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Form 504

U. S. COAST AND GEODETIC SURVEY
DEPARTMENT OF COMMERCE

DESCRIPTIVE REPORT

Type of Survey *Hydrographic*
Field No. Office No. *2958*

LOCALITY

State *Massachusetts*
General locality *Georges Bank*
Locality *and Nantucket.*

1908

CHIEF OF PARTY

P. A. Welker

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COAST AND
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Department of Commerce and Labor
COAST AND GEODETIC SURVEY

O. H. Sittmann
Superintendent.

State: *Mass.*

DESCRIPTIVE REPORT

Hydrographic Sheet No. *2958*

LOCALITY:

*Georges Bank and
Nantucket Shoals*

1908

CHIEF OF PARTY:

P. A. Walker, Asst.

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Post-Office Address: Coast and Geodetic Survey Office, Washington, D.C.

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Department of Commerce and Labor

COAST AND GEODETIC SURVEY

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Washington, D.C.January 28th, 1909.

Mr. O. H. Pittmann,

Superintendent, Coast and Geodetic Survey,

Washington,

D.C.,

Sir:

1. In obedience to "Instructions and Memoranda for Descriptive Reports, 1887", I beg leave to submit the following report on Hydrographic Sheet No. 2958:

2. This sheet is on a scale of 1:200,000. The work represented upon the sheet was executed during the months of September and October, 1908, and comprises a hydrographic survey of that region in the vicinity of the Nantucket Shoal Light Ship, the center of which is about S.E. of Nantucket Island, Massachusetts and distant from it about 60 nautical miles. The limits of this work are, roughly, west longitude $68^{\circ} 20'$ to $70^{\circ} 00'$ and from the 41^{st} parallel southward to the 50 fathom curve in about latitude $40^{\circ} 10'$ north.

3. In the execution of the work, your instructions of August 13th, 1908, were followed as nearly as practical.

4. A whistling buoy was placed in latitude 40° 54' 00", N., longitude 68° 46' 00, W. This buoy, with the watch buoy of the light ship and the light ship itself, served as points to one or more of which as many sounding lines as practical were connected. All other lines of soundings were located by means of astronomical observations, magnetic courses and distances measured by log. The season was rather unfavorable for work of this character, not only on account of foggy and stormy weather, but on account of the difficulty in obtaining accurate astronomical locations at a time of the year when the sun was so far from the prime vertical. Star observations could be obtained only during twilight and dawn. Soundings were taken, night and day, every three minutes, with Tanner - Polish sounding tubes while the vessel was running at a speed of from five to nine knots per hour according to conditions and requirements for proper development of the contour of the bottom. During the entire time while sounding the submarine sentry was set at depths varying from ten to twenty five fathoms. The log

was read every half hour and at every change of course.

5. It was attempted to run the lines of soundings about midway between the lines of the system of the old work as shown upon C. & G. Survey Chart No. 7, but this was not always practical on account of the difficulty in obtaining accurate locations and the strong currents in the locality. In a run of fifty miles it was not an unusual occurrence to make leeway of as much as five miles. Special developments were made in the localities about the eight and sixteen fathom spots shown upon the published charts, with lines of soundings and the submarine sentry set to a depth of twenty five fathoms, without any indications of such shoals as represented. These indicated spots are in latitude $40^{\circ} 44'$, longitude $68^{\circ} 45'$ and latitude $40^{\circ} 33'$, longitude $69^{\circ} 28' 30''$. The indications are that the shoal spots do not exist. Fairly close developments were also made in the general vicinity of the whistling buoy and about the light ship.

6. The general character of the bottom over the region sounded is of a fine gray sand, with occasional indications of broken shells and coarse yellow sand. The bottom is generally smooth

with no sudden depression or other changes.

7. During the season while engaged in this work, the headquarters were at Hyannisport, Massachusetts, with the coaling station at New Bedford. The atmospheric conditions for astronomical observations were fairly good except on two days when the refraction was observed to be abnormal, indicated chiefly by the unusual great distance that the buoys and light ship were visible.
8. The position of the light ship was determined by seven (7) observations for latitude and eleven (11) for longitude, taken at the red can buoy, one mile N.N.E. of the light ship or on sounding lines near the same and connected by bearings and distances with the light ship.
9. The position of the white surveying buoy was determined by three (3) observations for latitude and five (5) for longitude, taken at the buoy or on sounding lines connected with the same by bearings and distances. One observation for latitude and four (4) for longitude, were not used because of the very evident high refraction at the times of the observations.
10. The locations of the sounding lines were determined by courses and distances; by astronomical observations on the lines; by bow and beam bearings on the

light ship, the red can buoy near the light ship, or the white surveying whistling buoy; or by lines run to the buoys or light ship.

11. In adjusting the work to the astronomical observations or the checks on the buoys and light ship the following method was used: In all cases except when it was very evident by the observed direction of the current that it would not be correct to do so, the leeway, drift, or error in courses and log, was proportioned equally between the lines between known positions, in proportion to the length of the lines.

12. Sights at or near the buoys or light ship which were used in determining the positions of the buoys or light ship, were adjusted in plotting the lines for the mean position of the same.

13. A number of sights (Nos. 20, 21, 22, 23, 24) were rejected on account of very ^{evident} high refraction at the times of observations. Sight No. 31 was rejected on account of very hazy atmosphere. Sight No. 50 was not used in plotting as it was too far from the sounding lines to be of any practical value. Sight No. 52 was rejected on account of the low elevation of the sun, $5^{\circ} 03'$, making the refraction very uncertain.

14. The path traveled by the Trans-Atlantic Steamships is within the region surveyed. The steamers seem to

confine themselves to a belt only about five miles wide, and it is seldom that a vessel is sighted outside of this belt.

15. A descriptive report of the character that is usually submitted for hydrographic sheets seems to apply only in a very limited manner to the work of the class that is represented upon this sheet and no further report than the above seems necessary.

Very respectfully,
P. A. Walker,
Asst., C. & G. Survey.

DETERMINATION OF POSITION OF NANTUCKET LIGHT-SHIP .

No. of Sight.	Description of Sight.	Approx. place of Sight.	Character of Observation.	Latitude.	Longitude.
34	Long. P. M. from Sun.	At red can buoy	Fair.		69° 39' 51"
35	Lat. Noon. from Sun.	15 miles off.	Excellent.	40° 34' 10"	
36	Long. P. M. from Sun.	At red can buoy	Excellent.		69° 39' 20"
37	Lat. P. M. from Polaris	11 miles off.	Very good.	40° 37' 55"	
38	Long. P.M. from Arcturus	11 miles off.	Very good.		69° 39' 30"
39	Lat. A.M. from Polaris	10 miles off.	Very good.	40° 39' 55"	
40	Long. A. M. from Venus.	10 miles off.	Very good.		69° 35' 50"
41	Long. A.M. from Jupiter.	10 miles off.	Very good.		69° 33' 45"
46	Lat. P.M. from Polaris.	15 miles off.	Very good.	40° 37' 30"	
47	Long. P.M. from Arcturus	15 miles off.	Very good.		69° 41' 00"
48	Long. A.M. from Sun.	At red can buoy	Very good.		69° 36' 35"
49	Lat. Noon from Sun.	15 miles off.	Very good.	40° 36' 10"	
55	Long. A.M. from Sun.	At red can buoy.	Very good.		69° 36' 06"
56	Lat. Noon. from Sun.	At red can buoy.	Very good.	40° 35' 45"	
57	Lat. A.M. from Polaris.	At red can buoy.	Excellent.	40° 38' 25"	
58	Long. A.M. from Venus.	At red can buoy.	Excellent.		69° 36' 30"
59	Long. A.M. from Jupiter	At red can buoy.	Excellent.		69° 36' 45"
60	Long. A. M. from Sun.	At red can buoy.	Good.		69° 35' 00"

The position of the light-ship was determined by the mean of the above observations, and is Latitude 40° 37' 07", Longitude 69° 37' 17"

DETERMINATION OF LOCATION OF WHITE SURVEYING WHISTLING BUOY.

No. of Sight.	Description of Sight.	Approx. place of Sight.	Character of Observation.	Latitude.	Longitude.
(1)	Long. A.M. from Sun.	At buoy.	Very good.		68° 43' 30"
(2)	Long. A.M. from Sun.	At buoy.	Very good.		68° 45' 15"
(3)	Lat. A.M. from Sun.	At buoy.	Very good.	40° 52' 41"	
(9)	Lat. Noon from Sun.	5 miles off.	Excellent.	40° 54' 07"	
(10)	Long. P. M. from Sun.	13 miles off.	Excellent.		68° 45' 55"
(51)	Long. P.M. from Sun.	7 miles off.	Good.		68° 47' 25"
(53)	Lat. P.M. from Polaris.	$\frac{1}{2}$ mile south.	Excellent.	40° 55' 06"	
(54)	Long. P.M. from Arcturus.	$\frac{1}{2}$ mile south.	Excellent.		68° 48' 00"

The position of the buoy was determined by the mean of the above observations, and is Latitude 40° 54' 00", Longitude 68° 46' 00".

Hydrographic Sheet No. 2958.

Nantucket Shoals and Georges Bank,
Massachusetts.

1908.

P.A. Welker.

This work is not satisfactory in either essential, determination of depth or determination of position.

DEPTH. Descriptive Report, p. 3, par. 6, states that "The general character of the bottom over the region sounded is of a fine gray sand with occasional indications of broken shells and coarse yellow sand. The bottom is generally smooth with no sudden depression or other change."

Examination of the soundings as plotted on sheet or of section along lines A and B (sheet H, herewith) reveals marked and often systematic or periodic variations from character indicated by second sentence of above quotation.

That the bottom is irregular along the ridge extending from the lightship toward the eastward through Georges Bank is very evident; but these irregularities diminish and finally disappear in the deeper water north and south of the ridge.

The systematic variations in depth extending over the smooth bottom on the deep slopes are quite marked and are attributable in great measure, doubtless, to uncertainties in results peculiar to sounding device used to determine depths in this work. (See notes on Tanner-Blish Tubes, J.T.W., Feb. 16/09).

Differences in depth at crossings noted in this work,

also where checked by previous surveys, are very likely due to uncorrected temperature errors, in addition to those resulting from position errors. (See notes on Tanner-Blish Tubes, J.T.W., Feb.26/09).

POSITION. The positions depended upon traverses by dead-reckoning between established points, with astronomical sights for intermediate control.

One established point, the whistling buoy, was not well determined; subsequent adjustment seems to indicate that it should be about one mile east of its plotted position. Lines of position do not appear to have been used to best advantage in adjusting the traverses.

The dead-reckoning is doubtless hopelessly erroneous on account of notable failure to correct for tidal currents; most irregular, variable and uncertain phenomena over area covered by this survey. In N. to M. #15, June 15, 1878, Notes on currents at Georges Bank, Supt. Patterson stated that "These observations show that the tidal currents of this locality are of sufficient strength to render their consideration in the reckoning, especially of sailing vessels, highly important" and the statement applies with greater force to the reckoning of surveying vessels in that region.

CONCLUSIONS. Sounding devices should be more carefully tested for "adjustment" and complete data obtained for all other necessary corrections. Journal of operations complete in every particular and program followed consistently. Occasional checks on results should be obtained by duplicate

observations with different means and methods.

Offshore traverse should be corrected between determined points for drifts due to set of tidal or other currents, wind, heave of sea, etc. Whenever the currents are of sufficient importance to affect seriously the resulting positions, current stations should be established and observations made throughout the period of the work. Complete meteorological data, water temperature at surface and bottom should be included in the record. Note direction of currents at lightships, buoys, etc., as they trail to current, and give velocity approximately. Observations at determined points of reference should be more systematic to insure increased precision.

For determination of geographic position the astronomical sights should be combined with the dead-reckoning traverse as independent loci, and not as definite positions derived from unwarranted combinations based upon misleading criteria.

To illustrate adjustments suggested, the traverse 14/A to 75/B has been corrected and soundings plotted on attached tracings.

Sheet A is traverse plotted by dead-reckoning without regard to geographic position or other consideration.

Sheet B is traverse with corrections for predicted tidal currents applied at 30 minute intervals. Predictions agreed fairly well with currents noted at whistling buoy at beginning and end of traverse.

Sheet C is traverse closed for set other than tidal. Correction as applied agrees very well with probable direction and velocity of Labrador Current in this locality.

Sheet D is closed traverse adjusted to astronomical loci for determination of its geographic position.

Sheet E is field plotting of traverse and soundings.

Sheet F is adjusted traverse with soundings plotted as recorded.

Sheet G is adjusted traverse with depths derived from profile of bottom as shown by red line on H.

Sheet H is profile of bottom along traverse; recorded soundings indicated by black line, probable depths by the generalized red line.

J.T.W. 5/15/09/

Post Office Address:

Telegraph Address:

Express Office:

Department of Commerce and Labor

11-824

COAST AND GEODETIC SURVEY

Washington, D. C.,

January 14th, 1900.

1. In reference to comments regarding hydrographic sheet No. 2958, I beg leave to submit the following:
2. It seems that due consideration has not been given to the difficulties encountered in obtaining locations, the expense incurred, the time available and the practical use of the results.
3. In a survey of the character represented upon the sheet the choice seems to be between the execution of the work with a precision beyond what is necessary for practical purposes and obtaining few or no results, or, to execute the same within the limits suitable for what is required for practical navigation, and obtain the results that are necessary.
4. Perhaps more difficulties are encountered in off shore work in the vicinity of Georges Bank and Nantucket Shoals than upon any other part of the coast, on account of the great amount of foggy weather, strong currents, heavy winds and rough sea. Out of any available

ten days, about two and one half working days are as much as can be expected, and a ten day period is about the length of time that a Coast and Geodetic Survey Steamer can be kept at sea without coaling. It will, therefore, be realized that the available time for accurate astronomical observations for the determination of points is very limited if any sounding is expected. During the time of the execution of the work upon sheet No. 2958, twelve (12) working days was available and during that time 7 observations for latitude and 11 for longitude of the light ship were made and 4 for latitude and 9 for longitude of the whistling buoy were made. To have made more observations would have required so much of the available time that little or no hydrography would have been executed - Considering the requirements and the difficulty in obtaining the same I beg leave to state that in my opinion the work as executed is very satisfactory and that the criticisms regarding the quality is not entirely fair.

5. In regard to the intention to be conveyed as to the contour of the bottom, reference being made to the same in paragraph 2, I beg leave to state that the bottom is smooth in the sense that it is without sudden change in very short distances, as between two consecutive soundings. It was not the intention

of the descriptive report to convey the idea that it was claimed that the bottom was level. This, however, seems to be of little importance, as the contour of the bottom is indicated by the sheet.

6. That there should have been a revision of the field plotting with a view of making more reliable adjustments for current, drift &c. was recognized and it was a supposition that this would be done by experts with the best information that could be obtained in regard to the effect of currents and with data that could not be obtained in the field during the short time that was available and without special appliances. All possible observations of the best possible character were made, leaving it for the office experts to utilize them.

7. The conclusions arrived at in the criticisms are correct for localities where it is possible and practical to carry out the plan as stated. But, such a plan in the vicinity of Georges Bank and Nantucket Shoals, on account of the short periods of favorable weather available, would require two vessels, one for making the astronomical and current observations and another to make the soundings.

8. Results of experiments with the Tanner-Blish sounding tubes indicate an uncertainty of about 10%

of the depth. As the tubes are not generally used in depths less than 20 fathoms, or, in localities where there are indications showing necessity for special development, it is a question if they are not of sufficient accuracy for the practical purposes for which the survey is intended. The plan that all tubes should be tested is certainly desirable and also some plan for correction for effect of difference in temperature between the air and the water.

9. In localities where results fulfilling all practical requirements for navigation are considered as satisfactory, the Tanner-Bissh Tubes, even with their probable error, are the most useful for obtaining the same where the depths are greater than 20 fathoms.

10. For the location of sounding lines depending upon astronomical determinations at sea, all other things being equal, it is best to select the months from May to September, when the sun is nearest to the prime vertical. The work upon hydrographic sheet No. 2958 was executed during the unfavorable months of September and October.

11. Better work can be obtained at the expense of more time and money, but it is a question to be decided if it is necessary for practical purposes — In my opinion the work represented

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upon hydrographic sheet No. 2958 is of a degree
of accuracy sufficient for use in practical
navigation and should be considered as satisfactory.

Respectfully submitted.

P. A. Walker.

Asst. C. & G. Survey.