construction, certainly the most significant factor in the structure, is justifiable. More likely to have been understood and appreciated was the obvious juxtaposition of a group of parabolic reflector

45. J. G. Barnard, "Lighthouse Engineering As Displayed at the Centennial Exhibition," *American Society of Civil Engineers Transactions*, VIII (March 1879), 56.

lamps on the ground with the brilliant Fresnel lens in the tower. Though these lamps do not appear to have been lit, all but the most casual observer must have realized the superiority of the new system.

It is not clear exactly which lighthouse was actually exhibited at the centennial:

It so happened that the iron work for the superstructure to an iron lighthouse for a marine site, on the tubular plan was nearly ready for erection upon the already constructed tube base on the reef at the entrance of New Haven Harbor, called the *South West Ledge*, while another set of iron work exactly similar was in construction at Baltimore for a work on Ship John Shoal in Delaware Bay.⁴⁶

Which of the two lights was shipped to Philadelphia, or whether parts of both were sent, is not known. The question may be academic, as they were identical in construction; the Ship John Shoal light was first lit in 1877, the South West Ledge light following soon thereafter on 1 January 1878. The placement of the light is confirmed by the official report of the exhibition, published soon after its closing: "This iron structure is to be permanently placed on the caisson on Ship John Shoal, Delaware River, at the close of the exhibition."⁴⁷ The structure stands on that location to this day.

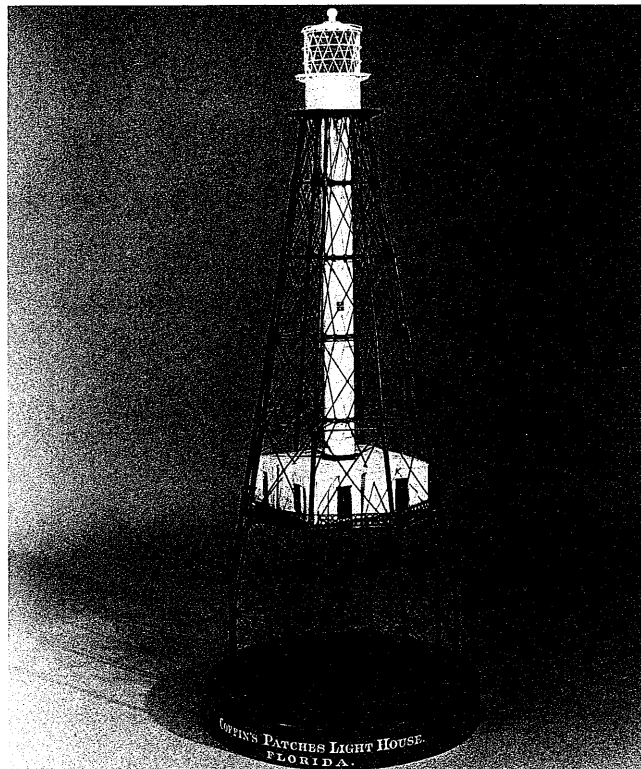
The last of the major exhibits of the Light-House Board was also placed outside; immediately adjacent to the lighthouse structure, it consisted of a collection of fog signals. Most prominent was the large bell, struck at intervals by a clockwork mechanism driven by a weight suspended in a small gallows frame next to the display. This was the bell manufactured by George M. Stevens & Co., for which room evidently was not found inside the building. Considerably more significant, both in terms of technological advance and public awareness, were the engine-driven sirens. As one report of the exhibit notes, the siren

was used to announce the opening and closing of the Exhibition grounds. When it sounded there was no mistaking the hour. Those in the fog about the time of day immediately took their bearings; those in its immediate vicinity were not left in doubt for an instant, and people miles away listened to the song of the siren with a feeling of astonishment not unmixed with awe.

The instrument is one of a class which Professor Joseph Henry, of the Board, and of the Smithsonian Institution, has

46. Ibid.

47. Board of Executive Departments, 1876, *Report*, p. 106.



This model of the Coffin Patches Lighthouse is typical of the designs that the U.S. Light-House Board used widely in the last half of the nineteenth century. They lent themselves to prefabrication and easy erection, thus minimizing costs. The model was displayed at the Centennial Exhibition, although the light itself had actually been erected in 1858 several miles from Coffin Patches, on Sombrero Key, Florida. (Courtesy of The Mariners' Museum, Newport News, Virginia.)

labored long to perfect, and this is the most effective of its class.⁴⁸

Apparently, the sirens were such a success that the attendants were unable to resist the thrill of cranking up the engines at the slightest provocation. In the face of this din, the feelings of the local populace were not long limited to astonishment and awe. The *Boston Daily Advertiser* reported that the siren "may be heard thirty miles—nay, it *will* be heard, whether you wish to hear it or not. When it shrieks, startled humanity shivers, groans, claps its hands to its ears, and wonders why it is thus."⁴⁹ Public outcry finally reached the point that the

48. Augustus C. A. Perkes, ed., *The Display of the United States Government at the Great Exhibition* (Philadelphia: George S. Ferguson, 1876), p. 79.

49. *Boston Daily Advertiser*, 29 August 1876.

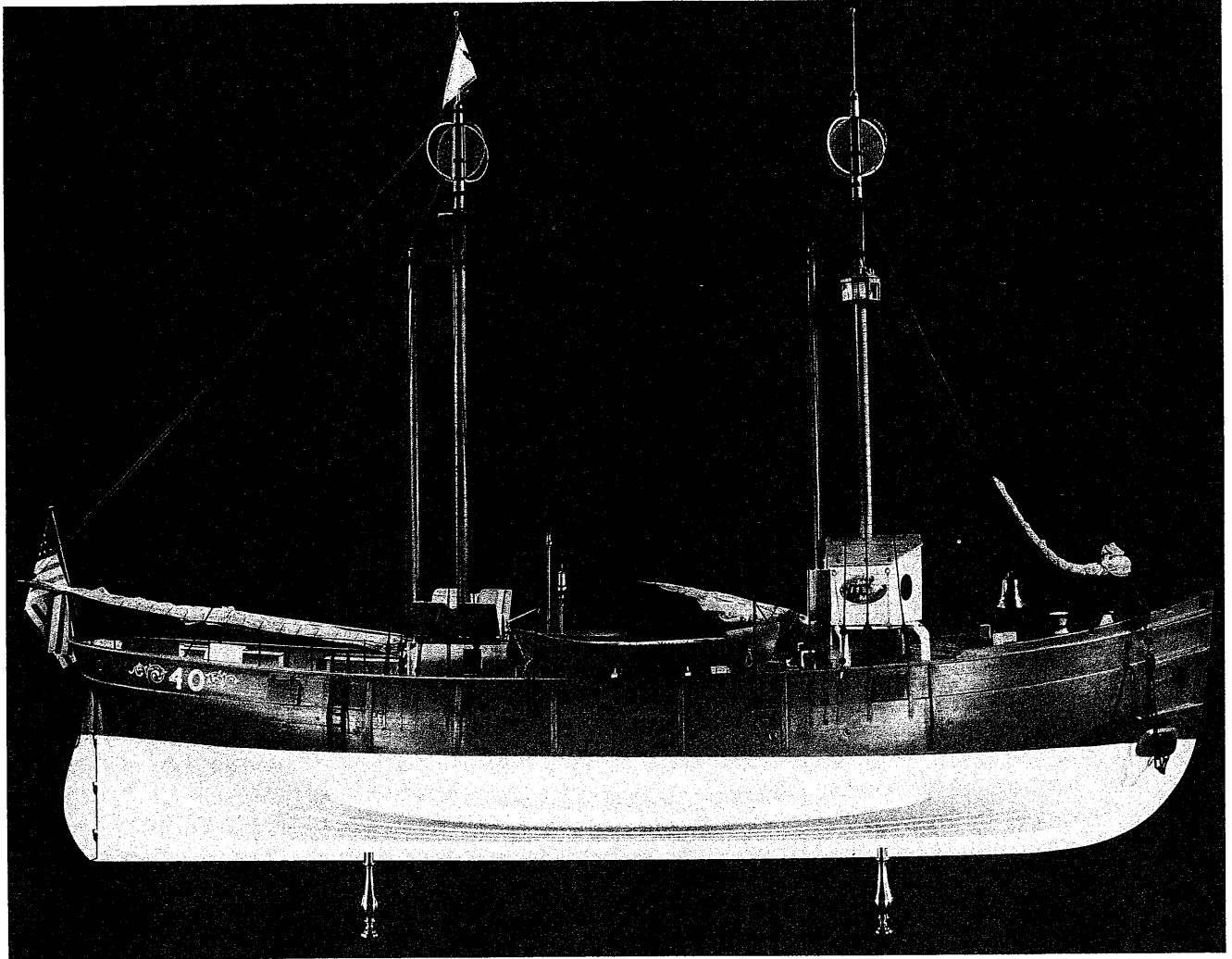
operation of the apparatus had to be limited to ten-minute periods at opening, closing, and noon of each day. The Light-House Board had finally found an exhibit that captured the public's attention. Certainly no visitor to the centennial could possibly have left without having heard the lonely wail of the new and improved fog siren, though they may never have realized all that lay behind its development.

The Light-House Board was not the only organization to exhibit lighthouse material at the centennial. Surprisingly, the British lighthouse establishment does not appear to have been represented, though the French were. Their Ministry of Public Works displayed drawings of several different lighthouses, and a number of lamps designed for use with the mineral oil they had recently adopted. They also exhibited an electrical light capable of emitting intermittent flashes rather than a simple steady light; this was presumably along the lines of the carbon rod arc light then in use in several French lighthouses. The French exhibit attracted considerable attention, particularly for the engineering achievements represented.

The engineering strength of the French was, like that of the English, in doing the impossible, even if it took a little longer. Such feats of architectural construction obviously represented major accomplishments, a fact recognized by professional engineers and by the judges in charge of awards at the centennial. However, these were solutions to a different set of problems from those that faced the American establishment, solutions only occasionally applicable in this country. In those areas where the French did use iron towers, it was either for a very remote site or to solve a particular problem of construction, and the structure was usually specially designed for the individual instance. Such an approach was not of much help in a country that needed to build and maintain hundreds of towers, often in similar situations, at the lowest cost possible. For this, the standard designs of iron towers developed by the board proved considerably more practical.⁵⁰

For some reason, the U.S. Army Corps of Engineers took it upon itself to exhibit several designs for lighthouses along with its large array of civil engineering material. These were all attempts to design a floating

50. Capt. D. P. Heap, *The Engineer Department, U.S. Army, at the International Exhibition, 1876* (Washington: Government Printing Office, 1884), pp. 392-405. Francis A. Walker, ed., *International Exhibition, 1876: Reports and Awards* (Washington: U.S. Centennial Commission, Government Printing Office, 1880), pp. 28, 34, 62-69.



Lightship number 40 represented the latest design in floating beacons when this model was built for the Centennial Exhibition in 1876. The vessel itself had been launched the previous year by Jackson & Sharp of Wilmington, Delaware, and stationed at Pollock Rip, off Chatham, Massachusetts. This model has recently been restored to its nineteenth-century appearance. (Courtesy of The Mariners' Museum, Newport News, Virginia.)

beacon, and appear to have been undertaken by independent inventors associated with the Corps of Engineers. The inventors were concerned that light-houses could not be placed far at sea, and sought innovative design solutions:

They would be anchored anywhere on the high seas, and both guide and light vessels to their destination. One inventor represents his light-houses strung across the ocean like street lamps in a city; they could be used as post-offices, telegraph, signal, and life-saving stations. Pilots could await on them the arrival of vessels. In stormy weather ships could tie up to them and outride the gale. All these advantages and more are claimed by the inventors for a floating light-house which would be permanent and stable.

.....

Mr. H. B. Stone shows two models. The flotation is purposely hidden for fear of having his idea stolen. As well as could be ascertained his light-house was swung on gimbals and heavily weighted below and supported on a circular, hollow, wrought-iron ring, the idea being that the ring would move independent of the tower supporting the light. No allowance seems to have been made for the action of the wind.⁵¹

This last may have been the understatement of the age. It is not surprising that the inventive genius demonstrated by these designers should have been ignored in favor of a solution that had been satisfactorily employed for several hundred years, the lightship. It is little wonder

51. Heap, *Engineer Department*, pp. 491-93.

the Light-House Board was anxious to avoid any confusion with their own exhibit.

Even before the exhibition closed, the Light-House Board was facing the problem of what to do with its display. The lighthouse and fog sirens were the biggest problem in logistics, but they did not raise philosophical issues, as they were already destined for installation at their designated locations. The interior display was another matter. The board felt a considerable effort would be wasted if the material were simply sent back to the Staten Island Depot and eventually dispersed. Therefore, at the meeting of 25 October 1876, they resolved:

on motion of Capt. Davis, that the light house exhibit as shown in the U.S. building at the Centennial, be brought to Washington and placed as a whole in a room or rooms hereafter to be provided for its reception.

On motion of Capt. Davis, it was ordered that a series of photographs be taken of the light-house exhibit as it now stands in the U.S. building at the Centennial.⁵²

Such a display of lighthouse material on a permanent basis was not an entirely new idea; Major Elliot had visited a museum maintained by the *Commission des Phares* in Paris in 1873.

Joseph Henry was fully cognizant of the value of the many collections that had been brought together in the Government Building. He wrote to the president on behalf of the National Academy of Sciences, requesting that provision be made for their exhibition as a unit in Washington. In response to his letter of 13 November 1876, the president ordered that the *status quo* of the collections in the Government Building be maintained until he could seek an appropriation from Congress for the erection of a building for their reception in Washington. This appeared to be a step in the right direction, until the first rainstorm hit Philadelphia. The leaky roof that had plagued the building from the first did considerable damage to the exhibits still in place. As a result, the president agreed to allow those exhibits most likely to be damaged to be sent to Washington in the care of their respective owners. The residue was to remain in Philadelphia, though it could be packed for protection against the elements. In the meantime, Spencer Baird had been actively collecting for the Smithsonian, having declared open season on the foreign exhibitors. He managed to get practically every-

thing that wasn't nailed down, and this material was stored in the Government Building as well. In the face of this growing problem, the president finally decided in January to have the material sent to Washington, that the building might be sold.⁵³ The situation was not finally resolved until March:

The Naval Secretary presented a letter from Col. Lyford, U.S.A., dated March 12th, to Hon. R. W. Taylor, Representative of the Treasury Department, upon the Centennial Commission, which letter was referred by him to this office, in which it was stated that the President of the United States, had directed that the articles contributed to the International Exhibition, by the several Executive Departments, be now remanded to their proper custodians, Congress having failed to provide for the erection of a museum for their display in this city.⁵⁴

The exhibit thus became the property and responsibility of the Light-House Board once more, and they were ill equipped to handle it.

The lenses and usable equipment were returned to Staten Island and eventually employed in the service. Whether any provision was ever made for exhibiting the remaining material in Washington is unknown, but this seems unlikely, especially in light of an entry in the board's journals for 14 December 1882:

The Naval Secretary stated that Prof. Baird, Commissioner of Fish and Fisheries, had asked permission to send to the International Fishery Exhibition, to be held at London in May next, certain models of light-houses, light-ships, buoys, and appurtenances, which the Board had exhibited at the Centennial Exposition held in Philadelphia, in 1876, and which were now in store at the National Museum, and pictures and models of such other aids as have been adopted since.

Ordered, That the Executive Officers be authorized to permit the use of such models as can properly be spared, provided they can be sent to, and brought back from London, without expense to the Light-House Establishment.⁵⁵

Joseph Henry had himself been no great believer in museums. He was, however, the main supporter of the concept of preserving the government displays intact. With his failing health and death in 1878, it seems that the Light-House Board lost any desire it might have had to exhibit the collection intact.

While the centennial display of the Light-House

53. Taylor Correspondence, 18 November 1876; 20 November 1876; 19 January 1876.

54. U.S.L.H.B. Journals, vol. 7, fol. 179.

55. Ibid., vol. 9, fol. 179.

52. U.S.L.H.B. Journals, vol. 7, fol. 290.

Board may not have been the most startling exhibition at the fair, it was a respectable showing. More important, it reveals much about the American lighthouse service in 1876. Although the board overspent their budget by nearly \$3,000, the effort was worth it. Interest was stirred, not only among those who had previously been involved, but also among those who had never before had reason to come into contact with the lighthouse service. Finally, and perhaps most important, notice had been served on the general public that the United States had at last been provided with a trustworthy system of navigational aids, a system to rival that of any other nation.



John O. Sands is a graduate of Trinity College, the Winterthur Program in Early American Culture at the University of Delaware, and the Smithsonian Program in American Studies at George Washington University. He was senior curator of The Mariners' Museum in Newport News, Virginia, for twelve years, and is now manager of administration for the Department of Collections, Colonial Williamsburg Foundation. Sands is the author of Yorktown's Captive Fleet, a study of the naval history and subsequent archaeology of that decisive battle.