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C. & G. SURVEY  
L. & A  
APR 5 1928  
Acc. No.

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Form 504  
 DEPARTMENT OF COMMERCE  
 U. S. COAST AND GEODETIC SURVEY

State North Carolina

11-5613

DESCRIPTIVE REPORT.

Hydrographic Sheet No. H 4769

LOCALITY:

CAPE FEAR

TO

CAPE LOUKOUT

1929

CHIEF OF PARTY:

K. T. Adams

69217

# DESCRIPTIVE REPORT

To accompany

Hydrographic Sheet "H"

The hydrography on this sheet was executed in compliance with instructions dated July 31, 1926 and supplemental instructions dated May 25, 1927 and July 13, 1927.

GENERAL DESCRIPTION OF THE COAST - The coast line cannot be seen from within the limits of this sheet. For a description of this ~~the~~ coast refer to descriptive reports, accompanying sheets D, E, and G.

Outlying Dangers and Islands non-existent within the limits of this area. However, Frying Pan Shoals lies immediately to the South west, which has been surveyed and described by a previous party.

CURRENTS - No adequate data on currents was obtained. Some observations were taken, which are being submitted as a part of the records with this sheet. In general, it appears that the current within the fifty fathom curve is tidal, being greatly distorted by prevailing winds. Some little effect of the Gulf Stream is felt outside the fifty fathom curve by very little. In the vicinity of the Frying Pan Shoals Gas Buoy and to the east and southeastward thereof, the current is much stronger and seems to have a prevailing easterly set, this being no doubt due to the current banking up on the south side of Frying Pan Shoals. The same effect was noticed on the south side of Cape Lookout Shoals, just beyond the northern limit of this sheet. This effect may be accounted for by a slight effect of the Gulf Stream into these deep bights between the shoals, which from the contour of the shore line is forced to eliminate itself along the south side of the shoals. But, inasmuch as this work was completed during the summer and early autumn, when the prevailing winds are southerly and southwesterly, it may be caused by a wind current acting in the same manner.

ANCHORAGES - This vessel anchored on the inshore area of this sheet only. Refer to my descriptive reports for sheets D, E, F, G and J.

UNFINISHED AREAS - It is probable that a few radial lines should be run from the Frying Pan <sup>shoals</sup> Gas Buoy at the extreme southern limit of the sheet. Between the two most northeasterly seventeen fathom lines, of course, the next hundred fathom line is to be run. Otherwise the sheet is complete in itself to the northeastern limit.

SURVEY METHODS - It had been expected to control the work in this area by Radio Acoustic Ranging and when the method failed to give the desired results after a year of continuous effort, the offshore work was so far behind it was necessary to bring it up to the other work by some other method. A method was originated which is particularly feasible when echo sounding is available. This method appears to combine the most desirable features of several older methods of control. A complete report on this method was submitted to the office at an earlier date, a copy of which is appended to this report. Therefore the methods of field work will be merely mentioned below, the methods of adjustment and plotting of the smooth sheet will be discussed more in detail.

(1) All soundings in this area were taken by the echo sounding method, with the vessel running at 100 R. P. M. This gave an average speed of about nine and three quarters knots per hour. The sounding machine was the Fathometer, before the tube relay was installed. A great deal of trouble was had with the mechanical relay, but only once was so much ~~time~~<sup>LINE</sup> lost that it was necessary to re-run it.

(2) A check sounding was obtained by the handlead at the beginning and end of the line. No other checks were obtained during the run. Surface temperatures were obtained each hour and bottom temperatures each two hours, except in depths about fifty fathoms, when they could not be obtained going full speed. The average of the surface and bottom temperature was used to obtain the factor for correcting the soundings for velocity of sound. The check soundings were not used, except to indicate that the Fathometer was functioning properly. It will be noticed that considerable of the old work done in 1924 was overlapped. This was done intentionally to show the accuracy of the echo soundings and to give confidence in the ~~checked~~<sup>UN</sup> work. An examination of these crossings show very good checks. Of course the question of control, as well as depth enters into consideration here.

(3) Control of ends of lines - The row of buoys at the inshore ends of the lines were those used on hydrographic sheets F and J and for their locations, please refer to those sheets. Cape Lockout light vessel was located by a theodolite azimuth from Cape Lockout Lighthouse, crossed by astronomical sights taken by Lieut. H. A. Patch at several consecutive dusks and dawns on the Light Vessel. A chronometer was taken on board the Light Vessel and time comparisons were obtained by radio. Frying Pan Shoals Light Vessel was located by the same method as above. This was located merely to get an azimuth to Frying Pan Shoals Gas Buoy.

The officer being on board the Light Vessel only a short time, a watch was used and time signals were automatically transmitted from a chronometer on this vessel by radio. At the time the astronomical sights were taken on this Light Vessel, an officer measured, with a sextant, the angle from the Gas Buoy to the Light House. It was found impossible to reflect the buoy in the sextant, when the angle was so large. To overcome this, this vessel got in range with the Gas Buoy and the Light Vessel and showed the search light. This gave a fairly accurate azimuth to the buoy. This line was crossed by astronomical sights taken that same evening and on several later occasions.

(4) All echo-soundings were taken by and recorded by officers. A separate recorder was found unnecessary.

(5) Astronomical sights were taken by three separate officers, each having his own recorder and own record book. These sights were rated by the observing officer at the time of observation as Excellent, Good, Fair, Poor and these ratings were taken into consideration when finding the position of the vessel. The confusion of so many observers was overcome by one or two taking their observations from the boat deck. It was, in practice, discovered impossible for so many officers to get log readings when desired. The log readings at time of sight were therefore usually computed, by comparing watch time with the clock time used in the Dead Reckoning book and interpolating from the ten minute log readings therein. Usually the sights were taken by K. T. Adams, Commanding Officer, L. D. Graham, Executive Officer, and H. A. Paton.

It was found impractical to use the sights at the outer end of lines to lay a new course from on the return line. At first it was tried by hastily computing just a couple of the sights to get a tentative position but it was found that this sometimes gave an erroneous position as compared to the entire round of sights. Therefore in general no changes of course were made during the run based on astronomical sights.

(6) The courses and distances for the entire round trip were laid out and worked up before the line was started. Instructions called for lines run to four miles beyond the hundred fathom curve. The officer reading the Fathometer notified the Officer of the Deck when he had one hundred fathoms, and he ran four miles by log and turned.

(7) Lines to seventeen fathoms were in general run without sights; however some of the longest of these lines were controlled by sights on the outer end.

(8) In constructing the smooth sheet, no sights were plotted on the sheet, as many lines would have been only confusing. The sight books were checked. And the lines of position plotted on cross-section paper; each officer's sights at each position plotted on separate sheets. A ship position was then adopted for each officer's sights independently. These sheets and positions were then critically compared and the most reasonable mean ship position adopted. It is considered that the probable error of one of these positions is not more than one third mile. The above mentioned sight books and position sheets will form part of the records.

REPORTS - Attached to and a part of this descriptive Report will be found a copy of my previous report on "Star Control Echo Sounding" and also a copy of my instructions to officers for doing this work.

Respectfully submitted,

*K. T. Adams*

K. T. Adams,  
Commanding Officer.

TABLE of STATISTICS - SHEET H

Date	Letter	Volume	Positions	Miles (statute)	Vessel
Aug. 13-14, 1927	A	1	109	187.0	LYDONIA
14-15,	B	1	75	129.1	"
15,	C	1	53	82.0	"
17,	D	1	56	92.5	"
24,	E	1	60	102.9	"
25,	F	1	38	64.0	"
25,	F	2	4	6.9	"
Sept. 10,	G	2	71	122.9	"
13-14,	H	2	67	115.9	"
15,	J	2	57	63.3	"
16,	K	2	48	82.6	"
16,	L	2	43	74.8	"
Oct. 8,	M	2	16	22.0	"
8,	M	3	67	92.0	"
11,	N	3	65	113.0	"
Nov. 11,	P	3	28	42.3	"
12,	Q	3	64	111.0	"
25,	R	3	55	88.8	"
27,	S	3	26	41.7	"
30,	T	3	27	40.0	"
			<u>1009</u>	<u>1674.7</u>	

Area = 3498 Sq. Stat. Miles.

## LIST of BUOYS

## SHEET H

Name	Latitude	D.M.	Longitude	D. P.	Remarks
Able	34° 00'	- 339.0	77° 37'	- 480.0	Scaled from aluminum sheet.
Boy	34 03	- 948.0	77 34	+ 2473.7	do
Cat	34 03	+ 3763.8	77 34	- 336.0	do
Cog	34 00	+ 9264.0	77 30	+ 5328.0	Scaled from smooth sheet.
Dog	34 06	+ 2912.2	77 31	+ 1381.3	Scaled from aluminum sheet.
Egg	34 09	+ 1239.8	77 28	+ 1978.0	do
Elf	34 10	+ 432.0	77 30	- 1560.0	Scaled from smooth sheet.
Fox	34 09	+ 4893.3	77 25	+ 2404.1	Scaled from aluminum sheet.
Fir	34 09	+ 5495.1	77 25	+ 1848.8	do
Go	34 13	+1301.2	77 21	+ 4099.6	do
Hat	34 13	+3481.7	77 18	+ 4224.8	do
Ink	34 16	+ 396.4	77 15	+ 3884.4	do
Joe	34 16	+ 2864.6	77 12	+ 3521.7	do
Kit	34 19	+ 66.0	77 06	+ 3219.0	do
Lee	34 19	+ 2781.0	77 06	+ 3051.0	do
May	34 22	+ 765.0	77 03	+ 2736.0	do
Man	34 22	+ 612.0	77 03	+ 2367.0	do
Not	34 22	+3723.0	77 00	+ 2208.0	do
Ol	34 25	+ 294.0	76 57	+ 1794.0	do
Pat	34 25	+1686.0	76 54	+ 858.0	do
Quo	34 25	+ 2649.0	76 48	+ 4533.0	do

## LIST of BUOYS

## SHEET H

Name	Latitude	D.M.	Longitude	D. P.	Remarks
Rat	34° 25'	+3211.5	76° 45'	+ 3465.0	Scaled from aluminum sheet.
Sun	34 25	+3600.0	76 42	+ 2509.5	do
Frying Pan Shoals Gas Buoy	33-28-00		77-34.65		Determined by astronomical observations.
Cape Lockout Light Vessel	34-19-50		76-24.57		do



March 7, 1928.

**INSTRUCTIONS FOR OFF SHORE SOUNDINGS**  
(to supercede all previous instructions)

The following records will be kept, to form part of the data of the hydrographic sheet; the Sight Book, the Dead Reckoning Book, the Sounding Record, the Current Observation Book. These will be discussed in detail later.

General Considerations.

All sounding lines will be started with the aim of reaching the outer end at dawn or dusk. Lines will be started from a three point fix on buoys or shore objects, as far as possible offshore. Lacking this lines will be started from one object the position of which is known. An extra officer is needed on the bridge at the start or end of the line, when such start or end is during daylight.

Vessel will always run at 100 R. P. M.

Astronomical Positions.

An astronomical position shall be composed of two or more star sights (preferably four) taken in sequence, the lines of position of which will make an adequate crossing (not less than  $30^{\circ}$ ) with one another. Single sun or star sights taken more than thirty minutes apart shall not be run up to one another but shall be treated as lines of position.

The official sights will be taken by two or three officers designated by the Commanding Officer, except that the Officer of the Deck shall take sun sights each hour when the sun is between altitudes 12 and 45 degrees. All officers are encouraged to take sights but these shall not be a part of the official record. Star sights will be taken at dawn or dusk and one sun sight shall be taken by one of the official observers when the sun's altitude is between  $15^{\circ}$  and  $20^{\circ}$ . When the horizon is exceptionally clear moon sights will be taken at a like altitude.

When possible, at least three consecutive sights shall be taken in rapid succession on each heavenly body. When in doubt as to the identity of the star, observe an accurate pelorus bearing on it.

Each official observer shall have a Sight Book and there shall be a Bridge Sight Book, in which shall be recorded the sun sights taken by the officer of the Deck. Follow the form used in preceeding work, a copy of which should appear on the first page of each book.

The following data must be recorded in the Sight Book.

(a) The log reading taken on the middle sight. At dawn or dusk, rather than the above, have your recorder record exact time (by observers watch) of each position, indicated by one blast of whistle, and get log readings from the Dead Reckoning Book later. This will give the data for computing the correct log reading at time of sight.

(b) The true course assumed to be made good.

(c) The rating of sight, in your opinion, taking into consideration, state of sea, state of horizon, altitude of body and proportional parts of time and change of altitude. These must be entered before computing.

(d) The D. R. position. Always use the best available position. In case of stars, the same position is to be used by all

observers, for comparison purposes.

(e) Height of eye. To be measured daily by leadline from water to the boat deck and bridge deck; observer's own height to be added.

(f) I. C. Always give the correction and not the error. These have different signs.

(g) Recorder's initials, and in the bridge sight book the observer's initials.

(h) Record what watch is being used.

(i) Time to be recorded in tenths of seconds and estimated to at least the nearest half second.

(j) Date, approximate time of sight, name of heavenly body and approximate bearing. If name is unknown, the true bearing.

(k) The position number, where a dead reckoning position is used which has a number.

Sextants must be checked for I. C. at each sight or series of sights and preferably should be checked on the sun or a star and not on the horizon. I. C. must be obtained as correctly as possible. In the case of a complete round of stars the error in the I. C. is eliminated, but it is not eliminated in single sights. Navigating sextants only shall be used.

Observations shall always be entered directly in the Sight Book, in chronological order, even if not immediately computed. No sights shall be recorded on loose pieces of paper. See that all data is complete at time of observation.

Star sights must be taken as late as possible in the morning and as early as possible in the evening. In general stars should be taken whose altitudes are between 15 and 30 degrees. True perpendicularity is difficult when the altitude is greater and the lower stars are generally not visible, except when the horizon is too dark. After taking a sight in the morning, the officer finds it possible to get a good set later, when the horizon is bright, he should reject the first set.

Too much emphasis cannot be placed on the brightness of the horizon. That is the limiting condition to the accuracy of almost all star sights. Sights on Venus are very valuable when obtainable, as they can be taken when the horizon is bright as day.

In general take stars in all four directions, so that a figure as nearly rectangular as possible will be formed.

#### Instructions for the Bridge and Dead Reckoning Book:

Two logs will be streamed at all times. Both logs will be read simultaneously every ten minutes. O. D. will have Q. M. stand by to read log 174 and O. D. will read log 173 and check log 174 immediately afterward. For the present log 173 will be used in all adjusting and will be recorded at astronomical sights. Log 174 will be used merely as a check. Two whistles will be the signal for stand by and one whistle for mark, in reading logs and recording positions.

When making a decided change of course, one log must be hauled in, i.e. the log of the side away from the direction in which you are going to turn. This must not be forgotten, as the logs will certainly foul if the outer one is not hauled in. Before hauling in one log, make a simultaneous comparison and enter it in the D. R. Book.

When making a decided change of course, read the log remaining out and the time exactly when the order is given to the helmsman. Then again both time and log exactly when he gets on new course. Record in D. R. Book. In making these turns the log does not properly function. It does not show enough run around the turn and then shows too much run on the first interval after the turn.

Stream the other log as soon as possible. It can usually be streamed when within 30 degrees of the new course.

When after a turn, in your opinion, both logs are functioning normally, read them and record as a sub-position.

Each hour get the temperature of surface water. The thermometer to be read by the O. D. or the officer at the Fathometer and recorded in the Sounding Record. The Q. M. must not read these temperatures.

Each two hours get the bottom temperature and a specimen of the bottom. This can be done at all times when in depths less than fifty fathoms. The O. D. must not let them attempt to get these in depths greater than fifty fathoms.

Each hour the O. D. must record the weather in the D. R. Book and the O. D. himself must estimate this weather and not take the Q.M's. weather. Wind velocity and direction and condition of the sea must be carefully estimated.

The O. D. must himself change the course to correct for any wind-lee way made. This allowance should be based on the following:

Correction to course in degrees	Force of Wind Beaufort Scale.
1/2	1
1 1/2	2
2 3/4	3
4 1/4	4
6	5

Each hour the Bridge Clock and recorder's clock must be compared and the comparison entered both on the sounding record and D.R. Book

Each hour record the R. P. M.

Each half hour compare compasses and record the comparison.

Get a check sounding with hand lead before the start and after the end of the line.

#### Numbering of Positions:

Great care must be taken that the numbering of positions in the sounding record and the D. R. Book correspond. This should be checked up often. Each ten minute log reading will constitute a position and each sight will be given the position number preceding followed by a sub-letter. Changes of course and so forth shall be entered likewise with a sub-letter.

On the ten minute positions, a boatswain's whistle will be blown so that the recorder may get the exact time.

When a line is started or ended at a visible object, it shall start at least a half mile back of the object to get the logs started functioning properly. And when ended shall be run past the object. When within a half mile or less of the object in the day time, a vertical

angle measured from the horizon to the water's edge at the object and an accurate bearing shall be taken. When farther than a half mile, bow and beam bearings shall be taken. When vertical angles are taken, record the corrected angle as well as the distance.

In taking bearings, the pelorus shall always be set on 360 degrees on the ship's head and the pelorus reading and the corrected compass heading at time of bearing recorded. O. D. must watch the helmsmen for a tendency to always give the course they are steering rather than the compass reading at the time of marking.

When a line is started from anchorage, at night, the position having been obtained the day before, one log shall be streamed immediately when the engines are rung ahead, and the others as soon as the ship is on her course. A simultaneous comparison of the logs shall be made as soon as they are functioning properly. Time shall be entered when the engines are rung ahead and also when full speed has been attained and when the vessel is on her course.

In coming to anchor at night, to end a line for which a position is to be obtained, do not head up to the wind. Haul in port log before stopping engines. Then have Q. M. stand by to haul in starboard log. Read starboard log and time when engines are backed but log is to be left in the water until it ceases to turn and then hauled in and read and recorded. Read time again when ship is dead in water and drop anchor.

O. D. must watch to see that Q. M. Has the log boom at the height to put as little friction as possible on the log line. Log rotators must never be laid on the deck by the Q. M. They must always be hung up on the awning wire ridge rope.

When a line is to end at a buoy, such as the lines<sup>radially</sup> from Frying Pan Shoals Gas Buoy, as soon as the buoy is sighted head for it, noting changes of courses as given above.

When a line is started from a buoy or light vessel in the day time a bearing and vertical angle will be obtained. At night either pass close enough to estimate the distance or take bow and beam bearings.

#### Soundings and Sounding Records:

Fathometer watches to be stood by the Junior Officers. They can arrange their own relief. At first a recorder will be provided but after things get going he can be dispensed with.

Instructions in regard to Fathometer soundings to the following in general. When it says to "observe soundings to tenths", interpret it to mean "record soundings in tenths". Soundings to be estimated as closely as possible of course. Also, in my opinion a change of 5% in the depth is too great a change to wait for. Between 13 and 25, intervals of 1/2 fathom, between 25 and 50 intervals of 1 fathom and between 50 and 100 intervals of 2 fathoms is about right.

#### Operation of Fathometer:

At times the signal has a tendency to wander. Do not record this. It is not a true sounding. A good sounding is being obtained when the red light flashes at least three or four times consecutively in the same place. Pay no attention to a single flash. The adjustment of the two rheostats is very critical and the sounding will be obtained best at one certain setting of the rheostats.

Do not wait until the Fathometer fails entirely. When its operations is becoming less good, try changing the rheostats and if that does no good call Kampf.

Remember that loss of ten or twenty minutes soundings ruins the whole line out and back and it has to be done over, just as though it had never been run. Thus you will see the emphasis of keeping the Fathometer operating once a line has been started.

No check soundings will be obtained on the runs. But before starting a line and after finishing a check sounding will be obtained with the leadline, the ship being stopt. These to be recorded in the record.

Temperatures will be recorded in the sounding record, clock comparisons also and numbers of positions.

In the vicinity of 100 fathoms the echo and the direct signal are confusing at times. There is a switch which can be used which permits the oscillator to sound only every other revolution, so that the direct and the echo alternate in coming in. By listening in the head phones you can tell which revolution each is on.

We used to get a bad persistent stray in the vicinity of 15 and another in the vicinity of 25 fathoms. Around these depths you must be careful not to get this stray in place of the sounding. When the operation of Fathometer is good there is no confusion. It is only when the operation is poor that there is confusion.

In general the Fathometer works best in shallow depths with both rheostats at a minimum. These must be increased as the depth increases.

You must watch your frequency on the frequency meter. It should be about 510. Also watch the speed. The middle reed should always be vibrating. The present installation has no governor and constant use of the speed rheostat is necessary. When you cannot get it up to speed by the rheostat send word to the engine room to give more voltage.

If for any reason you do not get results on the Fathometer for more than two or three minutes enter the time which it stopt operating and then if it gets going, enter that time with an appropriate note in the sounding record.

Officers must not leave the Fathometer to read thermometers, have the seamen bring them to you.

#### Current Observations:

No current observations will be taken on the lines. But they will be taken every time we anchor by the Q. M. on watch, once each hour. An effort will be made to get 24 consecutive hours current observation far out offshore sometime during the work.

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STAR - CONTROL ECHO SOUNDING

With the advent of the new instruments which permit soundings to be taken in any depths at full speed, it seems desirable to adopt different methods of control from those recently in use.

With former methods of sounding; i.e. had lead, trolley, tube or vertical casts, it was necessary to run the vessel at comparatively slow speed and in the case of vertical soundings, to stop and back at frequent intervals. This running at slow speed and stopping made dead reckoning of doubtful value and various methods of control were adopted; i.e. precise dead reckoning and buoy control.

The advantages of a full speed run without stopping are at once apparent, in that current and wind can affect the dead reckoning proportionately less and the logs function better; it is well known that a log functions more accurately at full speed than at slow speed.

The Principal disadvantage of the new method is that it does not provide for check soundings, nor does it permit of taking current observations, except at the beginning or end of the line.

Star-Control Echo Sounding is based on the following considerations: first, that soundings can be taken at full speed; second, that no stopping is necessary; third, that lines be run in comparatively smooth weather; and fourth, that lines be run in very clear weather and the outer end of the line be reached at dawn or dusk.

Logs must be carefully rated at full speed and continually checked and as soon as there is any question of a change of rate they should be re-rated. Two logs must be streamed, as one may foul at any time. It is the practise on this vessel to stream these logs from the bridge where they may be read by the officer of the deck, as dependence should not be placed in the quartermaster. The logs are read every ten minutes and at each change of course and at times of sights.

The inner ends of the lines should be fixed either from shore objects or a row of buoys parallel to the shore which have been accurately located. If the outer end of the line is to be reached at dawn, it is necessary to anchor on the line the previous evening and get a fix after anchoring; and vice versa, when the outer end is reached at dusk, it will be necessary to anchor at the inner end of the line and obtain a fix the next morning.

The outer end of the line must be reached at dawn or dusk and a careful series of star sights taken to fix this point. It is desirable to have two or more officers take independent sights, not necessary on different stars. These sights taken by different officers must not be combined but each officer's sights must be used to obtain an independent position and the positions compared. This fixes the outer end of the line.

Having the outer end of the line and the inner ends of the line fixed, single sun sights and occasional moon sights should be taken during the run but these sights should be plotted at the point they are taken as lines of position and the sounding line adjusted to them. Under no consideration should one sun sight be run up to another and this crossing be used as the position of the vessel. Slight inaccuracies in each sight may produce a large error in the location of the vessel.

It is necessary to judge the weather nicely, as when a line is started there must be reasonable assurance that it will be clear when the outer end is reached. A failure to get a location on the outer end may necessitate rejecting the entire line.

The principal requisites for obtaining a good star fix on the outer end are; (a) experienced observers, (b) good sextants, (c) a correct index error, (d) a clear cut horizon, (e) stars between ten and forty degrees altitude, (f) stars in all directions from the observer.

(a) Practice is essential in obtaining good sights and a new observer cannot do good work. Practice is necessary in order that in the evening as soon as a star is visible it can be observed and no time lost in finding it in the sextant.

(b) Good navigating sextants with the best mirrors are necessary and (c) a correct index error is very essential. If stars equally spaced about the horizon are observed the index error is not so essential because the error in index and the personal error are eliminated by taking the mean position; however it occasionally happens that a complete set of stars is not obtained, due to the sky clouding over or due to a poor horizon in one direction. In this case the error in index cannot be eliminated.

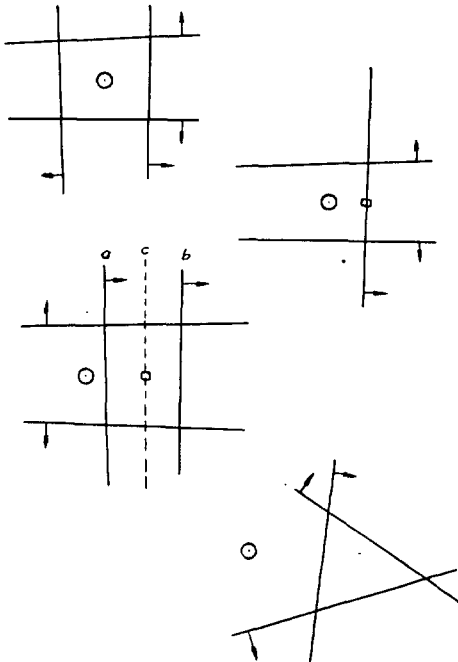
(d) Probably the most essential of all is a clear cut horizon. for this reason the clearest nights are needed and it is necessary in the evening to observe the stars the instant they appear and in the morning to wait as long as possible before taking the sights. With two very bright objects visible, which make a good intersection with one another, such as Jupiter or Venus and Sirius, it is probably more accurate to use this single intersection than to take a mean with other stars.

For in this case they can be obtained when it is very light and the horizon clear cut. However an absolutely correct index error must be known and there must be a very small personal error as these cannot be eliminated in this case by a mean.

(e) Stars at high elevations are undesirable even although they usually appear when the horizon is lighter. In the case of high altitude there is too great an error in obtaining perpendicularity in the observation. Neither are extremely low stars desirable because they are not visible when it is so light and they are subject to greater errors of refraction. Probably altitudes of twenty degrees are the most desirable but these cannot always be obtained.

(f) It is necessary to obtain a complete round of stars, approximately equally spaced about the horizon, if this is possible; and after these have been plotted in taking a mean position, the mean position should come either away from or toward all of the stars and not away from some and toward some. When a complete set of stars is obtained the error in index, error in refraction, and personal error is eliminated. If a symmetrical figure is obtained it is not essential that it be small.

In determining the most probable location of the ship's position after the sights are plotted it is always necessary to take into consideration the directions of the bodies observed. The following examples will illustrate, in which the arrows point toward the observed bodies and the circle indicates the position of the vessel.



In case I, it is obvious that the most probable position of the vessel is indicated by the circle.

In case II, the probable position is shown by the circle and not, as might be supposed where the square is shown.

In case III, the probable position is shown by the circle and not by the square. This is one of the most ambiguous cases and good judgement of the value of the sights must be used. If the two sights a and b are judged of equal value, a mean line c should be drawn and then treated as case II.

In case IV, the probable position is outside the triangle where the circle is shown and not inside.



When the sights are taken they should be rated by the observer as Poor, Fair, Good, Excellent, taking into consideration the clearness of the horizon, the elevation of the body, the darkness, the steadiness of the vessel and the observer's natural feeling of how good the sight is. These ratings should be taken into consideration in finding the most probable position of the vessel.

On each body at least three or four observations in succession should be taken and the mean of these used. Before working the sight, if the differences of times and altitudes between separate observations are compared a good idea will be obtained of the accuracy of the observations.

It will some times happen that one sight of a series will not prove correct, although rated by the observer "good or excellent". For this occurrence, there is no explanation <sup>yet</sup> when it occurs and is proven by comparison with the other observer's sights it should be unconditionally rejected, altho' there may be no reason for doubting its value.

Star sights taken when the horizon is dark or gloomy should not be considered, because of a large probable error they are more apt to confuse than aid when adjusting the line. The sounding lines should be adjusted on three fixed points, the inner fixes at the beginning and end of the line and the outer star fix. In adjusting each half of the line individual sun sights should be used as single lines of position and be given consideration.

The records used are three (a) the regular sounding volume in which only the position numbers are entered, in addition to the sounding data. (b) the dead reckoning book, in which is kept all course, log, time and position number data and which is similar to the Buoy Control Book; and (c) The Sight Books, in which is entered all data relative to the sights and necessary for the working of same, each observer having his own book. A sample double page of the sight book used on this vessel is appended herewith. It will be noted that all data for working the sights is recorded on the left hand page, the actual computation being performed on the right hand page.

It is advisable to run long lines during the neap tides if possible, in which case there is less current. The observations of currents on the ends of the lines and during the night, between lines, has to date been of little value. It has been found advisable in laying out courses to ignore the current altogether, rather than to attempt to estimate it in advance.

As stated above full speed and continuous line are necessary, with this in mind the advisability of using faster vessels becomes at once apparent. If a return line which now takes twelve hours to run could be run in four or five hours it would reduce the effect of the current and wind to one third or five twelfths, logs would function still better and courses could be steered better and more work could be accomplished in less time. If echo sounding can be successfully carried out on a small vessel it would seem advisable to try vessels of the 110 foot submarine chaser type or slightly larger. These sounding lines cannot be run in bad weather and therefore a large seaworthy vessel is not essential. The smaller much faster vessel could retire before bad weather.

May 9, 1928.

Division of Hydrography and Topography:

✓ Division of Charts:

Tide reducers are approved in  
volumes of sounding records for

HYDROGRAPHIC SHEET 4763

Locality: **COAST OF NORTH CAROLINA**

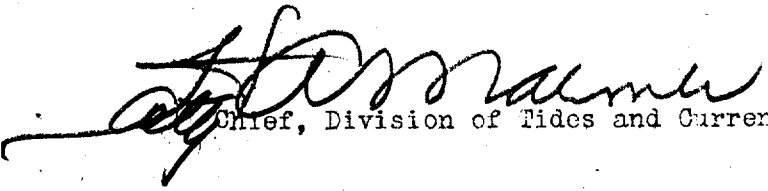
Chief of Party: **E. F. Adams**

Plane of reference is **M.L.W**

**1.5** ft. on tide staff at **Cape Lookout, Staff No. 1.**

Condition of records satisfactory except as checked below:

1. Locality and sublocality of survey omitted.
2. Month and day of month omitted.
3. Time meridian not given at beginning of day's work.
4. Time (whether A.M. or P.M.) not given at beginning of day's work.
5. Soundings (whether in feet or fathoms) not clearly shown in record.
6. Leadline correction entered in wrong column.
7. Field reductions entered in "Office" column.
8. Location of tide gauge not given at beginning of each day's work.
9. Leadline corrections not clearly stated.
10. Kind of sounding tube used not stated.
11. Sounding tube No. entered in column of "Soundings" instead of "Remarks".
12. Legibility of record could be improved.
13. Remarks.

  
Chief, Division of Tides and Currents.

Sept 26, 1928

# Report on H 4769

Chief of Party - K.T. Adams

Survey by - K.T. Adams

Protected by - H.A. Paton

Sounding Penciled by H.A. Paton.

Verified & Inked by John S. Ladd

1. The records conform to the requirement of the general instruction.
2. The plan and character of development fulfill the requirement of the general instruction.
3. The sounding line crossings are adequate.
4. The usual depth curves could be drawn.
5. The field plotting was complete and accurately done.
6. The work as a whole was excellent. The plotting, in as far as I was able to verify it (having checked only the 3 point fixes and the positions with a bearing and a single angle) and the soundings were very accurately done.  
John S. Ladd, Jr. Capt. U.S. Army.

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

AND REFER TO No. 11-DRM

WASHINGTON

March 14, 1929.

SECTION OF FIELD RECORDS

Report on Hydrographic Sheet No. 4769

Cape Lookout to Cape Fear - Offshore

Surveyed in 1927

Instructions dated July 31, 1926, May 25, 1927, July 13, 1927  
(LYDONIA)

Fathometer Soundings

Chief of Party, K. T. Adams.

Surveyed by K. T. A.

Protracted and soundings plotted by H. A. Paton.

Verified and inked by J. G. Ladd.

1. The records conform to the requirements of the General Instructions with the exception that not a single bottom characteristic is noted in the sounding records. The character of the bottom should at least have been obtained when the leadline soundings were taken, at the beginning and ending of lines. But even during the progress of a fathometer survey bottom characteristics can be obtained by throwing over the leadline even though no vertical sounding is obtained.
2. The plan and character of development conform to the General Instructions.
3. The plan and extent of development conform to the specific instructions with the exception that between the 12 and 15 fathom curves at the northeastern portion of the sheet the spacing of lines is greater than the required 1 mile. At the northwestern end the spacing between these two curves is also beyond the requirements but this area is adequately covered by H. 4306.

Another departure from the specific instructions is in the scale of the survey, which is 1:240,000 whereas the instructions call for 1:120,000.

4. The usual field plotting was done by the field party and was found to be very accurate.

5. The sounding line crossings are satisfactory.
6. The junction with the contemporary surveys H. 4750 and H. 4689 are generally satisfactory. There are some differences averaging about 3 feet between these surveys and the present survey. This it is believed may be due to the inability to read the fathometer closer than the nearest half fathom. In consideration of the fact that the above two surveys were controlled by three point fixes on buoys, are direct method soundings, as well as the fact that the scales of the above sheets are larger and the development in considerable detail, it is recommended that in all cases where the present survey H. 4769 overlaps the above two surveys, these surveys be given preference, regardless of whether the depths on the present survey are shoaler or deeper.

Comparison with H. 4306, H. 4468 and H. 4437 (surveyed in 1923 and 1924) shows an agreement within the allowable limits.

7. Within the limits of this survey no additional work is required except at the northeastern end where a split line should be run between the last two lines on this sheet, that is, from  $\odot$  Pat to the southeast and out to the 100 fathom curve.

It is recommended, however, that the work on H. 4468 be supplemented by additional lines using the more modern methods of echo sounding and buoy-astronomic control. The lines on this sheet are spaced from 5 to 10 miles apart.

8. Taken as a whole this sheet represents perhaps as fine a specimen of surveying as has come into this office in recent years and demonstrates what might be accomplished in the way of accuracy when miles out of sight of land. The Chief of Party is to be commended for the excellent supervision, and standards maintained by him throughout the survey. The descriptive report is unusually comprehensive and contains much information of value.
9. A number of comparisons were made between the fathometer and the leadline at the beginning and ending of lines. These comparisons not being fixed by positions have not been plotted on the sheet. They may be useful for further study of fathometer work and have therefore been tabulated and added to this report.
10. Reviewed by A. L. Shalowitz, September, 1928.

Approved:

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Chief, Section of Field Records (Charts)

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Chief, Section of Field Work (H. & T.)

Comparison of Fathometer and Vertical Cast Soundings

Fathometer Fathoms	Hand Lead Fathoms	Difference Fathoms	Fathometer Fathoms	Hand Lead Fathoms	Difference Fathoms
10.2	10.4	-0.2	13.5	13.8	-0.3
10.8	11.2	-0.4	13.5	13.2	+0.3
10.8	10.8	0.0	13.5	13.7	-0.2
10.9	10.3	+0.6	13.6	13.7	-0.1
11.0	10.8	+0.2	13.8	13.7	+0.1
11.0	10.8	+0.2	13.9	13.7	+0.2
11.2	10.9	+0.3	14.2	14.0	+0.2
11.2	11.5	-0.3	14.3	14.0	+0.3
11.4	11.8	-0.4	14.4	14.2	+0.2
11.5	12.0	-0.5	14.4	14.3	+0.1
11.5	11.7	-0.2	15.3	15.3	0.0
11.8	10.6	+1.2	39.2	39.3	-0.1
11.8	11.5	+0.3	54.9	54.4	+0.5
12.0	11.1	+0.9	63.8	64.4	-0.6
12.1	11.8	+0.3	72.1	72.4	-0.3
12.3	12.2	+0.1	83.5	83.4	+0.1
13.0	13.0	0.0	94.9	94.1	+0.8
13.2	13.7	-0.5	104.0	103.7	+0.3
13.3	13.2	+0.1	114.1	114.0	+0.1
13.4	13.3	+0.1			

Average difference between fathometer and hand lead soundings based on 39 comparisons = 0.3 fathoms with a maximum difference of 1.2 fathoms.

Fathometer Fathoms	Trolley Fathoms	Difference Fathoms
15.5	15.4	+0.1
20.5	19.3	+1.2
24.5	22.5	+2.0

Average difference between fathometer and trolley soundings based on 3 comparisons = +1.1 fathoms.

	Watch Error	Time of Sight	Sight	D.R. data
Date	Chronometer Time	Watch time	1st observation	Lat.
Ship's Time	" error.	" "	2nd "	Long.
Observed Body	G. C. T.	" "	3rd "	height of eye
Approximate Bearing	Watch Time	3 ) Sum	3   Sum	log reading
Observer's Initials	Watch Correction (to be applied to watch to obtain G.C.T.)	Mean watch time	Mean altitude	true course
Accurate Bearing by Pelorus	Whose Watch	Watch correction	Index correction.	Recorder's Initials.
	Rating of sight- excellent, good, fair, poor.	G. C. T.	correction to angle	
			true obs. altitude	
5/18/15 7 <sup>21</sup> / <sub>am</sub>  O E  K. T. A.	9 - 42 - 06.0	7 20 15	29 35 30	41°33 N
	4 - 59.2	20 47	41 20	33°30 W
	9 - 47 - 05.2	21 14	46 10	23
	7 25 00	3 ) 2 16	3   3 00	P29.78
	+ 2 22 05.2	7 20 45.3	29 41 00	
	C. & G.S. # 73	+ 2 22 05.2	- 30	137.3
	9 42 50.5	+ 9 34		
		29 50 04		
	Good			K. T. A.



G. C. T.	t = Hour Angle.	log hav		
Long.	L = Latitude	log cos		
L. C. T.	d = declination	log cos		
Eq. t or R.A.M.S.		log hav	nat hav.	
LAT or LST	L ~ d		nat hav	
R. A. star.		zenith distance	nat hav	
t = Hour Angle,		cal. altitude		
		obs. altitude		
	Azimuth	altitude diff	towards away	Computer's Initials.
9 - 42 - 50.5	4 - 28 - 02.9	9.48392		
2 - 14 38.	41 - 30 - 00 N	9.87446		
7 - 28 - 12.5	19 21 11 N	9.97474		
+ 3 - 44.6		9.33312	0.21534	
7 - 31 - 57.1	22 08 49		0.03689	
		60 - 17 - 40	0.25223	
4 - 28 - 02.9		29 - 42 - 20		
		29 - 50 - 04		
	N 89°-52' E	7.7 mi	towards	K. T. A.

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY

REG. NO. 4769

HYDROGRAPHIC TITLE SHEET

(Prepared in Office)

The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

Field No. H

REGISTER NO. 4769

State North Carolina

General locality Cape Fear

Locality Cape Lookout to Cape Fear-Offshore

Scale 240,000 Date of survey July 19-Nov. 30, 1927

Vessel Lydonia

Chief of Party K.T. Adams

Surveyed by K.T. Adams

Protracted by H.A. Paton

Soundings penciled by H.A. Paton

Soundings in fathoms ~~feet~~

Plane of reference Mean Low Water

Subdivision of wire dragged areas by

Inked by

Verified by

Instructions dated July 31, 1926

Remarks: