

COAST SURVEY.

JANUARY 12, 1843.

Laid upon the table.

*Mr. Mallory, from the Select Committee on the Coast Survey, reported in part the following proceedings, in obedience to the resolution of the House of Representatives, 2d session 27th Congress, February 19, 1842, viz :*

CONGRESS OF THE UNITED STATES.

IN THE HOUSE OF REPRESENTATIVES UNITED STATES,

February 19, 1842.

On motion of Mr. Mallory,

*Ordered*, That the letter of the Secretary of the Treasury laid before the House on the 3d of January, transmitting a report of F. R. Hassler, superintendent of the coast survey; showing the progress made in that work, and the report from the Secretary of the Treasury laid before the House on the 31st of January, 1842, in relation to the expenditures on account of the survey of the coast, be referred to a select committee.

Mr. Mallory,

Mr. Wise,

Mr. Cushing,

were appointed said committee.

Mr. Aycrigg, and

Mr. Holmes,

Attest :

M. S. CLARKE, Clerk.

The committee, thus organized, instructed the chairman to request the attendance of Mr. F. R. Hassler, and such of his assistants as the superintendent might designate.

On motion of Mr. Cushing, it was further

*Resolved*, That the chairman be directed to address a letter, in the name of the committee, to the President of the United States, requesting him (if compatible, in his judgment, with the public service) to communicate to the committee the following information, viz :

1. A list of all persons, other than officers of the navy and army, employed in the coast survey, from its commencement to the present time, the order or orders under which they were employed, and the amount of compensation, regular and extra, paid to each.
2. A list of all such persons who hold, or have held, other civil appointments, and their pay and emoluments under such other civil appointment, held during their employment in the coast survey; with the time and orders for their appointment and pay.
3. A list of all officers of the navy employed in the coast survey, their navy pay during their service in the coast survey, and the additional pay of each on the coast survey.
4. A list of all officers of the army employed in the coast survey, their

army pay and emoluments, in dollars and cents, whilst so employed, and the additional pay of each for service in the coast survey.

5. The time when and the authority under which all appointments and allowances of pay, regular, extra, or for arrearages, in the coast survey, were made.

And, on motion of Mr. Wise, that the President be requested to cause the proper Department to answer—

1. Whether a part of the topographical corps of the army can be detached for the purpose of the coast survey.

2. Whether the expense of the service of the coast survey will probably be reduced by detaching a part of the topographical corps.

3. Whether the expense of the service of the coast survey will probably be reduced by employing other persons than officers of the army and navy to perform the duties which they are now employed to perform in the coast survey.

In compliance with this resolution, the above interrogatories were transmitted to the President of the United States, with the letter hereunto annexed :

HOUSE OF REPRESENTATIVES, *March 12, 1842.*

SIR : I have the honor to enclose to you the within resolutions of a select committee of the House of Representatives on the subject of the coast survey.

The committee decided to address these resolutions to you, in consideration of the fact that the act of Congress authorizing the survey placed it under your direct and immediate control.

I beg leave to add, that, if consistent with your views, it would be acceptable to the committee to receive the information called for by either of the resolutions, so soon as it shall be ready, without waiting for the other.

I am, with the highest respect,

F. MALLORY, *Chairman.*

To the PRESIDENT.

Upon the motion of Mr. Wise, it was

*Resolved*, That the committee would proceed in the following order of inquiry :

1. The progress which has been made in the survey of the coast.
2. The number, location, and length, of the several base lines measured for the triangulation.
3. The number of stations occupied for triangulation.
4. The observations made for, and the corrections applied to, the triangulations.
5. The astronomical observations made for the determination of latitude and longitude.
6. The work done by each corps employed in the service.
7. A description of the charts published, if any.
8. The amount of money expended, from time to time, since the commencement of the work.
9. The sums appropriated for instruments and books.
10. The names of all persons employed, distinguishing such as were of the army or navy, together with their salaries or other compensation.
11. By whom appointed.

12. The direct appropriations for the survey, and the indirect expenditures upon it, by reason of the employment thereon of public vessels and officers.

13. The probable length of time required to complete the survey.

14. The probable amount of money required to complete the same in the mode heretofore pursued.

15. Any other mode of survey which shall have for its object the acquisition of the greatest amount of information in the shortest time, and at the least expense.

THURSDAY, *March 17, 1842.*

Present: Mr. Mallory, Mr. Wise, Mr. Holmes, Mr. Aycrigg.

Mr. Hassler appeared before the committee, agreeably to the request of the chairman, made by order of the committee at former meeting.

*Examination of F. R. Hassler.*

1. Question by Mr. Mallory. Have you deviated in any way from the original plan adopted in 1807?

Answer. Not in the least.

2. Question by same. Is not the work now conducted on a more extended plan than was originally intended, and does it not embrace objects not originally contemplated by the Government?

Answer. Not in the least.

3. Question by same. Is it intended that the present coast survey shall furnish the necessary data for the measurement of an arc of the meridian or a parallel of latitude?

Answer. No.

4. Question by same. Is there any necessary connexion between such measurement and a hydrographic survey of the coast?

Answer. No.

5. Question by same. Could an arc of the meridian or parallel of latitude be measured with more facility, expedition, and economy, if disconnected from all other objects?

Answer. Yes.

6. Question by Mr. Aycrigg. You refer in your report (Doc. No. 28) to a number of volumes in which the work is contained; is the work in those volumes reduced?

Answer. They are reduced.

7. Question by Mr. Mallory. Where are these papers kept?

Answer. In my office.

8. Question by same. Are they safe from fire?

Answer. Yes.

9. Question by same. Are there any duplicates of these papers?

Answer. Some; of the greater part.

10. Question by same. Of what papers are there duplicates?

Answer. Of all, except the last year's work.

11. Question by Mr. Aycrigg. Is the Government in possession of any of the data, or are they in your possession?

Answer. They are in the office—a house rented by the Treasury Department—and under the care of persons in the employment of Government.

12. Question by Mr. Mallory. Whom do you mean when you say "persons in the employment of Government?"

Answer. Myself and my assistants.

13. Question by same. Suppose the house should be burnt, and papers destroyed, would not Government sustain great loss?

Answer. Yes; but I conceive the house completely safe, proper measures being taken to guard against fire. The houses have been slated with this view.

14. Question by same. Have any other maps or charts been published, besides those of New Haven, Newark, and Bridgeport?

Answer. No other.

The hour of 12 having arrived, the committee adjourned to meet on this day week.

THURSDAY, *March 24*, 1842.

*Examination of Mr. Hassler continued.*

At subsequent meeting of the committee, the following questions were propounded to Mr. Hassler by various members of the committee, whose answers were as stated:

1. Question. Have any maps been prepared and completed, so as to be ready for publication, other than the three published; and if so, what?

Answer. Yes: 1. A complete map of New York harbor is engraving. 2. A partial map of the entrance of New York has been prepared and delivered to the Auditor for the light-house bureau. 3. One of the Thames river, in Connecticut, nearly ready for delivery, on order of the Secretary. 4. One for the Topographical bureau, for the site of fortifications of the entrance of New York harbor, at Sandy Hook. 5. One of the north shore of Long Island sound, at New London, called for by the Secretary of the Treasury. The four last named were prepared for the offices.

2. Question. Is either of the eight maps above named so far correct and complete in itself as to be of any utility in and for the localities to which it applies?

Answer. To be sure; each is complete, and of use in itself.

3. Question. Are these all on the same scale, or otherwise?

Answer. They are not all on the same scale, but some larger and some smaller, according to the purpose for which they were respectively intended.

4. Question. Is there any objection to the publication of definite and successive parts of the work as they may be completed, as the map of New York now in the engraver's hands?

Answer. No, not in the least, so soon as the engraving is finished.

5. Question. Is it necessary to complete the survey of Delaware bay before it can be practicable to publish a chart of Long Island sound?

Answer. No.

6. Question. Is there any objection to the publication of the work connected with the maps as they are published?

Answer. No; it is proper to publish the data on which the chart is constructed, in order to verify its correctness, and as a guide for the use of it.

7. Question. Has the work of mensuration and triangulation connected with the maps of Bridgeport, New Haven, and Newark, been published with them?

Answer. No.

8. Question. Has any part of the mensuration of the survey, and of the other scientific elements of the work, been published?

Answer. No.

9. Question. Has any systematically full part of the work between two base lines and two astronomical stations been completed as yet?

Answer. No; the locality of the coast hitherto surveyed has not permitted it.

10. Question. Where is your furthest eastwardly astronomical station on the coast?

Answer. Mount Carmel, near New Haven.

11. Question. Where is your next astronomical station, proceeding south-westwardly?

Answer. Tashua, near Bridgeport.

12. Question. Where your next?

Answer. West Hill, on Long Island.

13. Question. Where the next?

Answer. Buttermilk Hill, near Tarrytown, New York.

14. Question. Any other?

Answer. Yes; Weasel Mount, near Paterson, New Jersey, and none southwest of that.

15. Question. How many base lines have been measured in the survey?

Answer. Two in 1817 and one in 1834.

16. Question. Between what points is the base line measured in 1834?

Answer. On the beach at Fire Island light-house, Long Island; and the line measured is eight and three-quarters miles in length, running eastwardly from the light-house.

17. Question. Where are the base lines of 1817?

Answer. One in English Neighborhood, New Jersey, and the other at Gravesend beach, Long Island.

18. Question. Has any use been made of the two last-named base lines in the work of the survey?

Answer. Yes; for the beginning, in 1833.

19. Question. What objection is there to publishing the details and mathematical elements of the work, as completed, from Point Judith to New York harbor?

Answer. The main triangulation has not been completed so far as Point Judith, but only the secondary. The main triangulation has been completed only between Friar's Head, opposite New Haven, and Mount Carmel, in Connecticut, eastwardly, and Mount Holly, New Jersey, and Yards, (Newton township, near Philadelphia,) southwestwardly. The secondary triangulation has been completed from Point Judith to Cape Henlopen, on the coast, and from New York across to the head of the Chesapeake.

20. Question. What reason is there for concealing from the public the elements of the work between Friar's Head and Mount Holly?

Answer. None.

21. Question. Has it been published?

Answer. No; it is not proper.

22. Question. Why is it not proper?

Answer. Because it will introduce imitations of the work, to the detriment of its validity.

23. Question. Imitations by whom?

Answer. By common chart sellers, or others.

24. Question. How is the survey injured by individuals publishing charts copied from those of the survey ?

Answer. Because the maps would not be official.

25. Question. Would not the publication of the data with the maps enable scientific men to judge of the accuracy of the work ?

Answer. Of course.

26. Question. Would not the withholding of the data until the completion of the survey enable the operator to force results ?

Answer. No ; in the manner in which the work is carried on it cannot be.

27. Question. Can scientific men judge of the accuracy of the work unless the mathematical elements of it be published ?

Answer. No.

28. Question. Have the mathematical elements of the charts of Bridgeport, New Haven, and Newark, been published ?

Answer. No ; that will come into the general account.

29. Question. When do you propose to publish such a general account ?

Answer. So soon as I shall have reached the verification base on the Chesapeake.

30. Question. When do you expect to reach that point ?

Answer. In a few years.

31. Question. When do you expect to complete the Delaware ?

Answer. If I can get out in season, by the end of this year.

32. Question. What prevents your getting out in season ?

Answer. The want of money, nearly all the appropriation having been expended.

33. Question. Does the work on the weights and measures occupy any of your time, which might be appropriated to the survey ?

Answer. No. It does not take any of my time.

34. Question. How much of your time is devoted personally to the coast survey ?

Answer. All the time, except the inspection and reporting on the weights and measures.

35. Question. How much time does it take to inspect and report upon the weights and measures ?

Answer. About half an hour in the morning and half an hour in the afternoon of the day, but not of each day. This is only while I am in the office. I am generally in the field from the middle of May to that of December ; sometimes I am in the field to the end of December.

36. Question. At what time in the spring do the different corps start on their duties ?

Answer. Generally in April, remaining until the middle or end of November.

37. Question. Did you lose part of a year last year ; and if so, why ?

Answer. I lost the most of last year's work, in order to answer the resolution of the House of Representatives on the coast survey of June 24, 1841, and by the fever which seized me in October.

38. Question. At what time did you take the field last year, and how much of your time did the resolution occupy ?

Answer. I did not take the field until the middle of September. The resolution occupied me three or four weeks. I was also detained to make a report on weights and measures.

39. Question. Is the work in the office now in such a state of forward-

ness as not to interfere with the commencement of the field work this year, so soon as the season will permit the work to go on?

Answer. Not in the least.

40. Question. Why is not the main triangulation up with the secondary?

Answer. On account of the difficulty of finding suitable elevations on both sides of the Delaware.

41. Question. Who conducts the main triangulation?

Answer. I myself, according to positive stipulation.

42. Question. Why is not the main triangulation carried as far eastward as the secondary?

Answer. Because it was not needed.

43. Question. When will it be needed?

Answer. So soon as the junction is made with the base line on the Chesapeake.

44. Question. When that junction is made, do you propose to suspend the work south, and go back east, or to have two parties?

Answer. When the junction is made, while the secondary triangulation goes on south, I shall continue the primary triangulation east.

45. Question. Cannot the main triangulation be carried on except under your immediate personal supervision?

Answer. Not in the present state of things.

46. Question. Why not?

Answer. Because there is no body to do it, and the circumstances are contrary.

47. Question. Is there nobody else attached to the survey who can do it?

Answer. Not now.

48. Question. What are the contrary circumstances spoken of?

Answer. Want of money; that is, of a larger appropriation.

49. Question. Must the main triangulation be suspended eastward until you can take it up personally?

Answer. In the present state of things, yes.

50. Question. In what portion of the field work have you been personally employed the last year?

Answer. At Yards, behind Philadelphia.

51. Question. Where the year before?

Answer. Willow Grove and Mount Holly.

52. Question. Where do you propose to employ yourself on the field work the present year?

Answer. South of Yards and of Mount Holly, on both sides of the Delaware.

53. Question. What is the precise duty or part of the work performed by you at Yards and at Mount Holly?

Answer. Measuring the angles of the main triangulation.

54. Question. How many assistants were there in the party in which you operated last year?

Answer. None. I did the work alone; that is, I did the mathematical work alone.

55. Question. Is there any person in the coast survey competent to take charge of and continue the work, if you should cease to do it?

Answer. Not as yet.

56. Question. Do you mean to be understood that without your personal

superintendence the work would cease, and that no man can take it up, continue, and complete it?

Answer. Not honorably.

57. Question. Is there any profound secret in the mensuration of triangles and the making of astronomical observations, known to you alone of all mankind?

Answer. Science is a public thing, but it requires study to be perfect in it.

58. Question. Is there any person in the survey who is pursuing such a line of observation and study as to be in the way of learning to measure triangles and take observations, hereafter, in your stead?

Answer. I give them all instruction which they will accept.

59. Question. Does no one in the survey but you measure triangles or take observations?

Answer. Every one of the principal assistants take the secondary triangles.

60. Question. What difference is there in the mathematical elements of primary and of secondary triangles?

Answer. The larger triangles require more attention to the figure of the earth and to the mathematical elements arising from it.

61. Question. Does geodesy apply to the main triangulation and not to the secondary?

Answer. More especially, but not exclusively.

62. Question. How long will it take to finish the work along the whole coast of the United States, going on at the rate of time and appropriation heretofore used?

Answer. That nobody can say, in either one way or another.

63. Question. What is the whole extent of the general coast, from Pas-samaquoddy to the Sabine, not including rivers?

Answer. I cannot tell.

64. Question. What proportion of the entire coast of the United States has thus far been surveyed?

Answer. I cannot say.

65. Question. You have said that the latitude and longitude of Cape Hatteras was erroneous in the charts. How did you ascertain it?

Answer. By having attempted to make a union of the Northern and Southern maps, which join at that place, in 1828.

66. Question. How long before the survey will reach Cape Hatteras?

Answer. It is impossible to say—it is too vague a guess.

67. Question. Have you any personal knowledge of the location of the Southern coast?

Answer. I have never been any further south than Norfolk.

68. Question. You have said that it was difficult to find suitable elevation on both sides of the Delaware, which cause prevented the main triangulation from keeping up with the secondary, (No. 40:) how do you propose to obviate similar difficulties on the flat coast of the South?

Answer. By care and assiduity, and by the methods used on the Jersey sea coast.

69. Question. Is that work on the Jersey sea coast a primary or a secondary triangulation?

Answer. It is secondary triangulation.

70. Question. What is the peculiarity of the methods used on the Jersey sea coast, where there is a deficiency of natural elevations?

Answer. By adapting the triangulation to any locality which may be found favorable.

71. Question. You do not specify any of the means you propose to recur to at the South, in the absence of natural elevations. Do you decline to state what they are?

Answer. No.

72. Question. What are they, then?

Answer. By mixed astronomical and geodetical observations.

73. Question. Why were not such means used to overcome the impediments to the completion of the main triangulation on the Delaware?

Answer. Because they would not apply with propriety. There are better means.

74. Question. What are those better means?

Answer. By meeting those localities by triangulation from the south side of the locality.

75. Question. You say that the peculiar methods by which you propose to overcome the difficulties on the Southern coast are mixed astronomical and geodetical observations; are not such the general means used every where in the survey?

Answer. The means of both are different in the two cases.

76. Question. What is the object of the second base line?

Answer. The verification of the whole work, which is in the system of all such works.

77. Question. If the object be to verify the survey, and suppose it does not agree, what is the consequence?

Answer. That the error, if any, is to be investigated.

78. Question. It is stated in one of your reports that the survey extends over 11,000 square miles; is that mapped?

Answer. Yes, to be sure.

79. Question. What benefit results to navigation by having all the details of the topography of the country?

Answer. There is no more topography in the maps than what is necessary for that object.

80. Question. Cannot a portion of the topography be dispensed with without detriment to the object of a knowledge of the coast for navigation?

Answer. Not to that extent to which it is carried now. I could not dispense with any of the topography as it is now done.

81. Question. Do not the hydrographical parties have to wait for those engaged on the topography?

Answer. They cannot go six inches without it, but they do not wait; the topographical part has always been ahead.

82. Question. What distance from the coast have they carried the soundings?

Answer. Until they were out of sight of land; I mean the points given to them as guides. Those points are made to be seen as far as possible. We elevate signals thirty feet, or more.

The committee wish you to state the time each year, since the commencement of the work in 1832, at which you have taken the field; and also the time each party has commenced its work; also, the whole number of months occupied by yourself in making the main triangulation.

83. Question. You have sounded from Point Judith to Egg Harbor, along the coast; have those soundings been extended as far out as you intend?

Answer. They are complete for the detailed maps, but they have not been carried out so far as I intend.

84. Question. How much further do you intend to carry the soundings?

Answer. To the Gulf stream.

85. Question. What will be the probable time required to extend the soundings, with the same force now employed, so far as you intend?

Answer. As this kind of work is to be done by astronomical observations, it depends entirely on the weather.

86. Question. Where are these astronomical observations to be made?

Answer. Of course, on board the ship or sounding vessel, according to special instructions given to Lieutenant Gedney, in writing, last summer.

87. Question by Mr. Wise. For the present, is it necessary, in order to carry the survey south, to extend the soundings to the Gulf stream? And, ultimately, will the survey of the coast not be complete without extending the soundings to the Gulf stream?

Answer. No, to the first clause of the question. As to the second clause, I answer, that the survey is, in that respect, ad libitum.

88. Question by Mr. Wise. By your answer to the second clause, am I to understand you as saying that the Government may carry the survey as far out into the ocean as it chooses, but that the survey, as far as it goes, wherever it stops, will be complete?

Answer. Yes.

89. Question by Mr. Mallory. Do you propose this or the next year to carry on these deep soundings, by employing any of your present force?

Answer. Whenever any fit vessel is disposable, without otherwise impeding the work.

90. Question by Mr. Mallory. Is it probable that any such vessel will be disposable for that purpose during this or the next year?

Answer. It is likely, but it depends on the weather.

91. Question. Of how many points in the United States have the latitude and longitude been ascertained and verified in the course of the survey?

Answer. The calculation of the triangles in my work gives, in ultimate result, the latitude and longitude of each point of the triangle, primary and secondary, according to my special form of the work.

92. Question. Of the points of latitude and longitude thus determined, how many have been made public?

Answer. None; because it is not yet the proper time. •

93. Question. Have you determined the latitude and longitude of any points on the coast; and if any, how many and what?

Answer. I have ascertained the latitude and longitude of points on the coast as well as inland, according as the triangle fell.

94. Question. Why have not these important points on the coast, thus determined, been made public?

Answer. The time of the publication is when the general account of triangulation is given, before which it will be of no use.

95. Question. Did the French, in the triangulation of their country, use mixed geodetical and astronomical observations?

Answer. Not in the form in which I have stated in the first part of my written explanation.

96. Question. Do you regard the survey as a great scientific enterprise,

embracing delicate problems of geodetic research, beyond what is necessary to an accurate but rapid survey of the coast for nautical purposes?

Answer. There is not a single movement in all I do which is not necessary for the honorable and faithful execution of the work.

97. Question. Is it intended as the basis of a topographical, military, and statistical survey of the whole United States?

Answer. That is the Government's business, and not mine.

98. Question. Is the survey conducted now with a view to any such ultimate purposes?

Answer. That is not given in any charges by the Government; therefore I do nothing with it.

99. Question. Was not the secondary triangulation along the Jersey shore found to be sufficiently accurate?

Answer. Yes.

100. Question. Was not the main triangulation through New Jersey made with a view to the topographical survey of that State?

Answer. No.

101. Question. Cannot the survey of the bays and rivers be postponed, without injury to the general work, till the survey of the coast proper is completed?

Answer. It is impossible, because no accuracy could be got for the coast.

102. Question. How many plates are now in the hands of the engraver?

Answer. Of actual copperplates, two.

103. Question. Do these contain the whole map you are now getting ready for publication?

Answer. No; the map of New York harbor will cover eight such plates.

104. Question. Why are not more preparing for publication?

Answer. They are in work; in a few days we can cut off a few more.

105. Question. How many engravers have you in employ?

Answer. Two; I would have more if I had the money.

106. Question. How long have these two been employed, and at what salary?

Answer. Since last January or December; one at \$1,500, and the other at \$1,300, per annum.

107. Question. Where did you procure the copper for the above engraving, and where the engravers?

Answer. The copperplates used were procured from Keim, in Philadelphia; the engravers from Hamburg, because they were the best, and best recommended.

108. Question. Cannot American engravers put on copper all map engraving which can be put on paper?

Answer. No.

109. Question. What is the ordinary amount of error in transferring from paper to copper?

Answer. In the way in which I do it there shall be none.

110. Question. Have the grossest errors in the position of places, stated in one of your reports to have been ascertained by you during the survey, been pointed out by you, for public information?

Answer. They have not yet been made public, but will be when the works relating to those places are published.

111. Question. Are the measures in the survey taken in French metres? If so, why?

Answer. Yes, because it is the only absolute standard ; but the results are given in yards and metres both.

112. Question. In what parts of yards ?

Answer. In decimal parts only.

113. Question. What reason is there why all the *data* must remain in your office ?

Answer. Because they are in daily use there.

114. Question. Have you any reason to believe that the surveys made by Captains Gedney, Wilkes, and Glynn, are not sufficiently accurate for the purposes of navigation ?

Answer. I know nothing in regard to them.

115. Question. Did the British officers survey the North sea after the same manner that you are now surveying the coast of the United States ?

Answer. I am entirely unacquainted with what they did ; there is nothing of it published.

116. Question. You stated in your printed report that you had accomplished more in a shorter time, and at less expense, than had been done in any other work of a similar kind ; with what works do you make this comparison ?

Answer. The English general survey of England, Ireland, and Scotland ; the French survey of the inland and coast of France.

117. Question. How many hours per day do your subordinate parties work in the field, in favorable weather ?

Answer. As many as possible.

118. Question. Are there any data to ascertain how many hours ?

Answer. They keep an account, and will answer as to this.

119. Question. Does this survey employ the whole extent of your mathematical knowledge ?

Answer. No.

-120. Question. Do you think that, under the most favorable circumstances, and with continuance of a yearly appropriation of \$100,000, the survey of the coast can be completed in twenty years ?

Answer. Perhaps. The progress is slower at first, and the means increase as the work proceeds.

Questions by the committee. At what time has Mr. Hassler taken the field each year, since 1832 ? At what time each party ? How many months in all has Mr. Hassler been employed in the main triangulation ?

*Times of going to the field work, and returning from it, each year.*

In 1832.

September 25. Having received the instruments, I left Washington the 26th September, at 8 o'clock, A. M., to reconnoitre for the continuance of my works of 1817, towards the east of it ; returned to Washington the 31st January, 1833, in the evening.

1833.

April 5th. Left Washington for the first beginning of actual primary triangulation ; returned to Washington the 3d January, 1834, in the evening.

1834.

After having finished all the preparations and comparisons for the measurement of the base line, I left the 29th May, at 9 o'clock, A. M., having made also stations; returned 21st January, 1835, in the evening.

1835.

There being much calculation to be made, and many arrangements for the organization of the parties, the State of Maryland having offered an arrangement; to join the survey of that State with that of the coast survey, I went out only at different intervals, to reconnoitre the country in Maryland, and until Washington, and the outer bays, accompanied by Mr. J. H. Alexander, of Baltimore, until late in the fall and winter.

1836.

The present office was established. I left 17th August, and returned the 8th January, 1837.

1837.

I left Washington 4th June, and returned 5th January, 1838.

1838.

I left Washington July 19th, and returned 24th December, 1838.

1839.

I left Washington the 9th June, and returned the 5th January, 1840.

1840.

I left Washington the 17th, September, 1840, and arrived again at Washington the 20th January, 1841.

1841.

I left Washington 29th August, 1841, and returned 22d December, 1841.

This enumeration shows how the office work has increased since the beginning, when the elements for it were first to be collected in the field. In the progressed state of the work, the calculations, making of projections, to take to the field for the topographic and hydrographic works, their plotting, and working out, &c., require as much, and in most cases even more, work in the office than out of doors, so that indeed the going out for the field work is considered a real relief from the harder and tedious works of the office.

For the time of the going out or returning of the assistants, for their part of the work, they must be called up themselves individually; it is easily comprehended that they depend entirely on the favorable or unfavorable season for the going out as well as for the return.

F. R. HASSLER.

WASHINGTON CITY, *March* 30, 1842.

APRIL 15, 1842.

Present: Mr. Cushing, Mr. Aycrigg.

*James Ferguson examined.*

1. Question How long have you been employed in the coast survey?  
Answer. Since 10th May, 1833.

2. Question. In what capacity ?

Answer. As a principal assistant ; one of the three principal assistants.

3. Question. What particular part of the duty do you at present perform ?

Answer. Making the secondary triangulation.

4. Question. Who makes the primary ?

Answer. Mr. Hassler.

5. Question. Is there any essential difference in the scientific principles of the primary and the secondary triangulation ; and, if so, what ?

Answer. The primary requires an instrument of great power, and of nicer graduation ; there is no other difference. There is no difference in the mathematical elements.

6. Question. Cannot any scientific person, who is competent in and well practised in the secondary triangulation, perform the primary ?

Answer. The primary requires more mathematical knowledge than the secondary, and greater knowledge of practical means ; but to the whole question, I answer, yes.

7. Question. If Mr. Hassler should die, must the survey stop, for want of any person in the survey, or in the country, to take it up and carry it on ?

Answer. No.

8. Question. Which has proceeded furthest in advance, the primary or the secondary triangulation ?

Answer. The secondary. I add, that the secondary is necessarily imperfect, inasmuch as it depends on the primary for its verification.

9. Question. If the primary had preceded the secondary, might not the latter have been verified as it proceeded ?

Answer. Certainly.

10. Question. Why has the primary been allowed to remain in arrears of the secondary triangulation ?

Answer. I cannot say.

11. Question. Is not the secondary triangulation sufficiently accurate for all practical purposes in the publication of a map of the work so far as it has gone ?

Answer. Yes ; for all practical purposes.

12. Question. From what point to what point on the coast have the secondary triangulation and the hydrographical survey been completed ?

Answer. The secondary triangulation has been completed from Point Judith, including the sound and both sides of Long Island, to Cape May, covering both shores of New Jersey, and including the whole of the Delaware on both sides ; and it also crosses the peninsula to the Chesapeake, where it is now in progress, but not yet completed. I refer to the officers engaged in the hydrographical work for answer as to that part of the question.

13. Question. Do you expect that any perceptible error in the secondary triangulation will be detected by the further progress of the primary ?

Answer. I should think the maximum error would not exceed five feet in the whole distance. This I infer from the work already verified, where the error proved to be no greater than this. I refer in this to my own work ; but the other may be, for aught I know, more accurate still.

14. Question. Did you use the main triangulation as the basis of your work (the secondary triangulation) when you commenced ?

Answer. Yes.

15. Question. Do you not in fact proceed in the secondary triangulation at present in the same manner as in the primary?

Answer. The only difference is the difference of the instruments.

16. Question. You have exhibited to the committee abstracts of the whole work on the coast, from Point Judith to Cape May; what objection is there to the publication of those abstracts?

Answer. The first objection is, that no base of verification has yet been measured; the second is, that we are uncertain as to the difference in any meridian in this country and any in Europe, to a minute and a half in longitude; and the third is, that we have not yet determined the ellipticity of the earth.

17. Question. Is either of those things necessary to give practical utility to the soundings and distances in particular bays or harbors?

Answer. Perhaps not; but the superintendent will of course take care of his character as a man of science.

18. Question. In your opinion, ought the practical use of the work, by its publication, to mariners, to be deferred indefinitely, for the supposed purpose of allowing the superintendent to take care of his character as a man of science?

Answer. No.

19. Question. Has the character of the superintendent as a man of science suffered by the publication of the charts of New Haven and Bridgeport, and Newark bay?

Answer. No.

20. Question. If not, what injury would it do to his character as a man of science to publish a chart of New York harbor?

Answer. None; such a map is now in the engraver's hands, for publication.

21. Question. What injury, by the publication of charts of the whole coast, from Point Judith to the Delaware?

Answer. If it were practicable, none.

22. Question. Do you furnish the points of observation to the sounding parties yourselves?

Answer. They are ascertained by us, reported to Mr. Hassler, and by him furnished to the sounding parties.

23. Question. Do you reduce your own observations?

Answer. Yes, certainly.

24. Question. Have you been engaged in Maryland in 1835?

Answer. No; I came in Maryland in 1839.

25. Question. Was any body else engaged in Maryland in 1835?

Answer. Only Mr. Hassler, with Mr. James H. Alexander, as a mere reconnoissance.

26. Question. Has there been any difficulty in procuring suitable points for observation as far as the main triangulation has proceeded?

Answer. Yes; since we entered the valley of the Delaware.

27. Question. Where first?

Answer. At Mount Rose, near Princeton, in New Jersey; some in opening the line from Newtown; then at Willow Grove and at Stony Hill; some difficulty in connecting Mount Holly with the point below; a good deal at Yards. These obstructions could not have occupied more than five months.

28. Question. When is it you propose to measure a base of verification ?

Answer. It is spoken of for this year.

29. Question. Why has it not been done sooner ?

Answer. The work has not been sufficiently advanced. It has been thought desirable to obtain such a line on the Chesapeake.

30. Question. What is the present condition of the place of the original base line ?

Answer. I have not been there since 1836. Then the beach was considerably washed, but the points were undisturbed. Now, I understand, the beach is changed, and the base in danger ; but the elements of it will be preserved by the mountain base, inland from the original base.

31. Question. Will a minute and a half's difference between the European and American meridians show on ordinary maps ?

Answer. Yes ; it would be about a mile.

32. Question. Why has not this difference, in the course of the ten years since the resumption of the survey, been ascertained ?

Answer. I cannot answer that. We have observed eclipses of the sun. We have made no other observations for the longitude.

33. Question. Have the observations thus made been reduced ?

Answer. Yes, and calculated. I add, that, if we had considered it a sine qua non to determine the longitude, the time occupied in this way might have retarded the other work.

34. Question. But you have previously said that the want of the determination of this fact was one of the objections to publishing any part of the work.

Answer. I said it was an objection, but I did not mean to be understood as saying that it was an insuperable objection.

35. Question. Is the absence of a base of verification any insuperable objection to the publication of the work along Long Island sound ?

Answer. I think not. I say no.

36. Question. Is the survey engaged now in measuring an arc of a great circle of the earth, with a view to ascertain its ellipticity ?

Answer. That will be one result of the survey, and a very important one, in a scientific point of view.

37. Question. When will that result be reached ?

Answer. It should await the measurement of the base of verification.

38. Question. Is it necessary to have measured such an arc, and verified the ellipticity of the earth, before it is possible to publish a map, for practical purposes of navigation, of Long Island sound ?

Answer. I think not.

39. Question. Where are the results of the work, so far as completed, now kept ?

Answer. In the depot of the survey, at Washington.

40. Question. Are they in duplicate ?

Answer. Some ; not all. The primary triangulation is all in duplicate. Of the secondary, mine is not. As to the rest, I do not know.

41. Question. Of that which is in duplicate, are both parts kept at the depot ?

Answer. Yes.

42. Question. Several of the public buildings at Washington have from time to time been destroyed by fire ; is the depot a fire-proof building ?

Answer. No ; it is not.

43. Question. If the results and other matters in the depot should be destroyed by fire, must not the work be done over again?

Answer. Yes. Precautions have been taken to enable the speedy removal of the papers, if the building take fire, by their being in cases on the ground floor.

44. Question. Of the work in duplicate, why is not one copy deposited for safe keeping in the Treasury Department?

Answer. I do not know.

45. Question. Is all the work in such a state that, if Mr. Hassler should die suddenly, it may be used, and reduced or calculated immediately by others?

Answer. Yes.

FRIDAY EVENING, *April 15.*

*Examination of Mr. Ferguson continued.*

Present: Mr. Cushing and Mr. Ayer.

[NOTE.—To make the evidence more distinct, from question No. 46 to question No. 74, it must be observed, that the statement after No. 74, (marked A,) the statement marked "to be annexed to Mr. Ferguson's evidence," and the statement marked "to be annexed to Mr. Ferguson's testimony," together with the chart of Newark bay, referred to in question No. 48, were presented at the beginning of this meeting; the statements having been previously prepared, in writing, by Mr. Ferguson, in answer to questions put to him by the committee at the previous meeting.]

46. Question. Is there any substantial and adequate reason why the mathematical elements of the work should not be published as parts of it are completed?

Answer. No other but that it will require time to put them in order.

47. Question. At what time in each season do you take the field?

Answer. This is stated in the schedule annexed, and marked A.

48. Question. There is shown by you a published chart of Newark bay, purporting to be an extract from the United States coast survey; is there any meridian on the map? (Annexed, and marked B.)

Answer. No.

49. Question. Is the latitude or longitude of any part of it given?

Answer. No.

50. Question. What is the length of Newark bay, as stated in this map, from Shuter's island to the confluence of the Passaic and Hackensack rivers?

Answer. It is, by the scale of the map, five miles and eighty-two-hundredths. But the scale is an erroneous one, and was not published or verified by the superintendent. The actual distance between the two points specified is five miles and six hundred and twenty-three thousandths, obtained by me by measuring on the original topographical map.

51. Question. Please to inspect the map of Newark bay, which is now shown to you, marked C.

Answer. It appears to be the same map, engraved from the same plate as B; but the scale is different, and is at the same time erroneous. It seems to be written  $\frac{1}{200000}$  instead of  $\frac{1}{100000}$ , or erroneous in the proportion of 2 to 1, or about that.

52. Question. If the chart of New York, or any part of the coast, be

published, do you apprehend any dangerous error would be introduced by map sellers?

Answer. If published without care, there would, undoubtedly.

53. Question. Is it considered judicious to suppress the results of the survey, through fear that, if published, map sellers may make errors in copying the maps for sale?

Answer. No.

54. Question. Is the survey of any practical use, unless published?

Answer. Yes; in the experience acquired by the officers of the navy and others engaged on the survey. I am not aware of any other.

55. Question. Do you understand the proper uses of the survey to be confined to the instruction thus acquired by the officers engaged in it?

Answer. No; the uses are a knowledge of the coast for commerce and navigation, and a communication of it by a publication of the maps.

56. Question. Can the survey be of any practical use to the country at large, without the publication of charts and maps?

Answer. Certainly not.

57. Question. Where are the instruments used by you repaired?

Answer. At different places, but generally at the office of the survey here.

58. Question. Have you had any difficulty in procuring repairs at other places?

Answer. I have scarcely ever had occasion for repairs; I should think not exceeding five dollars in amount since 1833, when I entered the survey. All my instruments are of European manufacture. They are good instruments.

59. Question. What necessity is there of plane-table parties, except near the coast?

Answer. No absolute necessity, except for the secondary triangulation near the coast.

60. Question. How far in from the coast have plane-table parties gone on the survey?

Answer. I cannot say precisely. They are carried on by Mr. Gerdes, Mr. Sands, Mr. Boyd, Mr. Dickens, and Mr. Werner.

61. Question. Do the plane-table parties require much science?

Answer. They require practical skill.

62. Question. When a secondary triangulation precedes the primary, is it not a second without a first?

Answer. Technically, it is.

63. Question. Is it not working wrong end foremost for a secondary to precede a primary triangulation?

Answer. I think not, because the secondary loses none of its accuracy by the primary following it.

64. Question. Can you ascertain what the errors of the secondary are until you have the primary?

Answer. No.

65. Question. How are your distances measured?

Answer. In French metres. It is not the standard of the country, but it is the standard best authenticated, and best known in geodetic operations. Our standard is the English yard. The foot is the most common measure used in this country, both for scientific and practical purposes.

66. Question. Is the metre in common use in this country in any way?

Answer. No.

67. Question. Is it not as easy to convert yard measure into metres as metre measure into yards?

Answer. It is the same thing.

68. Question. In that case, what benefit is there in having the work of the survey in metres?

Answer. None but what I have given before.

69. Question. What is the standard used in the English survey?

Answer. Either the English yard or foot.

70. Question. What is the object of the proposed second base line?

Answer. To verify the work.

71. Question. Cannot the work proceed north and south at the same time?

Answer. Not at present, without a larger appropriation and more persons; at least, that is my opinion.

72. Question. Have you a general knowledge of the configuration of the coast?

Answer. Yes, to Cape Henry.

73. Question. On what part of the coast, north or south, can the work be carried on most easily?

Answer. At the north, by reason of the nature of the coast.

74. Question. Of how many points on the coast has the survey ascertained the latitude and longitude?

Answer. I should think my own points were five hundred; and, altogether, a thousand.

A.

| Year. | Time of taking field. | Time of going home. |
|-------|-----------------------|---------------------|
| 1833  | May 10                | December 28.        |
| 1834  | February 20           | December 3.         |
| 1835  | April 6               | January 10, 1836.   |
| 1836  | May 1                 | December 9.         |
| 1837  | April 25              | November 25.        |
| 1838  | May 20                | November 19.        |
| 1839  | April 15              | November 29.        |
| 1840* | June 16               | December 22.        |
| 1841  | February 15           | December 12.        |

It must be understood that these dates are given from recollection, and can only be relied on as accurate within a day or two.

\*This year I was detained longer from field work, to calculate triangles necessary for the map of New York.



|   |         |                     |
|---|---------|---------------------|
| In 1841, length of longest line, miles              | - 31.02 | } Square miles, 330 |
| length of shortest line, miles                      | - 17.07 |                     |
| Square miles covered by whole primary triangulation | -       | <u>3,577</u>        |

It is but fair, and perhaps also necessary, to state to the committee that the effect of the primary triangulation, in the progress of the survey, is not properly estimated by the number of square miles within the polygon which it makes, but by the quantity of secondary triangulation for which it afforded the bases. In this view of the subject, the number of square miles covered in each year would be much increased.

[To be annexed to Mr. Ferguson's testimony.]

|   |  |
|---|--|
| 1833—Buttermilk.<br>Round.<br>Bald.<br>Tashua.<br>Mount Carmel.<br>Ruland.<br>West Hills. | 1839—Harrow.<br>Weasel.<br>Springfield.<br>Bear on Hill.<br>Disborough.<br>Stony Hill.<br>Mount Rose.<br>Newtown.<br>Willow Grove. |
| 1834—Base measured.   | 1840—Willow Grove.*  |
| 1835—Reconnaissance in Maryland.  | Mount Holly.   |
| 1836—West Hills.  | 1841—Yard.   |
| 1837—Ruland.<br>East base.<br>West base.  |  |

NEWARK, April 18, 1842.

DEAR SIR: Your letter of the 16th I received this morning. I am not in possession of any map of Newark bay furnished from the coast survey. A short time after that survey was completed, I addressed the Secretary of the Treasury, requesting such a copy, for reasons then mentioned; he referred my letter to Mr. Hassler, who replied, that the coast survey being a public work and property, such extracts should not be given except upon call of Congress; and such work being under his charge and responsibility, he should be called upon by the proper Department, &c. I very much regretted that it could not be furnished, as our vessels were subject to repeated accidents and delays, by reason of the shoals, which could have been avoided by such information. I presume that Mr. H. would be willing to facilitate any mode you may take to procure such extract, as he expressed himself to me.

I am, dear sir, very respectfully, your obedient servant,

ARCHER GIFFORD.

Hon. JOHN B. AYCRIGG.

\* The station of Willow Grove was occupied both in 1839 and 1840.

FRIDAY EVENING, April 15, 1842.

Present: Mr. Cushing, Mr. Aycrigg.

*Examination of Mr. Blunt.*

1. Question. Do you know any sufficient reason why maps and other results of the survey should be withheld from the public knowledge?

Answer. None, when they are in sufficiently complete state to be useful to navigators.

2. Question. Is any part of the survey sufficiently complete for that now?

Answer. Yes.

3. Question. How much?

Answer. New York harbor is being reduced for the engravers. Long Island sound is capable of being reduced from Point Judith to New York. The outer coast is already complete, so far as expressed, from Montauk point to Great Egg Harbor, I believe, with exception of off-shore soundings.

4. Question. How far inland from the coast has any part of the work been carried?

Answer. I am unable to say, except in regard to the secondary triangulation, which I have in part conducted. I am one of the principal assistants.

5. Question. Are you acquainted with hydrographical surveys in England?

Answer. Yes.

6. Question. Do they publish results as soon as ascertained?

Answer. They are published in sheets so soon as completed, to be useful to navigation.

7. Question. Can copies or information be obtained by individuals?

Answer. Yes; I have known copies to be obtained repeatedly for my brother, who is a chart seller; as from the Thunder and from the Blossom.

8. Question. Does the hydrographical office in England derive any profit from the sale of the charts?

Answer. I think £200 or £300 per annum. The charts are published under the direction of the Admiralty, with the seal of the Admiralty to authenticate them.

9. Question. Have you applied at any time, as an individual, to the hydrographic office?

Answer. Captain Beaufort offered to give me personally any information I desired. This was when I was a private individual, before being connected with the survey.

10. Question. In your opinion, could the work be extended north and south at the same time?

Answer. It might, with more force; and with the present force, if the line of verification were not to be measured. We can proceed more rapidly at the north than at the south with the triangulation.

11. Question. In going south, do you apprehend any difficulty in the hydrographical part of the work, as distinct from the topographical? Cannot the mere coast survey be prosecuted without leaving the coast and going inland?

Answer. No.

12. Question. How do you propose to survey the coast of Virginia?

Answer. By carrying a series of triangles down the Chesapeake bay, and

by extending them up or down the valleys of the rivers, as circumstances will allow.

13. Question. What natural elevations have you in lower Virginia ?

Answer. None of any consequence.

14. Question. What do you propose to use as a substitute ?

Answer. Artificial elevations and signals.

15. Question. In what way do you propose to triangulate the region of Dismal Swamp, and similar regions of country ?

Answer. I have no knowledge in regard to that region.

16. Question. Are we not greatly deficient in knowledge of soundings in Buzzard's bay, Nantucket shoals, Cape Cod, and Massachusetts bay ?

Answer. Yes.

17. Question. Is not a knowledge of those soundings of the greatest importance to navigation ?

Answer. Yes ; it is more wanted there than any where else. More tonnage passes. Most vessels from Europe, for New York and Philadelphia, come between the Gulf stream and Nantucket shoals, in addition to the navigation north of Cape Cod. Most of the coasting trade comes through the Vineyard.

18. Question. What amount of work or repairs have you had done in the office here to instruments ?

Answer. Nothing but the mounting of one telescope, which came from Europe without a stand. I have had no difficulty in obtaining repairs elsewhere, if needed.

19. Question. Should you think it necessary to have a mechanician with you in the field ?

Answer. To measure the base line it might be desirable ; not otherwise.

20. Question. Was any copper imported for the engraving from Vienna ?

Answer. Yes.

21. Question. Was it used ?

Answer. No.

22. Question. Why not ?

Answer. It was not considered suitable.

23. Question. Can good copper for engraving be procured in this country ?

Answer. Yes.

24. Question. Have you had any practice as an engraver ?

Answer. Yes.

25. Question. Can impressions be taken from a plate in an unfinished state, to show the progress of the work ?

Answer. Yes.

26. Question. Can impressions be taken from the plates now engraving in the survey ?

Answer. Yes, without injury to them.

27. Question. How long will it take to furnish the eight plates of the harbor of New York, with the present force, at the rate it now goes on ?

Answer. I cannot state by conjecture. I should think about three years.

28. Question. Is it not possible to have the work done accurately and more rapidly than at present, if more hands were put on the work ?

Answer. Yes.

29. Question. Is it necessary to have a workshop for the repair of instruments at the office ?

Answer. I am not able to say. There are some instruments for which it is convenient. †

30. Question. In what time could the New York map be finished?

Answer. There might be an engraver for each plate.

31. Question. Of what use are the plane tables, so far as regards navigation?

Answer. I do not consider it of any use to extend the survey any further back than the slope of the hills at the head of navigation.

32. Question. Are the plane tables further back?

Answer. I do not know how far back. I presume they are.

33. Question. What is the signification of the words "primary triangulation?"

Answer. They signify the main series of triangles on which any work to be surveyed is based, extending as far as possible throughout the work.

34. Question. What is a secondary triangulation?

Answer. It is a series commenced within the primary triangles, extending in whole or in part through the same, and dependent on the primary series.

35. Question. Is it possible for a series of secondary triangles to exist where there are no primary ones?

Answer. No.

36. Question. Is not the use of secondary triangles for plane-table parties to furnish detailed points?

Answer. Yes.

37. Question. If in any work there be but one series of triangles, does any such fact exist as primary and secondary?

Answer. No.

38. Question. When you commenced, was not the secondary triangulation intended to be, as the name imports, secondary to and within a primary triangulation?

Answer. Yes.

39. Question. Is it so now?

Answer. East of New Haven I have extended a main triangulation to Newport, and filled up the same with a secondary series of triangles.

40. Question. Is the main triangulation determined by Mr. Hassler, and ending at Yards and Mount Holly, of the same nature as the main or as the secondary triangulation by you, east of New Haven?

Answer. The same as the main triangulation by me, east of New Haven.

APRIL 30, 1842.

Present: Mr. Cushing, Mr. Aycrigg.

*Examination of Captain Swift.*

1. Question. Are you employed in the coast survey; and if so, in what capacity, and since what time?

Answer. As an assistant, since 4th April, 1833. I am also the disbursing agent, since about 2d July, in the same year.

2. Question. Will you furnish to the committee an exhibit of the expenditure on the survey for the years 1841 and 1842; say of the appropriation of March, 1841, classifying the same so as to show the amount.

expended on the maritime, and the amount on the land part of the work; the amount on the primary and secondary triangulation, and on the plane tables; the amount for salaries, and for expenditure at the bureau; and in the same way of any and all other conveniently specified classes of expenditure?

Answer. The answer is annexed in the papers marked A 1 and A 2.

3. Question. Will you furnish to the committee a copy of a printed pamphlet on the coast survey, distributed among the members of the House in February last?

Answer. The pamphlet is annexed, (marked B.)

4. Question. Is there any sufficient reason for suppressing or omitting to publish the results of the survey as thus far ascertained, and as the same may continue to be obtained?

Answer. No, I think not.

5. Question. May not maps of specific completed parts of the survey be published, while the work is in progress on other parts of the coast?

Answer. Yes.

6. Question. Of how large a part of the coast is the survey now so far completed that such maps might be published?

Answer. The whole of Long Island sound, including both sides of Long Island, New York harbor, and a portion of the northern part of New Jersey, coast and interior.

7. Question. Might not the soundings, position of headlands, and the like, of all so much of the coast, be now published?

Answer. Yes.

8. Question. Is there any sufficient reason for withholding from Congress the mathematical elements of the survey, so far as completed?

Answer. No.

9. Question. In whose possession are those facts and *data* at this time?

Answer. They are at the office in Washington, so far as completed, and except so far as parts of the work now in progress are in the hands of the assistants.

10. Question. Are there duplicates of the observations, measurements, and other unpublished elements of the survey?

Answer. There are of parts, but I think not of the whole.

11. Question. Are the elements of the base line, and of other primary and essential parts of the work, in such form and situation as to be secure from loss by fire or otherwise, and be capable of being handed over to and understood by any competent successor of Mr. Hassler?

Answer. All this is in duplicate in the office, accessible to the assistants, and susceptible of being understood and used by them. No part of this has been published except the final result of the base measurement. The details have not been published. The papers are subject to the hazard of fire; but not more so, and perhaps less, than in some other buildings in Washington.

12. Question. Is there any objection to depositing one of the duplicates in each case in the safes of the Treasury Department?

Answer. No.

13. Question. Would not this be proper, to guard against accidents?

Answer. It certainly would add to the security.

14. Question. In what way are the principal duties of the survey subdivided between the superintendent and his assistants?

Answer. The duties of Mr. Hassler, in addition to the general supervision of the work, are the main triangulation, while the assistants are employed in the secondary triangulation and detailed surveys.

15. Question. Is the main triangulation in arrears of the secondary; and if so, why?

Answer. It is. I am not aware of the reason, except the illness of Mr. Hassler, and his inability to do it, caused thereby.

16. Question. Cannot that work be performed by one of his assistants?

Answer. Yes.

17. Question. How long has Mr. Hassler been so ill as not to be able to attend to that work?

Answer. It was in October of last year that he became ill. He was also ill the preceding year, in September.

18. Question. What prevented his taking the field and performing the work in the spring and summer of those two years?

Answer. I am unable to say.

19. Question. What sum is allowed to Mr. Hassler, annually, for expenses, exclusive of compensation?

Answer. Salary \$3,000, and expenses \$3,000.

20. Question. For what expenses is this \$3,000 designed? Is it for personal expenses?

Answer. I suppose it is the expenses of living.

21. Question. Is he paid for other expenses when he goes into the field?

Answer. He is furnished with an instrument carriage and horses for the instruments and himself, and a baggage wagon besides, for instruments, at the public expense.

22. Question. Is it the same carriage which he is accustomed to use in Washington?

Answer. Yes.

23. Question. Are horses and men paid at the public expense for the carriage and wagon through the year?

Answer. Yes; four horses, one permanent driver, and one other man, who also assists about the office.

24. Question. Please to specify, in the answer to the 2d question, the whole of the expenditures on these carriages, horses, and men, as are of the classes of expenditures therein referred to.

Answer. It is contained in the paper annexed, and marked A.

25. Question. What are the precise duties performed by Mr. Hassler during the chief part of the year, in which he remains at Washington?

Answer. The weights and measures, and the computation of his own field work, and occasional general computation.

26. Question. Do not the assistants reduce and compute their own work?

Answer. Yes.

SATURDAY, May 13.

Present: Mr. Mallory, Mr. Cushing.

*Continuation of the examination of Captain Swift.*

27. Question. Do you wish to add any explanation to the papers now produced in answer to the 1st question, and marked A 1 and A 2?

Answer. In comparing the accounts in the papers marked A 1 and A 2, and in the printed sheet B, there is a discrepancy in the sums, assigned to

the secondary triangulation and plane-table parties, respectively. The manuscript (marked A 1 and A 2) is the later and correct statement, the statement in B being an approximate estimate, made up before the complete settlement of the accounts.

28. Question. Does the whole amount expended pass through your hands, and how is it drawn from the Treasury, and on what vouchers paid?

Answer. All the expenditure for work on shore passes through my hands, also the per diem allowance of the officers on board the vessels, and the extra compensation of the lieutenant commandant; but the other payments, in the hydrographical part of the work, do not pass through my hands, being made by the commander of the vessels. The money expended by me is received by me from the Treasury, on requisition made by me on the Department. All the disbursements, except for salaries, &c., fixed at the Treasury Department, are made under the authority of Mr. Hassler.

29. Question. Who prescribes the number of subordinate persons to be employed, and the amount of miscellaneous expenses to be incurred?

Answer. The assistant in charge of each party, subject to the control of the disbursing officer.

30. Question. Who appoints the persons employed in the survey?

Answer. Mr. Hassler.

31. Question. Who fixes their compensation?

Answer. If below \$1,000, Mr. Hassler; if more, it is referred to the Department. Such is the practice, so far as I know.

32. Question. Is it necessary to have an instrument maker's shop in the survey?

Answer. I think it is both economical and convenient. An amount of work was done there the last year fully equal to the cost of maintaining the shop.

33. Question. Cannot some portion of the topography of the survey be dispensed with without detriment to the hydrographic part of the work?

Answer. I conceive that the plane-table survey is useful, but it may not be necessary for any hydrographical object that it should be so far extended.

34. Question. What, then, is it useful for?

Answer. I do not know any thing, except that it contributes to a more exact knowledge of the topography of the country adjacent to the coast.

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A 1.

*Statement of the expenditures made for the survey of the coast of the United States, and for engraving the chart of the harbor of New York, during the year 1841 and a part of 1842.*

|  |             |
|--|-------------|
| Amount expended by Captain W. H. Swift,<br>from 1st January, 1841, to 31st December,<br>1841       | \$80,639 13 |
| Amount expended by Commander Thomas<br>R. Gedney, 17th May, 1841, to 31st March,<br>1842           | 9,162 42    |
| Amount expended by Lieut. Commandant<br>Geo. S. Blake, 11th March, 1841, to 28th<br>February, 1842 | 4,766 77    |

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\$94,568 32

*Details of the expenditures.*

|  |            |             |
|--|------------|-------------|
| For the main triangulation, including the compensation of the superintendent, the heliotroppers, and hands employed therein, and all incidental expenses, except horses, wagons, and harness, and repairs of same, and pay and subsistence of driver | \$9,289 87 |             |
| For horse keeping, (4 horses,) repairs of one instrument carriage, one wagon, harness, and pay and subsistence of driver   | 1,445 98.  |             |
|  |            | \$10,735 85 |
| For the secondary triangulation, including the compensation of the assistants, heliotroppers, and hands employed therein, and all incidental expenses, except horses and wagons, harness, and repairs of ditto                                       | 20,656 14  |             |
| For horses, horse keeping, repairs of wagons, and harness, pay and subsistence of 2 drivers, (3 wagons and 5 horses)   | 2,160 74   |             |
|  |            | 22,816 88   |
| For the plane-table surveys, including the compensation of the assistants and the hands employed therein, and all incidental expenses  | -          | 17,212 29   |
| For the hydrographic surveys: Amount paid by Capt. Swift to the naval assistants, for the authorized allowance of \$627 per annum to the lieut. commandants, and of \$1 per day to the lieutenants and passed midshipmen                             | 8,644 94   |             |
| For amount paid by Commander T. R. Gedney, from 17th May, 1841, to 31st March, 1842, for repairs of 2 vessels, sails, boats, pilotage, and incidental expenses, (Washington and Jersey)  | 9,162 42   |             |
| For amount paid by Lieut. Com't G. S. Blake, for same from 11th March, 1841, to February 28, 1842, (schooners Gallatin and Nautilus)   | 4,766 77   |             |
|  |            | 22,574 13   |
| For expenses of the coast survey office, including rent, fuel, lights, and attendance  | -          | 1,999 17    |
| For expenses of the instrument maker's shop, including the compensation of the persons employed therein, and the cost of tools and materials purchased for same  | -          | 2,318 11    |
| For compensation and expenses of the persons employed in engraving the chart of the harbor of New York   | -          | 2,011 14    |
| For the <i>general expenses</i> of the work, including the compensation of all assistants and others not embraced in the preceding schedule, and all purchases and expenditures not specified in same  | -          | 14,900 75   |
|  |            | 94,568 32   |
|  |            |             |

W. H. SWIFT,

*Disbursing Officer Coast Survey.*

WASHINGTON, May 4, 1842.

## A 2.

*List of all persons employed in the survey of the coast of the United States on the 1st April, 1842, and the annual compensation paid to them by Captain W. H. Swift, disbursing officer, from the appropriation therefor, made March, 1841.*

|  |            |
|--|------------|
| F. R. Hassler, superintendent, \$3,000 salary, \$3,000 expenses  | \$6,000 00 |
| Captain W. H. Swift, assistant and disbursing officer, 2½ per cent. upon disbursements   | 1,908 60   |
| James Ferguson, assistant  | 4,000 00   |
| Edmund Blunt, do   | 4,000 00   |
| Lt. Thomas J. Page, do   | 500 00     |
| C. M. Eakin, do  | 3,000 00   |
| Charles Renard, do   | 3,000 00   |
| W. M. Boyce, do  | 2,000 00   |
| J. J. S. Hassler, do   | 2,000 00   |
| John Farley, do  | 2,000 00   |
| Lt. B. F. Sands, do  | -          |
| Thomas W. Werner, do   | 1,500 00   |
| H. L. Dickens, do  | 1,500 00   |
| F. H. Gerdes, do   | 1,500 00   |
| Samuel Hein, clerk, \$1,000 per annum, \$4 per week for board in Washington  | 1,208 00   |
| William Windeman, instrument maker, \$800 per annum, \$4 per week board in Washington  | 1,008 00   |
| Thomas McDonald, artificer and heliotroper, \$600 per annum; and \$4 per week for board in Washington  | 808 00     |
| Selman Seibert, engraver   | 1,800 00   |
| Albert Rolle, do   | 1,300 00   |
| Ludolf Muller, calculator and heliotroper, \$800 per annum, and \$4 per week for board in Washington   | 1,008 00   |
| C. F. Flint, copyist (of calculations) and heliotroper, \$600 per annum, and \$4 per week for board  | 808 00     |
| W. Jacobi, employed in the instrument maker's shop, and heliotroper, \$2 50 per working day  | 782 50     |
| Samuel Schmid, copyist (of calculations) and heliotroper, \$300 per annum, and \$4 per week for board in Washington                                  | 508 00     |
| Gustavus Windeman, heliotroper and filer in the instrument maker's shop, \$300 per annum, and \$4 per week board                                     | 508 00     |
| H. L. Whiting, draughtsman and heliotroper, \$300 per annum, and \$4 per week for board  | 508 00     |
| Edward Sweeney, driver, (main triangulation,) \$18 per month, and \$4 per week for board in Washington   | 404 00     |
| William Greason, messenger, \$18 per month, and \$4 per week for board in Washington   | 404 00     |
| Christopher Kuff, fire maker, watchman, &c., \$18 per month, and \$4 per week for board in Washington  | 404 00     |
| George Kangnau, fire maker, watchman, &c., (temporarily employed since 1st January, 1842,) \$18 per month, and \$4 per week for board in Washington. |            |

*Hydrographic surveys.*

|                                   |   |   |   |   |          |
|-----------------------------------|---|---|---|---|----------|
| Commander Thomas R. Gedney.       | - | - | - | - | \$627 00 |
| Lieutenant Commandant G. S. Blake | - | - | - | - | 365 00   |
| Lieutenant G. M. Bache            | - | - | - | - | 365 00   |
| Lieutenant J. K. Mitchell         | - | - | - | - | 365 00   |
| Lieutenant H. S. Stellingen       | - | - | - | - | 365 00   |
| Lieutenant John M. Dale           | - | - | - | - | 365 00   |
| Lieutenant E. G. Parrott          | - | - | - | - | 365 00   |
| Passed Midshipman H. H. Lewis     | - | - | - | - | 365 00   |
| Passed Midshipman W. A. Bartlett  | - | - | - | - | 365 00   |

W. H. SWIFT,

*Disbursing Officer Coast Survey.*

WASHINGTON, May 4, 1842.

When an assistant or other person attached to the work is ordered by the superintendent from one place to another on public duty, the actual amount paid for railroad, steamboat, or stage fare, is refunded to the person incurring such expense.

W. H. SWIFT.

## B.

*Remarks upon the survey of the coast of the United States.*

1. The law authorizing the survey of the coast was passed February 10, 1807.

2. Circular letters were addressed by the Treasury Department to various scientific men in the United States, asking for a plan of operations. Thirteen such were received, and submitted to a committee of learned men in Philadelphia, with the late Professor Patterson at their head. After full consideration, the plan proposed by Mr. Hassler was adopted.

3. From the passage of the law until 1811, no active steps were taken, in consequence, principally, of the unsettled state of the country.

4. In August, 1811, Mr. Hassler was sent to England to procure instruments, in accordance with the plan proposed by him in 1807. These instruments had all to be *constructed*; and, for the purpose of superintending the same, he remained in England until 1815, at which time he returned to the United States, with all the instruments and appendages requisite for the work. The war, want of remittances for payment of the instruments purchased, the difficulty of procuring suitable artists to construct the same, &c., conspired to protract his stay in England nearly two years beyond the time which he had allotted to this part of his labor.

5. In August, 1816, Mr. Hassler was appointed to superintend the survey of the coast, under the law of 1807. The necessary preparations for the work, including reconnoitring, &c., consumed the time between August, 1816, and April, 1817. At that period a proper locality for a base line was discovered in New Jersey, and in July of the same year the actual triangulation was commenced.

6. April 14, 1818, that part of the law which authorized the employ-

ment of persons other than those belonging to the army and navy was *repealed*, and thus was Mr. Hassler's connexion with the coast survey closed.

7. Up to this period, the whole amount expended for the work was \$55,634; of this amount, \$37,549 had been expended for instruments and the expenses of procuring the same, leaving about \$18,000 for the cost of the survey, equipment for the field, &c.

8. In 1819, Mr. Hassler presented to the American Philosophical Society of Philadelphia his papers upon the coast survey, describing the method and means by which it had been designed to conduct the work, together with full descriptions of the instruments, with drawings of same, examples of the journals of observations, &c. These papers were published by the society, in their volume of Transactions for 1825, and are now in the Library of Congress; they contain much valuable and interesting information upon the subject. They were reviewed by the principal astronomers of Europe—Bessel, Struve, Schumacher, Ferrusac, Francoeur, Krusenstern, &c.—all uniting in the opinion that the plan of Mr. Hassler was of the first order, and that the instruments were in every manner adapted to the purpose for which they were designed. In 1832 a distinguished astronomer of France, now employed by the Government of the United States, declared that the instruments planned by Mr. Hassler for the coast survey, and executed under his eye, were, when constructed, *twenty years in advance of the science of Europe*.

9. In 1827, the survey of the coast, after a lapse of ten years, again excited public attention. The Secretary of the Navy, (Mr. Southard,) in describing certain surveys which had been made by naval officers for an especial purpose, stated in his annual report that "the time within which it was supposed desirable to make them, [the surveys,] and the means granted by the appropriation, did not permit them to be so made as to furnish perfect surveys and charts of those harbors; *nor can such surveys be made without the aid of the means contemplated by the act of 10th February, 1807, to provide for surveying the coast of the United States.*"

In 1828, the Committee on Naval Affairs addressed a letter to the Secretary of the Navy, (Mr. Southard,) asking information in reference to the survey of the coast, to wit: whether it ought to be made; the best plan for making it; what progress had heretofore been made, &c. In reply, he proceeds to say, after referring to a list of maps and charts: "Of the whole of the maps and charts in possession of the Government, it may be remarked that they do not furnish a satisfactory survey of the coast, for the following reasons:

"1. They exhibit detached parts, unconnected with each other.

"2. Are generally confined to the shore, and do not extend sufficiently far into the ocean.

"3. Were many of them made by incompetent men, with incompetent means.

"4. They were governed by no fixed and certain principles or guides, in ascertaining the latitude and longitude of the principal points and positions.

"5. They do not embrace the whole coast.

"*For these and other reasons they are unsafe, and, in many instances, useless and pernicious.*"

10. In answer to the question, "Whether, in the opinion of the Department, such survey ought to be made?" the Secretary replies: "Upon this point no doubt is entertained. It is called for by regard to our commercial

and naval interests, and to our means of national defence. I do not understand that you require a statement in detail of the reasons for this opinion; they will readily suggest themselves to every mind."

11. July 10, 1832, the law of 1807 was revived, and the employment of such "astronomers and other persons" as the President should deem proper was again authorized.

12. At the request of the Treasury Department, Mr. Hassler submitted a plan of operations for the work, being, in fact, the same which he had proposed in 1816. On the 9th August, of same year, he was again appointed to the survey, and to carry into effect the law of July 10. Prior to this period he had been employed by the Treasury Department in making comparisons of the various weights and measures in use at the several custom-houses, with a view to the construction of uniform standards of the same for the Union.

13. The two works, of the coast survey and that of the construction of standard weights and measures, being, by their nature, intimately connected, and the means of accomplishing each being in many instances the same, Mr. Hassler was charged by the Treasury Department with the execution of both; and, since the period referred to, the two works have received his whole attention.

14. Since 1832 the survey of the coast has been diligently prosecuted. The remainder of the season, between August and December of that year, was employed in reconnoitring and other preparations; and early in the following year (1833) the triangulation was recommenced, and has been making steady progress from that time to the present. In 1834 a new base line was measured on Long Island, and the secondary triangulation, hydrographical work, and plane-table surveys, have also been in active progress, *pari passu*.

15. By the official statement of the Secretary of the Treasury, (Doc. 57, H. R., Jan. 31, 1842,) it will be seen that the aggregate amount expended from 1808 to 30th June, 1841, is \$512,731 68; of this sum, by the same statement,\* \$33,723 05 has been expended for the purchase of "instruments, books, and repairs of instruments." This, with various sums expended for 5 surveying vessels, 20 boats, with all the requisite accompaniments, and the necessary equipment for the several parties engaged in the secondary triangulation and plane-table work, makes a gross sum which exceeds \$120,000, for objects of a *permanent* nature, now the property of the coast survey. This would reduce the amount expended upon the work itself to \$392,731 68; if to this sum be added the whole amount of the estimate of the Secretary of the Navy, for difference between shore pay and sea pay of the officers, and for pay and rations of the crews of the several vessels, from 1834 to 1841, (\$114,584,) we shall have a total sum expended of \$507,315 68, for about 11 years of actual work, or about \$46,000 per annum.

16. When the operations of the coast survey, under Mr. Hassler, were suspended in 1818, by the repeal of a portion of the law, the system which he had adopted was also suspended, and thenceforward detached portions of the coast were assigned for survey to naval officers, from time to time. Indeed, this same system, which was condemned so thoroughly by Mr.

\* There is an error in this part of the Register's statement; for the *original* collection of instruments cost \$37,549, and additional instruments have since been procured.

Southard in 1828, and for which the sound reasons quoted from his report, at the 4th page of this paper, were given, is still pursued—at what expense exactly we have not the means of stating. An approximate estimate may be formed, however, from the following facts: The direct expenditures, as exhibited by the printed statements in the office of the Register of the Treasury, from 1818 to 1841, are \$63,520 20; the incidental or indirect expenditures do not appear, but perhaps an idea of the extent of the same may be formed upon the following data: In 1832, \$5,000 were appropriated for the survey of Narragansett bay, in Rhode Island. There were employed in this work, 1 post captain, 3 lieutenants, 5 passed midshipmen, and 18 seamen, for one season, say six months. This appropriation of \$5,000 is nearly  $\frac{1}{3}$ th of the whole amount of *direct* expenditures. Adopting the same principles in computing the cost of the work chargeable to the naval establishment, which the Secretary of the Navy adopted in stating \$114,584 as the amount properly chargeable to the coast survey, for difference between sea and shore pay, and subsistence of officers, and pay and rations of seamen, we shall have a gross sum, for six months, of upwards of \$4,000. Therefore, for every \$5,000 expended directly for the work, we should add \$4,000; and this, for the \$63,520 20, amounts to \$50,800. It may be inferred, also, that nothing is included in the above \$63,520 20 for purchase or repairs of vessels, equipment, &c., these being provided, as usual, in the general expenses of the naval establishment; on the contrary, both purchases and repairs of vessels, boats, furniture, &c., is chargeable upon the coast survey fund, for all which now belongs to the work. Here, then, we have a sum of \$114,320 as the cost of some detached surveys of portions of the coast. Surveys of this nature, and those which are executed upon proper principles, are so unlike in character that they do not admit of comparison.

We proceed now to state briefly the principles upon which the survey of the coast is conducted.

The principle upon which the survey of the coast is conducted is, essentially, that which is known as the trigonometric method. By the relations which subsist between the sides and angles of a triangle, we are enabled, from certain known data, previously determined by actual measurement, to compute certain other parts which are unknown. For example: in a given triangle, by measuring one of the sides and the angles, the two remaining sides can be determined by computation. These computed sides then serve as bases for other triangles, and subsequently, by measuring the angles *alone* in the triangles thus formed, the work is extended *ad libitum*. This is called a triangulation, and may be made upon any part of the earth's surface upon which a line of a given extent can be measured.

A triangulation may be complete in itself, and, when the necessary corrections have been made for the figure of the earth, the actual distance between two points can be accurately determined. But this, alone, is not all that is required; it is necessary to ascertain the true position of the district or country triangulated upon the earth's surface—that is to say, its latitude and its longitude. The first of these is independent, it being simply its distance from the equator; while the second is not independent, but refers to the position of some other point on the earth's surface, and under another meridian. This latter place, or meridian, may be assumed at will; and the question then to be determined is simply the difference *in time* between the two places of observation; and this being converted into de-

grees constitutes the longitude, or rather the difference of longitude between two places.

For these determinations, observations upon the heavenly bodies must be resorted to. It is not necessary, however, that celestial observations should be made at every point determined by the triangulation; on the contrary, a few well-determined positions, ascertained by a long series of observations, often repeated, are sufficient, the connexion between the same being determined by the triangulation; hence the survey of the coast, as now conducted, is made by combined or mixed geodetic and astronomical observations.

Here, then, is the essential difference between a survey by triangulation and astronomical determinations, or even the so-called "chronometric survey," (a misnomer, by the way, for it is not a *survey*.) One consists in a *connected* work, carried on upon the earth's surface, and made by means of an uninterrupted series of triangles; while the other is composed of a collection of observations upon the celestial bodies, made at detached points, each place of observation being independent of the other. In the first method the connexion is complete, while in the others there is no connexion whatever.

To the question, whether the mode of making the survey of the coast by triangulation is better than any other, it may be said to be the *only* truly correct method which can be pursued. It is the only method by which a *connexion* in the work can be preserved. Of its accuracy the proofs are continually before the observer, and an error need not be extended beyond a single triangle. The three angles are measured in every principal triangle of the work; and, as this is all the *measurement* which takes place after the base is determined, it is obvious that the observer has his proofs of correctness continually at hand. There can be no *cooking* of observations, as is sometimes practised in astronomical determinations.

An idea of the exceeding accuracy attainable in works of the nature referred to may be formed by referring to the account of the measurement made by the French astronomers of the arc of the meridian between Dunkirk and Cabrera, for the determination of the figure of the earth, being 12 degrees of latitude in extent. After a great number of triangles had been measured, and an extent of about 500 miles upon the meridian determined, (between Melun and Perpignan,) a base of *verification*, as it is denominated, was measured at Perpignan. This verification consisted in *measuring* with the greatest accuracy one of the sides of a triangle in the series, which had been previously determined by computation from the original base. The difference between this computed side and the actual measurement was less than 2 feet.\*

In the work of the survey of the coast, the *secondary* triangulation now encompasses the southern part of the State of New Jersey, from Staten island to Cape May; one series of triangles was carried around on the east or coast side, while a second was carried down the Delaware river and bay, uniting near the southern point of the State. The length of the side of the triangle which was common to both series was, of course, determined by each chain of triangles—one by the coast, and the other by the Delaware bay; the difference between the two determinations was two metres, or about six feet. In the primary triangles this difference will, from present appearances, be less than one foot.

\* La Place.

Surveys of all the countries of Europe have been or are being made by the system of triangulation, to wit: Austria, Russia, Sweden, Denmark, Hanover, Prussia, Swabia, Bohemia and the States of Germany generally, Italy, Naples and Sicily, Switzerland, France, England, the British possessions in India, and the French colony in Algiers.

“Europe is covered with well-connected series of triangulations—from the south of Sicily to the polar circle; from Ireland, through England, France, Germany, to the interior of Russia; from Bordeaux to the frontier of Turkey, and in all the intermediate parts.”

Some of the practical benefits which have resulted from the coast survey are already apparent. The discovery of the ship channel into the harbor of New York, the better determinations of the channels into Delaware bay, and the detection of the grossest errors in the existing charts of that bay, constitute a portion of the advantages which have already been derived from this work.

The engraving of the chart of the bay and harbor of New York, with the country adjacent to the same, within a circuit of twenty miles, is now in progress; two sheets, embracing the entrance to the harbor, with the channel delineated thereon, are already in a state of great forwardness, and, in all probability, will be completed by the 1st of June, 1842.

To the question, “Whether no other mode exists by which accurate results can be obtained within less time than they can be furnished by a trigonometrical survey,” the answer is, *No*. There is no *short* method by which these results are attainable. It is not the “quantity” of triangles alone which determines the industry or skill of the observer, but the quality. To make the triangulation of a given district of country with the least possible number of well-conditioned triangles, is one of the important problems to be solved; quality, again, and not quantity, is the essential requisite.

Usually, the experience of the world is justly considered when any great object is to be attempted or effected. Why should it be excluded from the category, in judging the merits of this magnificent work? We have the combined testimony of all the science of Europe in favor of making surveys by triangulations, and, in fact, the positive assertion that it is the *only* proper method. Why should we not adopt the conclusions of nations which, to say the least, are older in these matters than we ourselves are, rather than to resort to methods which are a century behind the age we live in?

Why, with the great advantages which the “chronometric system” is said to possess, is it not adopted by those who are best capable of judging it by its merits? Rather let the whole work be destroyed, than to suffer it to be done discreditably. If we cannot make it in a manner which shall bear the scrutiny of the scientific world, let it rest for another fifteen years. Sextants and chronometers are invaluable instruments in their proper sphere, but they certainly do not furnish the means by which triangulations are to be made, or corrected, or superseded, as some would seem to desire.

#### *Organization of the work:*

1. The main or *primary triangulation*, upon which all the work depends, is made up of triangles, having sides of from 10 to 50 miles in extent. The angles in these triangles are all measured by Mr. Hassler.

2. Within these main triangles, smaller triangles are formed; this constitutes the *secondary triangulation*; the sides of these vary in length from 2 to 10 miles. The angles of these triangles are measured by the assistants of Mr. Hassler; two and sometimes three parties are engaged in this part of the work; usually they enter the field in March and April, and leave the same for the calculations, &c., in the office, in December.

3. The secondary triangulation, in turn, forms the basis of the plane-table or topographical surveys; these include all the details of the ground, outline of the coast or shore, courses of bays, rivers, roads, &c. This portion of the work is distributed among 5 or 6 parties, each having a district of country allotted to it. A party consists of 1 assistant and 5 or 7 hands, according to the nature of the country to be surveyed. These parties usually take the field in April and May, and return to the office, to make up their plottings and maps of the work of the season, in November.

4. The hydrographic determinations are made entirely by the naval assistants of Mr. Hassler. Points on shore are furnished by the triangulation, both main and secondary, together with the coast or shore line from the plane-table surveys. By this means the sounding parties are enabled to determine the true position of their soundings, by measuring the angles subtended between stations previously established upon the shore. Two parties are engaged in the hydrographic part of the work, each being furnished with the necessary assistants from the navy, and with vessels, boats, &c., belonging to the coast survey. These parties are engaged in their labors upon the coast from April or May to November, according to the character of the weather; in the winter months they are employed in laying down upon their charts the results of the work of the season.

The triangulation now extends from Narragansett bay, Rhode Island, to Cape Henlopen, Delaware, on the coast, and from the neighborhood of New York to the head of Chesapeake bay, covering an area of about 11,000 square miles. The hydrographic surveys cover 5,600 square miles, and the topographical or plane-table surveys 4,200 square miles. This work is represented upon upwards of 200 maps and charts, of various scales, according to the nature of the work, from  $\frac{1}{80000}$  to  $\frac{1}{100000}$ ; that is to say, one foot in extent upon the map will represent, according to the scale used, 5,000 feet, or 100,000 feet upon the earth's surface.

|   |   |   |   |                |
|---|---|---|---|----------------|
| The actual length of coast line, (including Long Island,) already determined and laid down upon the map, is | - | - | - | 631 miles      |
| Do. of the larger bays, rivers, and islands   | - | - | - | 697 "          |
| Total of shore line, coast, bay, &c.  | - | - | - | <u>1,328 "</u> |

#### *Classification of the expenses.*

The whole amount expended for the survey of the coast from the *appropriation* therefor, for the year 1841, was \$96,174 98.

|  |   |             |
|--|---|-------------|
| 1. Of this sum, the general expenses of the work, including the main triangulation, compensation of all persons employed therein, instruments and books, and all expenses not enumerated in the items below, amounted to | - | \$32,671 09 |
| 2. The secondary triangulation, including compensation of persons therein employed, 3 parties  | - | 19,352 06   |

|   |             |
|---|-------------|
| 3. The hydrographic surveys, including the cost of repairs of the vessels, boats, &c., and allowances to officers for expenses, 2 parties and 4 vessels - - - - - | \$25,459 16 |
| 4. Plane-table or topographical surveys, including compensation of all persons employed therein, 6 parties - - - - -  | 18,692 67   |
|   | 96,174 98   |

The conclusions which are deducible from the preceding remarks may be summarily stated thus:

1. Availing ourselves of the experience and practice of all European nations, it is just to conclude that the survey of the coast can only be made (if it shall be accurately executed) by a triangulation.

2. Conceding the ground that it is by a triangulation alone that exact results can be obtained, it may be shown, by a reference to the history of similar works, that the methods pursued in executing the survey of the coast of the United States are, in principle and in details, in accordance with the best of those adopted by other nations.

WASHINGTON, *February 25*, 1842.

[It is proper to state that this paper on the coast survey was prepared by Capt. Swift.]

MAY 2, 1842.

Present: Mr. Cushing, Mr. Ayerigg.

*Examination of Captain Thomas R. Gedney.*

1. Question. Are you an officer of the navy?

Answer. Yes.

2. Question. Are you now employed in the coast survey; and if so, since what time and in what capacity?

Answer. I have been employed in it since October, 1834, in charge of one of the hydrographical parties.

3. Question. How many of such parties are there?

Answer. Two. The other is commanded by Lieutenant Blake.

4. Question. How many persons, and what vessel or vessels, are employed in your party?

Answer. Last year I had two vessels, the schooner Jersey and the brig Washington, with, I think, fourteen officers, all told; and, I believe, thirty-two seamen and forty-four boys. This amount of force was necessary.

5. Question. What surveys have you made since October, 1834?

Answer. I have been engaged in making soundings. I commenced in Fire Island bay in 1834; then the outer coast of Long Island, in 1835, from Fire island to near New York; then the harbor and bay of New York, and to Montauk point, along the outer coast of Long Island, in part of 1835 and in 1836 and 1837; in 1838 and 1839, from Fisher's island to Block island and Point Judith; in 1840 and 1841, on the coast of New Jersey, as far as Egg Harbor. These soundings include also all the inland navigation from Fire island to Egg Harbor. In addition to this, in 1841, I performed a piece of detached work between Cape Henlopen and Cape May.

6. Question. Have you comrieted the soundings along the whole extent of coast from Point Judith to Egg Harbor?

Answer. Yes.

7. Question. Are those soundings, as verified by you, in a condition to be published?

Answer. Yes.

8. Question. Do you make any astronomical or other observations on the coast?

Answer. No, except so far as may be needful to keep my own time.

9. Question. Have any views of the coast been taken by you or from your vessels?

Answer. Yes. Mr. Farley has taken a panoramic view of the whole of Long Island and of all the light-houses wherever I have sounded. We have taken no other views, except of the entrance of the new channel in New York harbor.

10. Question. Is the coast of Long Island an easy or a difficult one?

Answer. I think it an easy one myself.

11. Question. What is the chief occasion of wrecks on Long Island?

Answer. When vessels are running in, and are caught by a heavy south-easter, it is difficult to get out, from the trending of the two coasts of Long Island and of New Jersey, and the current setting from New Jersey coast, by reason of which vessels, being thus embayed, are apt to be driven on shore.

12. Question. Have you sounded Jamaica bay?

Answer. Yes, in 1835.

13. Question. What depth of water did you carry into that bay?

Answer. Six feet at low water, eleven and a half at high water, in common tides. At the present time, the depth at low water is seventeen feet.

14. Question. Would not the knowledge of the actual depth of the water in the channel leading into Jamaica bay be useful to a vessel which was unable to claw off the coast?

Answer. Yes; it might preserve a vessel from being stranded.

15. Question. What amount of repairs of instruments have you had done at the office of the coast survey?

Answer. I cannot say.

16. Question. Have you had other repairs done elsewhere; and if so, by whom, and to what amount?

Answer. I have had repairs done for our, or my, party, the last year, to the amount of forty or fifty dollars, by Mr. Montandon, and by George Blunt, of New York, it having been convenient to have this done on the spot there.

17. Question. How far inland do any of the points extend which you have used, as furnished you by any of the triangulating parties?

Answer. Some of them have been from ten to twelve miles inland. They were used for measuring angles from the vessel and from different points. The points which I occupied for measuring were generally on the coast, within a quarter of a mile of the beach.

18. Question. Please to describe your mode of proceeding in this respect.

Answer. I have three officers on shore, at three different stations, with a sextant and a watch each, and a boy with a spyglass also to each station. I then am anchored or lying to off shore in my vessel. I make a signal

in the morning, when I get under way, to commence work, I knowing that the men are at their stations by their hoisting a signal flag for that purpose. I commence by running up a signal; so soon as the signal starts from the mast head, the officers on the shore measure the angle between the brig and one of the stations, and the officers on board the brig; two of them, then measure each of them an angle between the stations on shore, so as to give in all five angles; each officer, as well on shore as on board, marking the time, to see that they agree. Meanwhile I am taking my soundings, on the change of which the signals are repeated and new angles taken as before. In these observations I consider the vessel as a fixed point. This system of operation I have been able to carry out as far as twelve or fourteen miles seawards, which is the greatest distance I have gone. I can see the land inland about ten or twelve miles from the shore, along that part of the coast sounded by me; but if the land were higher the distance seen would be much greater.

19. Question. Did you sound the new channel, commonly called Gedney's channel?

Answer. Yes.

20. Question. Would you have been able, with the ordinary facilities for sounding, to ascertain that channel, without the previous triangulation of the coast?

Answer. Yes; I could have buoyed it out so far as to make it equally useful to navigation.

21. Question. Is the knowledge of that channel of great importance to the shipping of New York?

Answer. I think it is.

22. Question. Could not a master of a vessel, when employed off the harbor of New York, with such information as a good chart of the harbor would furnish, run his vessel in with tolerable safety by that channel?

Answer. Yes.

23. Question. Do you know any reason why a chart of that channel has not been published?

Answer. I do not know any, unless it be that it was not ready. Mr. Hassler has charge of that; I have not.

24. Question. When did you sound out that channel?

Answer. In 1835.

25. Question. Is not the channel as good now as when you first sounded it?

Answer. Yes; I sounded it again last year, for the purpose of ascertaining the fact, and found it so.

26. Question. Is the line of the coast, where examined by you, fixed or subject to change?

Answer. The beach itself, at the mouth of small inlets, is subject to change, with severe gales of wind.

27. Question. Is the topography of the country within the coast of any importance to navigators?

Answer. It is not, except for four or five miles, or where there is any remarkable eminence or other object inland.

28. Question. Is it customary to lay down the topography of the country on the charts of navigators?

Answer. I have never seen it in any charts except of islands. In charts

of the West India and other islands it is sometimes given; but in these cases it is not necessary for purposes of navigation.

29. Question. How long do you continue sounding, one year with another?

Answer. I generally commence in May, and leave off early in November.

30. Question. Are you able to keep up with the triangulation?

Answer. Yes; and I have been in advance of the plane-table parties.

31. Question. Are the plane-table parties necessary to the soundings?

Answer. Yes.

32. Question. If you had occasion to sound at a greater distance from the shore than 12 or 14 miles, how would you proceed?

Answer. I should employ small vessels, anchoring them to serve as fixed points; or it might be done by means of chronometers, starting from some given or known point.

33. Question. What proportion of the year, and of the day in each year, have you been able to make your observations, and carry on the work?

Answer. The answer to this question is annexed in paper marked A.

34. Question. Have not your operations along the coast either corrected errors in printed charts or added many new and more complete soundings to those heretofore published in any chart?

Answer. I believe they have.

35. Question. Do you know any reason why the soundings taken by you should not be published?

Answer. I do not.

MONDAY, *May 2*, 1842.

Present: Mr. Cushing, Mr. Aycrigg.

*Examination of Lieutenant George Blake.*

1. Question. Are you an officer of the navy, employed in the coast survey; and if so, in what capacity, and since what time, and on what part of the coast?

Answer. I am a lieutenant in the navy, and have had charge of a hydrographical party from 1835 to the present time; I have been in Long Island sound and Fisher's Island sound, and in Delaware river and bay.

2. Question. What vessel or vessels, and what number of officers and men, have you under your command?

Answer. My force has varied very much; I had last year the schooners Gallatin and Nautilus, with nine officers and forty-one men.

3. Question. Have you been engaged in the outer or the inner waters?

Answer. The inner altogether.

4. Question. What proportion of instruments have you had made or repaired at the office in Washington?

Answer. I have seldom had any sextants or glasses repaired there; but a large part of the drawing instruments have been made there, to the value or cost of say \$500 at any private establishment, that is, during the whole time I have been in the survey.

5. Question. Have any views of rocks, shoals, or other dangerous places, been taken from your vessels?

Answer. No; views have been taken of all the light-houses.

6. Question. Have you, in the examination of Delaware bay, discovered any great errors in the supposed location of any shoals?

Answer. Yes; very great.

7. Question. In what cases?

Answer. In that of Cross ledge, especially; but there is no proper chart of Delaware bay; the only one extant is a mere rude sketch. The error in the case of Cross ledge was four miles, I think.

8. Question. Is it not important that these errors should immediately be made known, and a correct chart of the bay published?

Answer. Yes, undoubtedly.

9. Question. Do you know of any reason for withholding from the public a knowledge of the soundings of Delaware bay, as far as verified by you?

Answer. I know of none.

10. Question. Can a topographical map, so constructed as to give in detail a full and self-explaining picture of the country, that, with the map before the eye, the military operations may be properly judged and guided in the cabinet, be obtained, in carrying on the coast survey, without adding greatly to the expense, and materially delaying the execution of the work?

Answer. No, it cannot.

MONDAY, *May* 30, 1842.

Present: Mr. Mallory, Mr. Aycrigg.

*Mr. W. J. Stone's examination.*

1. Question. Map marked exhibit C being shown, witness is asked if he recollects the map.

Answer. Yes.

2. Question. Who engraved the map?

Answer. I did.

3. Question. Is that an exact copy of the original sent to you from the House of Representatives?

Answer. It is.

4. Question. How long did it take you to engrave and print this map?

Answer. In from seven to ten days it was fully executed and delivered to the House.

5. Question. With what person connected with the coast survey did you communicate at the time you engraved this map?

Answer. Mr. Hassler. I called on him, and had a conversation on the subject.

6. Question. Exhibit B being shown and examined, he is asked if that in an impression from the same plate.

Answer. Yes.

7. Question. Will you please to examine exhibit B, and see if there is any difference between this and exhibit C?

Answer. The only difference that I can perceive is, that another scale has been put in the place of the one engraved by myself, which was copied from the original.

8. Question. In what manner was that alteration made?

Answer. By cutting out the engraved scale and inserting one with the pen. The engraved scale on exhibit C is 3 inches to the mile; while the scale inserted with the pen is  $\frac{1}{10000}$  th, being, in fact, 6 inches to the mile, instead of 3.

9. Question. Have you the original extract sent to you from the office of the coast survey?

Answer. I have.

10. Question. Are there engravers in the United States competent to execute, faithfully and correctly, any work like that required for the coast survey?

Answer. Yes; as well as it can be done in any part of the world.

11. Question. What is considered a liberal salary for a good workman?

Answer. About \$1,200 per annum.

12. Question. Is there any difficulty in getting good copper in the United States for engraving purposes?

Answer. No difficulty whatever.

13. Question. How long will it take to engrave the map of the harbor of New York, and what will it cost?

Answer. I cannot answer without examining the chart.

The chairman then gave Mr. Stone a note to Mr. Hassler, of the following tenor, as near as remembered, viz: requesting Mr. Hassler to permit Mr. Stone to examine the manuscript chart of the harbor of New York.

The committee then adjourned.

THURSDAY, June 2, 1842.

Present: Mr. Mallory, Mr. Cushing, Mr. Aycrigg.

*William J. Stone in examination.*

1. Question. What is your business and residence?

Answer. I reside in Washington, and I am an engraver.

2. Question. How long have you followed that business here?

Answer. From twenty-three to twenty-four years.

3. Question. Have you been accustomed to engrave maps and charts?

Answer. Yes; that has been my chief, and is, at present, my only business; I having abandoned other branches of engraving, to devote myself to that.

4. Question. Is there any difficulty in procuring competent map engravers in the United States?

Answer. None.

5. Question. Do you know of any special superiority of German engravers over those of the United States?

Answer. No; I consider the American workmen better, cleaner, and more rapid.

6. Question. Please to look at the map hereto annexed, and marked A. William J. Stone, and state whether it is the original map sent from the House to you, and from which you engraved the map of Newark bay, as mentioned in the first part of your testimony.

Answer. It is.

7. Question. What is the scale on that manuscript map?

Answer. Of three inches to the mile, as on the map I engraved.  
8. Question. Annexed is a map of Cape Cod, (marked B, William J. Stone :) did you engrave that?

Answer. Yes.

9. Question. How long does it take, in your establishment, to engrave such a map?

Answer. About two months.

10. Question. What are the dimensions of that map?

Answer. Thirty inches by thirty-six inches.

11. Question. When were you summoned by the committee to attend and be examined?

Answer. I received Mr. Mallory's letter on Monday, the 30th May, and attended that morning.

12. Question. Was that the first intimation you received on the subject?

Answer. Yes.

13. Question. Have you had previously any conversation with any member of the committee on the subject of the examination?

Answer. Never, of any kind whatever.

14. Question. Had you any knowledge of the purpose for which you were summoned?

Answer. No.

15. Question. Did you, as requested by the committee, call on Mr. Hassler, and present the note of the chairman?

Answer. I did.

16. Question. What occurred?

Answer. The interview was so disagreeable, that I would rather not describe it, unless it be insisted on by the committee.

The chairman therefore propounded to the committee the following question: Shall Mr. Stone be required to state what occurred in his interview with Mr. Hassler? and it was determined in the affirmative—Mr. Mallory, Mr. Aycrigg, and Mr. Cushing, present, and voting.

The question being again propounded to Mr. Stone, he answered as follows:

I went to Mr. Hassler's office, and knocked at the door. A servant showed me into his room, and asked me to sit down, and in a minute or two Mr. Hassler came in. I then handed him Mr. Mallory's letter. Mr. H. read it, and immediately fell into a violent rage, and swore that I should not see the map, neither should the committee have it. After much rudeness and violent language, both towards the committee and me, Mr. Farley came in, and Mr. H. handed him the letter. After some further conversation, Lieutenant Page came in, and Mr. H. showed him the letter; and further conversation ensued. At length Mr. H. permitted me to examine the map, which I did; and on my departure, he handed me a letter for the chairman of the committee, which I delivered to Mr. Aycrigg. This letter is annexed, and marked C, F. Mallory.

17. Question. How long would it take to engrave such a map, and what would it cost?

Answer. It would require about a year, I think. There are eight plates, each of 22½ by 32½ inches, making 5,912 superficial inches, which, at 3 cents per inch, would be \$177 36, for the copper; the engraving, the sum of \$4,132. This estimate is given for the execution of the work in the best and most accurate manner, understanding that the parallels of latitude and

longitude, with their subdivisions, are marked in by an officer of the survey, and the engraving is to exactly correspond with the same, which must ensure an accurate chart. I have made a liberal estimate, to enable the engraver to enter minutely into detail, and to do justice to himself and to the Government.

WASHINGTON CITY, *March 23, 1842.*

SIR : Among the questions put to me in the committee's meeting, there was one, at least, which appeared much insisted upon, and by circumstances was rather discussed than answered.

It seemed to put in doubt the propriety of the journals, and other works of the coast survey, to remain in the coast survey office, and requesting them to be delivered to the Treasury Department for safety. I will here supply more distinct answers.

1. This office here is one of the offices of the Treasury Department, exactly as much as any of the rooms in the Treasury building itself.
2. The extension of the Treasury Department works has obliged to have a number of other offices out of the yet unfinished Treasury building proper, so is this office.
3. The foreign standards of weights and measures have just now been transported from the Treasury building to this office, for their more proper and more appropriated safe keeping.
4. There are three houses, adjoining each other, rented by the Department, two at the expense of the coast survey, and one at the expense of the weight and measure works and the foundry establishment, besides its access to the street.
5. The total of the buildings adapted themselves so peculiarly to the use of both works, that no building in the city could, in any way, equal the conveniences they afford, by their present distribution.
6. Various arrangements have been made, at public expense, as well as at the expense of the owner, to adapt them the better; one story was elevated, to procure drawing rooms superior to any I know of; for better security, the roofs have been slated; and, in general, every arrangement made for convenience and security.
7. In every one of the three buildings, which connect all through with one another, two persons at least sleep; these are assistants, clerk, workmen, and I myself, so that the buildings are well watched all night.
8. The maps and many other valuable objects, are placed so that even in the extreme case of fire, they would be saved with the greatest ease.
9. The whole of the coast survey work must, in all cases, and at all times, be of the easiest access, nay, present, during the whole time that the work is going on, still more so than in any other office such may be required.
10. In requiring place in the Treasury building only to deposite the foreign standards, which had been expunged from the State Department to the Patent Office, where they were exposed to damage, I could not get a well appropriated place for want of room.
11. The lower vaults of the Treasury building, where I got a place to deposite the weight and measure standards, packed up and not yet sent off, could not but with difficulty be got, and such an one would not do,

because of their not being sufficiently dry and aired for paper, the maps especially would be utterly destroyed.

12. To displace the works from the office would be laying great impediment in the way of the work, and expose the parts deposited to *dilapidation* and *abuse*.

13. Every time that a certain systematically full part of the work, between two base lines, and two astronomical stations, will be executed, a full report will be made, and it is hoped published by Congress, which will rest that part forever, and then the documents of that part may be placed into some specially selected place of deposite, as original record, but until that time they *must remain* in the office in which they originate.

14. It would be the most effective mode of clearing up any subject whatsoever, that may be desired, and come in question, if the committee would be so kind to come over to the office, which is so near the Capitol, and visit all the parts of the work, as they are in activity, and constantly in evidence for every visiter.

F. R. HASSLER.

HON. F. MALLORY,  
*Chairman of the Select Committee  
of Investigation of the Coast Survey.*

WASHINGTON CITY, *March 30, 1842.*

I must add a more detailed answer to that question which asked me "How I would proceed in the Southern coast, where marshes, woods, &c., presented peculiar impediments?" I answered to it: "By mixed astronomical and geodetical observations." This question was followed by that: "Is that not more or less the case with all the coast survey?"

This question showed that the nature of the scientific principles to be applied and indicated by my answer were unknown. I must therefore *explain*: what is called, in mathematical practice, MIXED astronomical and geodetical observations, is, when both these elements concur in the *same individual determination*; this is the case in the application of a problem of practical mathematics, which I have applied in Switzerland and in this country, on Weasel mountain, (to the full knowledge of my assistants,) to obtain the junctions of my works of 1817 with those of 1833, in the beginning, when I had not yet a new base line nor sufficient angles; it was equally successful in both cases.

It consists in "one geodetic line being given in position and length, the latitude of either point being known, the latitude and the angle, the line subtends from a third point, being observed, together with the azimuth of either end point, to determine the place of observation." From such a result new connexions are then opened further onwards; other similar problems may be made.

This is what I was beginning to express when I was stopped, under the denomination of entering into arguments, which Mr. Cushing refused to hear.

That I should expose it from its elementary principles, is what I am sure the committee cannot intend, because it is a problem which, joining both branches of science, would require long deductions of principles, almost an elementary work, for persons not acquainted with the science.

In triangulation, the two kinds of observations, astronomical and geodetical, are *disconnected*; each operation is *separate*, and they are only compared to draw conclusions upon one another, for a new, different result, required to place the survey in general to its proper place upon earth; therefore the astronomical parts are only made at a few properly selected places, and with *general views* for the work, *not* for *details*, like in the other case, as I have stated in my answer to question 5, article 3d, of my report of December 2, 1841.

F. R. HASSLER.

*Upon the question of limitation of the works for the survey of the coast.*

WASHINGTON, April, 1842.

1st. The limitation to any determined distance from the coast would require that the mountains, which are indispensably necessary for the station points of the survey, be within that distance.

2d. This is well known not to be the fact, therefore also the limitation not adapted to the nature of the country, thence this limitation would become impossible to be observed, if even decreed.

3d. If even smaller elevations were found within these limits, which it might be said fit to substitute instead of the greater ones, it would be improper to use them otherwise than so as they are used now, namely, for secondary triangles, and the plane-table operations.

4th. These smaller elevations from their too great proximity would occasion triangles by far too small to give the accuracy required for the connexions of the work.

5th. The multiplication of the triangles would evidently also require a much greater length of time to execute them, because every one of them would require as much time and trouble as one of the large triangles, which might cover six or twelve of the small ones.

6th. With this increasing of the operations the necessity of cutting through woods, &c., increase actually in still greater proportion as the triangles themselves, and these cuttings are one of the great difficulties of the work.

7th. Such smaller triangles are even much more tedious to make properly than the large ones, therefore they consume each more time, and of necessity retard the work, by limiting the greater strides which the freedom of work at present admits.

8th. Upon the limitation of the work only in the *topographical part*, the same reasoning applies as to the more extensive operations; the inland bays, rivers, creeks, &c., which are navigable, are all so winding and very often hid in hardly approachable marshes, that to follow them, which often would be fully impossible, would necessarily take up much more time than to survey them by the general survey of the whole topography of the neighborhood.

9th. How far therefore this topography shall, can, or must, go, it is as impossible as improper to determine beforehand; without the special reference to any given locality nothing can be said about it in general terms.

10th. This reference to any given locality can only be decided by the operator upon the spot, and the special superintendent of the work, as has always been done hitherto.

11th. The topography has hitherto never yet been carried further than

the proper aim, and the principles of the work require; on the contrary, in several instances, an extension of the work has been specially desired.

12th. Any idea of limitation and distinction between the different parts of the works would never be understood by the uninformed people with whom the operators in the work must come in daily contact.

13th. Thence would result, that any owner of land, upon which an operator in the survey would have to go, could explain this limitation to his fancy or interest, and attack him, drag him to jail, and otherwise expose him to insult and ill-treatment, at his own option, as has been too often the case already.

14th. That even this accessory incident causes much loss of time, and forms an actual retardation of the work, is *self-evident*.

15th. The topographical part appears by experience to be that least objected to by the inhabitants, to judge from the manner in which the operators have been received, in comparison with the difficulties that have been laid in the way of the other parts of the work.

16th. In general, a limitation to three miles from the coast, as has been talked of, is a virtual abolition of the work itself, as well from the side of the natural as the moral difficulties it would suscite, and the impossibility of giving to the work the required accuracy, nor would any other limitation be less injurious.

F. R. HASSLER.

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WASHINGTON, *May 30, 1842.*

SIR: The unprovoked *insult* offered to me, by sending the engraver Stone to me to inspect the work of the coast survey in the map of New York, is too much, as well for the powers of the committee, as for the feelings of an honest man.

You know that the maps of the coast survey cannot be engraved but in the office under my own inspection. You know that the map in question is already cut up in plates, two of which are under the engraver's hands, nearly finished; two others just beginning; for two more the drawing is nearly finished; and two more are half finished drawings.

You know that the engraver Stone is in no way qualified to do such work, nor that I could be made responsible for any of his doings.

Hence you cannot otherwise but conclude that the measure you begin is destructive to the work, therefore to the execution and expenses hitherto incurred, therefore directly opposite to the aim professed by the committee to favor the coast survey work.

No man can expect that I, who am answerable for the work, could be compelled to give the final execution in the hands of a man in whom I have not the slightest reason to have any confidence whatever.

I consider the sending of Stone to *inspect my work, as he said first, as an unmerited insult*, and I am certain that every member of the committee, placed in my situation, would consider it so.

With best respects and good wishes, your obedient servant,

F. R. HASSLER.

HON. FRANCIS MALLORY,

*Chairman of the Committee on the Coast Survey.*

WASHINGTON CITY, June 3, 1842.

SIR: Mr. Mallory having communicated to me the questions addressed to me in the committee, with my hasty answers at the time, according to the agreement, in order that I might add to my answers the explanations and extensions which they require, I have made the proper additions and remarks, and added to them some papers, (copies,) which I had given in to the committee at some times intermediate, with nearer particulars in some instances.

Mr. Mallory, chairman of the committee, being now absent for a fortnight, as he said, I take the liberty herewith to address to you the papers resulting from these additions, for the use of the committee, most likely best to circulate among the members, to cause as little delay as I can in the labors of the committee, to a final close, which would be desirable, to enable me to go to the field work time enough for my plans or projects of this season.

I suppose Mr. Stone will have made his report upon his *examination* of the manuscript map of New York, for which he has been sent to me in the name of the committee.

Mr. Mallory has also informed me that I should not leave here, because the committee would call me up in examination upon the works of the weights and measures. I, therefore, am now waiting, and like always in readiness to answer also upon this part of my works.

I have the honor to be, with perfect respect and esteem, sir, your obedient servant,

F. R. HASSLER.

HON. ISAAC E. HOLMES,

*Member of the Committee upon the Coast Survey.*

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*Additions to the answers of F. R. Hassler to the questions of the Select Committee for the Coast Survey, May, 1842.*

To 1 add: By my contract with the Government, I am bound to deliver nothing of the work but to the Government or its order, that is, the Treasury Department, with whom my contract is made. It is therefore through that medium that all publications, and whatever may have reference to them are to be ordered, that are to be executed by me in this respect.

To 2 add: But they must, for that purpose, at the time of their application for publication or otherwise, be reduced to the scale which their application will require; like that is always the case, no map being published so as it is surveyed.

To 3 add: It is evident in principle that the map of harbors must as well surveyed as published upon a much larger scale than those of a mere running coast.

To 4 add: It is necessary on the part of the Government to take proper measures to give, with the publication, guaranty to the public, for the authenticity of all that is published. (See answer to question 5 in my report of December, 1841.)

To 5 add: But the publication of the Delaware is of much more pressing importance.

To 6 add: But this cannot be done until a full system of main triangulation between two base lines is completed.

To 7. Because this was not a requisite in the case; the points used were all only detail points. What may be proper to be quoted of mathematical data, belongs to the general account of the work.

To 8 add: My papers upon various subjects relating to the survey of the coast of the United States, in the philosophical transactions of Philadelphia, 2d volume, new series, 1825, which are in duplo in the Library of Congress, give full account of these parts; what may become necessary to add after the present work, has to await its proper time. (Remark:) The word measurement is, in all these articles, used entirely against its sense in the science.

To 9 add: Nor is this proper to be done but at an appropiated distance from the first base line, and astronomical station of some amount proportionate to the work which is to be grounded upon it.

To 10, 11, 12, 13, add: These stations were not exclusively astronomical stations; the astronomical observations were intended more for preliminary determinations at the beginning, to guide the work, and to take advantage of the presence of the assistants, who were all present, to introduce them and to exercise them in this kind of observations. The main aim of these stations was the determination of main triangulation points.

To 12 add: There also a solar eclipse was observed.

To 14 add: Upon the station of Weasel mountain all the means for astronomical determinations and azimuths, were united, and a regular system of these observations executed, with its appropriated combinations, upon peculiar methods, which I made and prescribed, and which succeeded to satisfaction. The isolated observations of the preceding stations were of course reduced to this by way of comparison.

To 15 add: Those of 1817 were measured only preliminarily with the chain; still the verification proved very satisfactory, as the triangle results and the measurement differed less than 8 inches in about five miles. The base line of 1834 was measured with the microscopic apparatus, and exactly so as described in the papers of the philosophical transactions of 1825, quoted above.

To 16 add: From a point southeast of the light house, towards the sea, upon the sand along the sea eastwards, the points are marked by square-hewn red sandstone, of near four feet length, fixed solid in the ground. (See my 3d report, May 8, 1835.)

To 17 add: The end points of these are marked by hollow cones of stone ware.

To 18 add: It was, of course, proper to take advantage of this element on hand, to start the work more rapidly in 1833, by using determinations grounded upon these bases, so much the rather as they had proved exact; the use made of them in 1817 appears in the schedula of the triangulation which I handed in to the Treasury Department in 1818.

To 19 add: The remark to 6 applies here most forcibly, and upon a larger scale; such an account is to be given only when two bases are joined. I did it on a small scale in 1818, because I had, by way of precaution, measured two bases near each other, (see the reasons in my printed papers above quoted.) Now, in the renewed work, this must be done only when another large base line is measured, by the same means and methods as that on Fire Island beach has been, and at a distance from that, in proper proportion

with the extent to which the survey shall reach. There is a *lapsus calami* in the statement of my answer.

To 20, 21, and 22 : For concealing. But it would be of no use whatsoever to any body except copyists, who would, by abusing the public property in the work, degrade it. It would be, therefore, an expense not only useless, but very detrimental. It will, besides, all appear in the account referred to in the addition to 19; in fact it would be highly improper to do it, before the publication of the more extensive system, of which it shall form a part in proper time. There is however no concealment about it.

To 23 add : It is the duty of the Government to let no parcelling out be possible, under penalty of seeing the Government's own work ultimately discredited; such a desire cannot be fairly entertained.

To 24 add: This quality of being official is absolutely required to give confidence to the public, therefore security to the navigation, (see question 5, in my report of December last.)

To 25 add : When the account of the modes, and of the means to their execution will be joined to them, which can be done only after a certain full system between two main bases, can be presented to the public.

To 26 add : Unless flagrant falsification, which men of science would discover immediately in the account rendered of the work, but in the map alone there lies no such verification, therefore also they are not admitted as any proof of the work ; notwithstanding that in common habit, *in the offices here*, this is not regarded, nor any account of the mode of operating is asked.

To 27 add : Just therefore the hasty publication of an unfinished work has no value.

To 28 add : Like stated upon question 7, which is in fact the same.

To 29 add : Where I expect to find a proper locality to measure one, probably upon what is called Eastern shore.

To 30 add : Unless circumstances should decide me to accelerate still more, on the ground of finding better locality, therefore larger triangles, which would be more advantageous to join northerly from there the points, now reached from the north.

To 31 and 32 add : The secondary, plane-table, and naval parties, are now (25th May) all out; how long I shall be detained by the circumstances, I cannot know, as it does not depend of me.

To 33 add : That is no more than is fully compensated by the advantages which it gives in the office part of the work, and the keeping in order of the instruments of the coast survey, which is of daily occurrence, in which my task is very much eased by it.

To 34 add : Without the constant attendance to my works, at any hours that can be used for them, my task would be positively inexecutable ; this is evidently the state of the establishment, and the works produced.

To 35 add : That extra works and varieties occur in all works, is too well known to expect that every day shall be equal to every other day; my easiest part is the field work.

To 36 add : The field work is more agreeable, in the favorable season, than the office work; they are always anxious to go out as soon as they can.

To 37 and 38 add : These are sufficiently explained as for the fact, but it must be added here, that the speaking disreputably and inimically against the coast survey work in Congress, occasions ignorant men in the