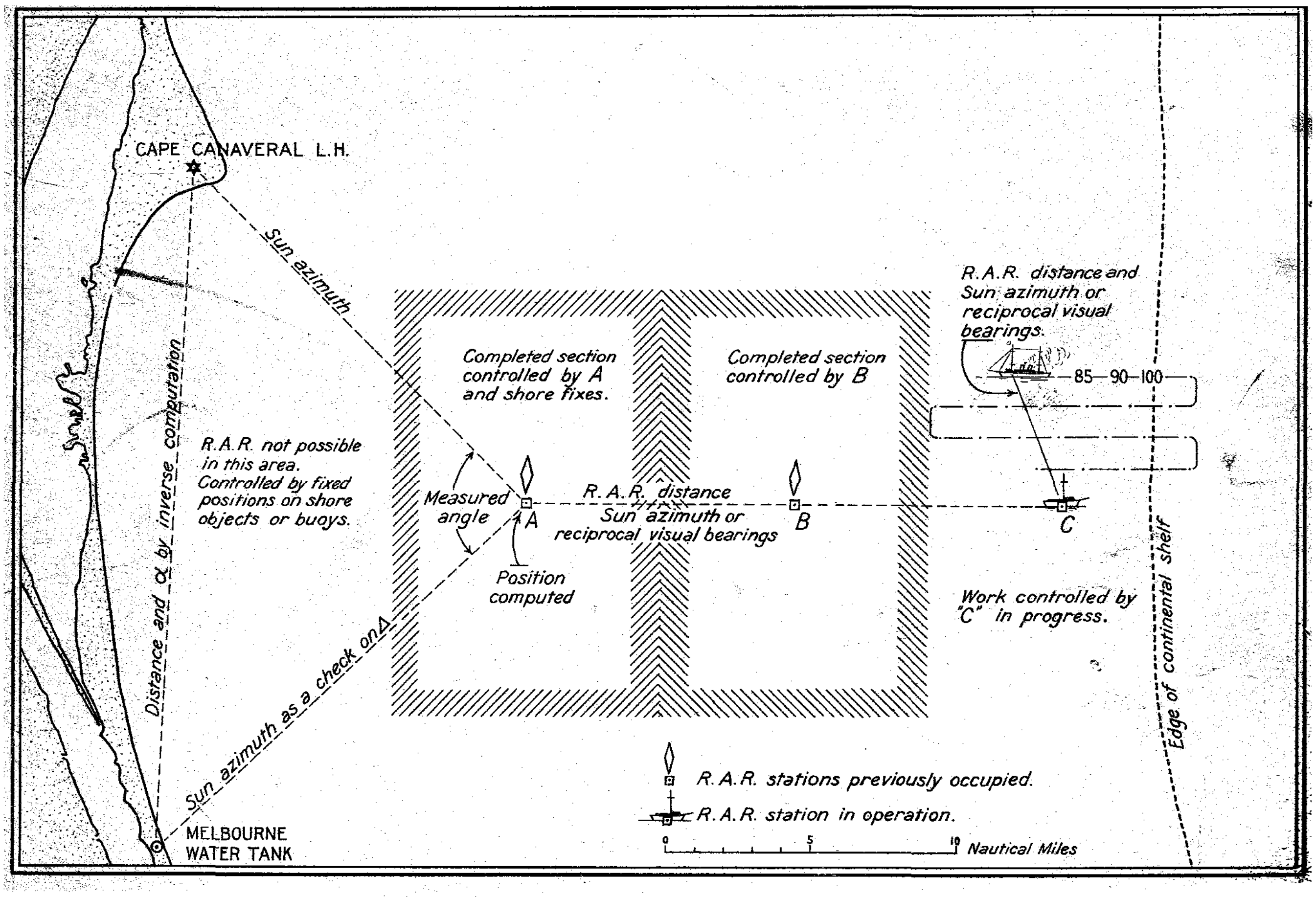
ASSOCIATION OF FIELD ENGINEERS

U.S. COAST AND GEODETIC SURVEY



BULLETIN

JUNE 1930

CONTENTS

THE BULLETIN

The large number of special reports and news items of general interest which have been received since the publication of the last bulletin indicate a marked increase in the interest being taken by our officers and a willingness on their part to cooperate in making the bulletin a real institution.

The interest manifested is further proof that some medium through which ideas and suggestions for the improvement of instruments, methods, etc., can be exchanged is not only warranted, but is essential if our widely separated officers are to be kept in touch with and receive the maximum benefit from the efforts and experiences of one another.

There seems to be no valid reason why there can not be developed a publication that will not only fill a long felt need in the Service but one that will also render, indirectly, a valuable public service. Certainly in an organization as broad as ours with close to 200 scientifically trained officers and employees engaged in engineering work, a large portion of which is in a rapid stage of development, there should be ample material available.

Our Director has stated that he believes such a publication desirable and is in sympathy with any steps taken to develop it.

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The cover page for this issue is an invitation to anyone to submit ideas, comments, suggestions and constructive criticisms which will assist in the development and standardization of methods for accurately surveying the extensive offshore areas along our Atlantic and Gulf Coasts where, up to the present time, it has not been possible to employ R.A.R. with the success with which it has been used on the Pacific Coast.

The method indicated on the cover page has not been tried, although several phases of it have been used successfully on different projects and on experimental tests. During the 1929 season the parties on the DISCOVERER and GUIDE employed sun azimuths in locating buoys. In the ease of one of the parties, the method was actually employed on sounding lines.

It might be noted that the development of methods which appear particularly applicable to the Atlantic Coast have, for the most part, resulted from the initiative shown by Pacific Coast parties. Are the officers on the Atlantic Coast going to continue to let our West Coast friends develop methods for them to use?

Comments on and discussions of the papers included in this issue of the bulletin are considered desirable and are invited.

THE LINEUP FOR 1930
ATLANTIC COAST

HYDROGRAPHER - Under construction at Newport News, Virginia
(8) G. T. Rude, Inspector of Construction
W. E. Greer, Chief Engineer.

LYDONIA - Georges Bank, Coast of New England
(24) G. D. Cowie, Commanding (56) W. M. Scaife, Executive Officer
(75) K. G. Crosby (87) W. F. Malnate O. B. Hartzog, D. O.
(78) L. S. Hubbard C. N. Conover, Chief Engineer M. A. Hecht, D. O.

OCEANOGRAPHER - Georges Bank, Coast of New England.
(31) F. L. Peacock, Commanding (57) R.F.A. Studds, Executive Officer
(68) T. B. Reed (133) K. B. Jeffers E. B. Brown, D. O.
(108) C. A. Burmister Harry Ely, Chief Engineer J. C. Tribble, Jr.,D.O.

Training Section
(61) L. C. Wilder, Training Officer
Deck Officers

E. L. Jones J. K. Holloway K. M. Eggen
C. R. Reed H. C. Applequist W. F. Deane
W. C. Russell J. T. Jarman

RANGER - Florida East Coast, northward of Fort Pierce.
(36) Chas. Shaw, Commanding (64) E. B. Roberts, Executive Officer
(90) W. M. Gibson F. L. Chamberlain, Chief Engineer
(140) J. S. Massey R. C. Overton, Mate H. C. Walker, D. O.

NATOMA - Florida East Coast, Jupiter Inlet to Fort Pierce
(37) C. A. Egner, Commanding (82) H. A. Paton, Executive Officer
(97) G. R. Shelton Antone Silva, Chief Engineer
(137) M. H. Reese J. C. Tison, D. O.

GILBERT - Under construction at Sturgeon Bay, Wisconsin
(50) R. R. Moore, Inspector of Construction

OGDEN and MARINDIN - Wire drag, Long Island Sound.
(59) B. H. Rigg, Chief of Party F. E. Okeson, Mate
(65) H. E. Finnegan F. Natella, D. O.

MITCHELL, ELSIE, ECHO, RODGERS - Current Survey, Block Island Sound.
(69) J. C. Sammons, Chief of Party (138) F. A. Riddell
(76) G. E. Boothe (141) M. E. Wennermark

Shore Party - St. Andrews Bay, Florida
(41) R. D. Horne, Chief of Party M. G. Ricketts, D. O.

Shore Party - Galveston Bay to Houston, Texas
(28) H. B. Campbell, Chief of Party
(Other officers not yet selected)

Air Corps, U. S. Army - Air photographs, Delaware Bay to Chesapeake Bay

Reduction of Aerial Photographs - Florida East Coast
(45) O. S. Reading, In Charge
(105) W. J. Chovan (126) R. C. Bolstad

PACIFIC COAST

SURVEYOR - Tenders: WILDCAT and HELIANTHUS - West Coast of Kodiak Island, Southwest Alaska

(9) F. H. Hardy, Commanding (53) C. D. Meaney, Executive Officer
(70) R. W. Knox (121) E. B. Lewey G. E. Johansen, Chief Engr.
(85) R. J. Sipe (128) C. A. George R. W. Healy, Mate
(92) A. C. Thorson (129) G. M. Marchand W. J. Leary, Surgeon
(118) L. W. Swanson (132) H. F. Garber

DISCOVERER - Tender: WESTDAHL - Aialik Bay to Chugach Islands, Southwest Alaska

(17) F. B. T. Siems, Commanding (52) J. A. Bond, Executive Officer
(72) G. L. Anderson (116) G. W. Lovesee (139) I. R. Rubottom
(81) R. C. Rowse (131) R. A. Earle J. L. McIver, Chief Engr.
(101) F. G. Quinn (134) John Laskowski F. J. Soule, Surgeon
(106) G. A. Nelson (136) G. C. Mast

WESTDAHL
(39) L. D. Graham, In Charge

PIONEER - French Frigate Shoals to Lisianski Island, T. H.

(22) O. W. Swainson, Commanding (42) C. K. Green, Executive Officer
(55) E. O. Heaton (125) C. J. Wagner D. R. Kruger, Surgeon
(109) P. L. Bernstein (135) R. A. Gilmore J. C. Ellerbe, Jr., D. O.
(111) V. M. Gibbens C. R. Jones, Chief Engineer

GUIDE - Cape Elizabeth to Cape Flattery, Washington

(29) K. T. Adams, Commanding (46) E. H. Bernstein, Executive Officer
(51) Herman Odessey (103) H. J. Healy Frank Seymour, Chief Engr.
(71) H. A. Karo (122) J. C. Mathisson J. S. Morton, D. O.
(89) F. G. Johnson (127) A. N. Stewart

EXPLORER - Tender: SCANDANAVIA - Behm Canal, Southeast Alaska.

(30) E.W. Eickelberg, Commanding Officer (58) H.C. Warwick, Exec. Officer
(79) P. C. Doran (115) H. O. Fortin K. S. Ulm, D. O.
(93) J. C. Partington A. N. Loken, Chief Engineer
(99) B. G. Jones Wm. Weidlich, Mate

Launch Party - Chartered Launch ROGUE, Cape Arena to Point Reyes, California.

(94) L. C. Johnson, Chief of Party
(130) J. N. Jones R. A. Marshall, D. O.

PHILIPPINE ISLANDS
(11) L. O. Colbert, Director of Coast Surveys

PATHFINDER - North Coast of Luzon Island
(27) G. C. Mattison, Commanding (48) C. M. Durgin, Executive Officer
(40) M. O. Witherbee K. R. Gile, Chief Engineer Arthur Hunnycutt, Chief Writer
(62) J. M. Smook J. V. Tormey, Surgeon

FATHOMER - East Coast of Luzon Island
(33) Jack Senior, Commanding (54) A. P. Ratti, Executive Officer
(77) E. A. Deily (100) E. R. McCarthy W. R. Scroggs, Surgeon
(80) J. C. Bose G. W. Hutchison, Chief Engineer

MARINDUQUE - Sulu Archipelago
(44) W. D. Patterson, Commanding (86) S. B. Grenell, Executive Officer
(120) F. R. Gossett John Wyer, Chief Engineer

GEODETIC PARTIES

(43) G. L. Bean:
(123) H. J. Oliver: Engaged in earthquake investigation triangulation in California just north of San Francisco. He is assisted by Ensign H. J. Oliver.

(47) H. W. Hemple: At present detailed to duty in the Washington office. On July 1 Lieut. Hemple will organize a triangulation party at Columbus, Nebraska, for work along the 42nd parallel to the eastward. He will be assisted by Lieuts, Gallen and Aslakson.

(67) Chas. Pierce:
(114) Curtis LeFever: Now engaged in coastal triangulation south of Cape Mendocino, California. This party will be engaged in first-order leveling in Oregon after July 1, 1930.

(73) E. J. Brown: Assigned to duty at Washington, D. C. Designing new apparatus for radio work in connection with astronomical and gravity observations.

(84) C. I. Aslakson: Now in Washington, D. C. Will later be in the party of Lieut. Hemple.

(88) P. A. Smith: Assisted by J. D. Thurmond. Is now engaged in first-order triangulation on the Atlanta-Shreveport arc. Smith's party will take up triangulation at Cairo, Illinois, after July 1.

(91) R. L. Pfau: Astronomical observations at 5 stations on the Trenton-Buffalo arc and at stations in Mass., Maine, Maryland, N. C. and Virginia. C. A. Schanck will assist with this work until July 1.

(95) E. B. Latham: Astronomical observations in Tennessee, Arkansas, Missouri and Iowa.

(96) John Bowie:	Assisted by W. R. Porter. Now engaged in first-order levels in Indiana. This work will be continued throughout the summer and carried up into Wisconsin.
(98) I. T. Sanders:	Engaged in the measurement of first-order bases in Missouri, Iowa and Kansas and will be engaged in triangulation in Wisconsin after July 1,
(104) J. H. Brittain: (119) O. R. Fish:	Now engaged in triangulation along the coast north of San Francisco, California. This party will engage in first-order levels in Oregon after July 1. Ensign Fish will be transferred to the triangulation party of Paul A. Smith.
(107) W. R. Porter:	Will be engaged in first-order levels in New Jersey after July 1.
(110) J. D. Thurmond:	Will be engaged in first-order levels in Minnesota after July 1.
(112) C. A. Schanck:	Reobservation of stations on the oblique arc in Tennessee, and later on will be engaged in reconnaissance in first-order triangulation along the Atlantic Coast beginning in the vicinity of Atlantic City, New Jersey.
(113) J. P. Lushene:	Will be engaged in astronomical work to July 1 when he will organize a first-order leveling party in Wisconsin.
J. S. Bilby, Chief Signalman:	Will have charge of the building party erecting steel towers for the Columbus, Nebraska, work.
William Mussetter:	Engaged in reconnaissance for first-order triangulation on several arcs radiating from Cairo, Illinois. Later he will engage in reconnaissance along the Gulf Coast north and east from Corpus Christi, Texas.

TRAVELING AND ON LEAVE

(16) J. E. Hawley
(35) G. C. Jones
(49) F. L. Gallen
(60) R. W. Woodworth
(63) A. J. Hoskinson
(66) C. M. Thomas
(74) I. Rittenberg
(83) W. H. Bainbridge
(102) E. H. Kirsch
(117) E. C. Baum
(124) G. E. Morris

FIELD STATIONS

(10) T. J. Maher, San Francisco
(13) R. p. Luce, Boston
(20) J. H. Peters, Honolulu
(21) E. R. Hand, Porto Rico
(25) H. A. Cotton, New York
(32) R. L. Schoppe, New Orleans
(34) R. P. Eyman, Seattle
(38) L. P. Raynor, San Francisco.

Legislation

State, Justice, Commerce and Labor Appropriation Bill, 1931 (H.R. 8960):
Reported to House January 22. Passed House January 29.
Reported to Senate February 8. Passed Senate April 1.
Sent to Conference April 9. Conference report agreed to in House April 14; in Senate April 14. Bill approved April 18.

Bill authorizes increase in the number of commissioned officers from 141 to 164. The net change of 23 is distributed as shown below:

Grade	Rank	Existing Law	H. R. 8960	Change
H. & G. Engineers with relative rank of	Captain (Director)	1	1	
	Captains	2	6	+4
	Commanders	7	10	+3
	Lieut. Commanders	9	17	+8
	Lieutenants	38	47	+9
Jr. H. & G. Engrs. with relative rank of	Lieutenants (j.g.)	55	54	-1
Aids with relative rank of	Ensigns	29	29	
	Totals	141	164	+23

S. J. Resolution #7.

For the appointment of a joint committee composed of five members of the Senate and five members of the House of Representatives to investigate the pay and allowances of the commissioned and enlisted personnel of the Army. Navy, Marine Corps , Coast Guard, Coast and Geodetic Survey and Public Health Service:

Senate passed resolution January 6. Reported to House January 17. Passed House January 21, but with title amended to include Lighthouse Service. Sent to conference January 23. Conference report January 27 "that the House recede from its amendment to the title of said resolution". House agreed to conference report January 30, Senate agreed January 31. President signed resolution January 31. Chairman of House appointed (Feb. 5) as members of committee: French of Idaho, Cooper of Ohio, Barbour of California, Oliver of Alabama, Crosser of Ohio. Vice-President appointed (Feb. 6) from the Senate: Jones of Washington, Reed of Pennsylvania, Oddie of Nevada, Fletcher of Florida, Broussard of Louisiana.

During the absence of Senator Reed in London as a member of the Naval Conference, the Chairman - Senator Jones - did not want to start hearings. At the present time, the Senate is engaged on the Five-Power Treaty, and as Congress probably will adjourn in June it is practically certain that nothing will be done before the December session.

An immense amount of data has been furnished the committee from each of the Services and to all outward appearances Congress seems favorably inclined to a revision upward of the service pay.

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Recent Arrivals

Dec. 27 - Glendon Bruce Boothe (5-1/2 lbs.) - Oakland, California.
Jan. 19 - Alice Elizabeth Garner (7 lbs.) - Washington, D. C.
Mar. 11 - Thomas Lancaster Durgin (9 lbs.) - Manila, P. I.
May 3 - Walter Hubert Bainbridge, Jr. (9 lbs.) - Corpus Christi, Tex.

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Marine Licenses Recently Granted

Master (unlimited)	Chief Mate (unlimited)
H. C. Warwick, Jan. 15, 1930	G. C. Shelton - Jan. 29, 1930
L. P. Raynor - Mar. 21, 1930	R. W. Knox - Mar. 14, 1930
F. E. Gallen - Mar. 26, 1930	K. G. Crosby - Apr. 11, 1930
	W. M. Scaife - May 13, 1930.

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From the OCEANOGRAPHER

On April 1 the Ship OCEANOGRAPHSR participated in the city of Pensacola's reception to its namesake, the first of the 10,000 ton cruisers. This was by authority of the Director on request of the Mayor of Pensacola. A fleet consisting of the OCEANOGRAPHER, three large tug boats and many smaller craft, all carrying citizens of Pensacola, met the cruiser down the bay and escorted her to her berth at Frisco Railroad Dock No. 2. Owing to the early hour of arrival, the cruiser was met off the Naval Air Station instead of at the sea buoy. As the Pensacolians deemed lots of noise essential to a proper welcome, the duty of signaling the proper moment to lay on the whistle cords was assigned to the OCEANOGRAPHER. The OCEANOGRAPHER carried 83 guests, invited by the Mayor of Pensacola or at his instance. From the Naval Air Station to Pensacola the escort vessels ranged in two prearranged lines, the OCEANOGRAPHER heading the starboard line. As the OCEANOGRAPHER'S regular berth in Pensacola is just across the wharf from the berth assigned the Cruiser PENSACOLA, she shared the interest of the public with the cruiser during the remainder of the day.

The participation of the OCEANOGRAPHER on this occasion seems to have been an act of courtesy much appreciated by the city and to have aroused a sentiment which will act to facilitate our work in that vicinity.

Training Section

The Training Section was installed as an independent unit on the OCEANOGRAPHER, under L. C. Wilder, on March 11. Seven officers are in training at the time this report is made. Wilder reports encouragingly in regard to the facilities for training afforded, in comparison with what might be accomplished on the MIKAWE, also the fact that the personnel were not addicted to seasickness though the OCEANOGRAPHER. "can" roll. But he proves that no more than a speaking acquaintance with salt water can be acquired in thirty days by the fact that on the first day away from the ship in a launch one officer fell overboard, another lost his cap and a third lost something or other; all were recovered, however.

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Here's Wilder's recipe for a substitute for golf for the ship's officers and guaranteed to be a good one: Take 5 pounds of lead as a center and construct a ball of 10 inches in diameter with a strand of 2-3/4 inch Manila rope (construct as you used to make twine or yarn balls years ago). Finish off to a sphere with single rope yarn and then for an outer surface use a system of half hitches (with one strand of 12 thread Manila), or cover with canvas to suit your taste and you have a sea-going medicine ball. Kidnap a shipmate and place him at a distance of 15 to 20 feet and heave the ball back and forth for ten minutes twice each day and I'll guarantee that the U.S.P.H.S. will not tell you once a year that you need more exercise.

This is prescribed for the use of Commanding Officers, Executives and all other politicians aboard ship. The beach crawling topographer and surf riding hydrographer should beware or a rest cure may be needed.

Make the above a requirement and I'll bet on the Field Force when the annual bowling championship is played off at Washington.

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From an Hydrographer Vacationing at a Mountain Summer Resort.

Green Mountain, N.H.
August 3, 1930.

Dear R.A.R.:

Got your "Notices to Mariners" and will answer it right away. When do you expect to heave anchor in that South Carolina gumbo (that only a crab can walk on or in) and proceed seaward to another surf riding, bottom hammering job?

I don't know why I dropped anchor in this bight, but I'm here, and with several small craft tied up alongside, as we brought the youngsters. I guess I was accumulating so much salt behind the cars that the wife thought this continual fog (they call it clouds up here in the hills) might dissolve it. We drove up Wednesday night and made our courses good in spite of the fact that I had no Light List to supplement my road chart. (I'm in favor of a Coast Pilot for these waters).

I'm too far from my usual habitat, but I guess I did need a rest from that Scotch plaid designing we were doing along the Florida coast. It's rather strange up here, however, as there's no swell and the lack of some kind of a roll gets monotonous. In earthquake might help. It's pretty warm but this morning the radiators commenced to hammer and sputter around the time I rolled out and I happened to remember that I had ordered "Steam at 7:00" last night, and tonight I rang, thoughtlessly, and when the bellboy hove in sight I asked him for the log books. I guess I'm a little "loco".

When we established our home port here I wasn't very well fixed as to these mountain goat clothes that all hands wear in these waters and they have no slop chest. But as we have been having heavy rains and high tides, I'm all shipshape with hip boots, s'wester, etc. However, we had one day that was b NW 0-1 which we spent cruising around the pinnacles. One of them was so sharp that a 20 meter displacement from the least sounding would have shown $\frac{0}{100}$. Dangerous for airships, eh! Why don't they buoy them?

I met another chap here that knows his salt water. I would say his salinity would run about 30 0/00, but I didn't like the cut of his jib. He was coarse sand with black specks but could reel off yarns like a f'castle hand. However, I think the only typhoons he ever rode out were Irish Hurricanes. I'm beginning to think they've layed me up in Snug Harbor.

Well, when I finish my assignment here, it's 4 bell and the jingle for the Pacific Coast, so I hear. How's it happen you haven't changed your address in the last eight months? Odd! Line Ends Day Ends.

Yours till P. I. surveys are completed,
"Fathom"

P.S. One of the principal things I object to here is the mess bill. They don't hold their elections according to Regulations and they don't seem to want me on the auditing board.

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The following messages were received by the Commanding Officer of the FATHOMER (Lt. G. C. Jones) in connection with the disaster met by the Japanese Steamer KENKYU MARU and the rescue of the crew by the FATHOMER, details regarding which were given in the official bulletin for January:

From JAVC to Master FATHOMER:

"I regret to inform you that we haven't got sufficient coal and water on board also we are unable to proceed too close to the seashore in such dangerous circle and so high swell sea with our poor knowledge for the coasts shall be much obliged if you try your best to search another boat according to Chief Officers opinion and your greatest knowledge for navigation of this neighbourhood stop we continue to search our best till now also we must find out unfortunate friend coal and water etc. on the way from Calcutta direct during 16 days voyage please allow to proceed to our bunkering ports and I will ask to assist you to the other following steamer to us stop kindly agree to me and hoping you to find out another boat anyhow by help of God."

"Master Momoha Maru"

"To dear Captain Fathomer:

"I searched carefully approached wrecked position from last night but sighted nothing stop this morning I received wire with delightfully that your ship save all crew by your hard fighting many thanks for your manly kindness as I return Moji 19th inst. soon I will report to the owner and crews families that you saved all crews and they are safety stop please say to the Captain and crews of Kenkyu Maru that above mentioned message."

"Yours truly Captain SS Oki Hokai Maru"

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Believe It Or Not

The following is quoted from "The Production of an Admiralty Chart" which appeared in the "Nautical Magazine", Glasgow, 1927:

"We believe that it is not insular prejudice, but a plain statement of fact, to say that the work done by the modern Surveying Branch of H. M. Navy represents the highest level yet reached in the science of hydrography, and the professional nature of the personnel insures that this science is adapted to practical ends,"

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With Reference to the Above

At the annual meeting of the American Society of Civil Engineers held in New York in January, 1930, the Norman Medal was awarded publicly to Commander G. T. Rude. The medal was instituted and endowed in 1872 by the late George H. Norman, M. Am. Soc. C. E., and is the oldest, as well as the highest, medal awarded by the Society. The first award was made in 1874, the 51st being to Commander Rude upon the recommendation of the Special Committee for the best essay on Engineering in 1929, this being his paper, "Tides and Their Engineering Aspects".

The medal was presented to the President and the Society by Captain Patton in a speech of about five minutes. The President then awarded the medal in a pronouncement of about one minute.

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The following is a copy of a letter received from Capt. E. Wold, Chief of the Division of Geodesy of the Norwegian Geographical Survey. In 1924 Capt. Wold spent six months in the United States, studying the field and office methods of the U. S. Coast and Geodetic Survey. His letter is brought to your attention because of the high tribute that he pays to the accomplishments of this Survey.

Norwegian Geographical Survey, Division of Geodesy
Office of the Chief

Director R. S. Patton, Oslo, February 26, 1930.
U. S. Coast and Geodetic Survey,
Washington, D. C.

Dear Sir:

With my best thanks I acknowledge the receipt of the fine triangulation sketch of North America showing the present status and evolution of your triangulation.

I must congratulate you as Director of such a famous institution as the Coast and Geodetic Survey. I am much interested in all your work and every step forward you make, which means increased accuracy and decreased cost, for that is the way we all have to work.

In Norway we follow - and especially of course I want to do so - in your footsteps. Since my return from your country our Survey has adopted night observations with electric signal lamps, your field and office methods in astronomical work and especially the system used by you for registering the observations and time signals. In base measurements I now use stakes instead of movable tripods and for the expansion to the triangle sides your strong figures and observations methods are used instead of the theoretical German manner proposed by Schreiber. Your water-gauge is also installed in several places along our coasts and works excellently. Your method for harmonic-analysis was also adopted.

But it is not only in my Division that your ideas are taken up. A wire-drag has been constructed and echo-sounding will be given its first trial this summer (sorry to say with a German "Atlas" apparatus instead of with your excellent instrument). I also hope to see your radio-acoustic methods in use within a short time. The Velox-transfer and a good many other practical time-and-cost-saving methods, which I brought with me, were tried out and adopted at once.

Almost every day I am asked, both inside and outside this Survey, if I have any news from you, so you understand how deeply I appreciate the great interest you take in me by giving me early news of the progress made in your brilliant work.

Very sincerely yours,
(Signed) K. Wold

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University of Michigan, Department of Geodesy and Surveying
Ann Arbor, Michigan,

Dr. William Bowie, May 1, 1930.
U. S. Coast & Geodetic Survey,
Washington, D. C.

Dear Sir:

During the recent spring vacation period I was in Alabama and Georgia. While there, I took advantage of your kind invitation, of long standing, to visit your field parties and spent three days with your first-order triangulation party operating under the supervision of Lt. Paul A. Smith.

As you know, my field experience in Geodesy was obtained with the U. S. Lake Survey prior to 1920. That background enables me to appreciate, in a degree at least, the wonderful progress in the last few years. The methods, instruments, towers, motor equipment, personnel and economy of operations strike me as marvelous.

I am enthusiastic about everything connected with that arc of triangulation. To mention only a few things, the Parkhurst theodolite is a real contribution to Geodetic instruments, the reconnaissance shows the work of a master, and the efficient manner in which Lt. Smith coordinates and directs the party is worthy of the highest praise.

Sincerely yours,
(Sgd.) Thomas J. Mitchell.

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Not So Good

Information has been received that all post-exchange privileges at the Presidio Post-Exchange, San Francisco, which had been extended to commissioned officers of the Coast and Geodetic Survey have been cancelled. This cancellation was the direct result of at least two of the officers leaving San Francisco without settling their bills at the Post-Exchange within the time required by the War Department. Such action on the part of commissioned officers appears inexcusable.

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During March and April E. J. Brown and R. L. Pfau developed methods for accurately determining latitude and longitude by observations with a theodolite. In determining longitude, meridian time observations were made by the key method, and the local time compared with Naval Observatory time by means of radio time signals. Latitude was determined by observing circummeridian altitudes of stars.

A Throughton and Sims 8 inch theodolite was prepared for the work. This instrument has a vertical circle reading to 10", and was fitted with an eleven line glass diaphram to permit making the time observations by the key method.

Results of test observations indicated that the methods employed were capable of giving astronomical positions in latitude and longitude within 5 seconds of arc.

A report of the work was prepared, giving in detail the methods of observation and computation. The report was prepared with the view of developing all phases of the operations completely enough to enable any officer, without special training, to make acceptable determinations of latitude and longitude.

The PIONEER will use the instrument and methods described in determining the position of Laysan and Lisianski Islands during the current season. It is probable that similar methods will be used frequently in the future in establishing initial points for the control of detached surveys.

Uses of Computing Machines on Board a Survey Vessel

Some of the purposes for which a computing machine, similar to the Marchant, can be used on board a survey vessel are listed by Commander Hardy as follows:

1. In checking bids and bills, particularly lumber, where unit prices often appear with fractions of a cent, a computing machine is extremely handy.

2. In constructing a projection or computing D.M.'s and D.P's of signals on a scale such that meridians tend parallels are five and ten minutes apart, the use of a computing machine is a rapid and accurate method of computing and reducing distances to the scale of the meter bar.

3. In computing tests for the velocity of sound in sea water, such a machine is far faster than the use of logarithms or long division. Further, in connection with the computations of velocity tests, very close approximations to the great circle distance between ship and hydrophone can be had by solving plain triangles using middle latitude - a solution greatly expedited by using a calculation machine.

4. I am informed by an officer recently transferred from a vessel equipped with a Mrchant that a method of locating the ship by observations on two buoys and an azimuth of the sun was so simplified that the position was known immediately. I am also informed that the machine is in use continually aboard that vessel.

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From One Officer to Another on Navigating Sextants

The first sounding line I started out from - - - - I could not make anything check. I was nearly crazy and finally ran down to an island to see where I was. After days and nights of worry over these sights, I sent an officer ashore at - - - - with all the sextants and a plane table and had him observe the angles between triangulation stations with the sextants setting on the plane table. He observed angles of various sizes. The result of that was that the sextant I was using was out as much as six and a half minutes at one place on the arc and various amounts up to that at other places. The others were out less than a minute.

I sent that sextant back to Washington and requested another. It finally came, a new one. Mr. - - - - took it for his sights. We used it at least a year before we laid more trouble at it's door.

Mr. --____could not obtain results from sun sights. His star sights were excellent but he got so he didn't like sun sights and did not believe in them. Also I found that I could not use his sun sights in adjusting the line. I thought it was just a state of mind and finally advised him to use a different sextant. Immediately his sun sights were all right. We then investigated and found that the colored glasses on his sextant were out so much that different combinations on them gave errors up to seven and a half minutes. Thus we have had to reject all sun sights taken with that sextant over a whole year's time.

We have also had a lot of grief with sextant mirrors. It has been difficult to get mirrors from Washington backed with a good surface and many of them have had the front and back surface so far out of parallel as to make it exceedingly difficult to take good sights with them.

I suppose you are familiar with the binocular sextant. I don't know how you will like it, but in my experience there is nothing like it. We use nothing else for anything on board ship. For astronomical work you can get excellent sights with it when you can scarcely see the horizon with an ordinary telescope. Its disadvantage is its small field of view, but you can soon get used to that. For taking sextant angles on buoys the higher magnifying power is almost necessary. Out here, nine-tenths of the time, the distance you can see buoys is limited by the horizon and not by the visibility. You can see them as far as they will stay above the horizon IF you have enough magnifying power.

Here is what I would strongly recommend: That you immediately request binocular sextants. Try to get six of them. Then, before leaving - - - -, test them out in every conceivable way, i.e., by measuring known angles which have been measured by theodolites, by testing the colored glasses, by testing the mirrors, et cetera; and pick out the best three sextants and reserve them for astronomical work, using the remaining three for hydrographic work.

Oh, yes, we also had one sextant on which the two ends of the vernier did not check, one end reading about one-half minute more than the other. I have come to the conclusion that, given fair conditions, we can take sights which are limited by the accuracy of the sextants. That is why I consider the situation so important.

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FROM SEASON'S REPORT (1929) SHIP EXPLORER
E. W. Eickelberg, Commanding

* * * * Mention has been made to me during the past season stating a desire for a paper or bulletin of some kind to be circulated among the crews of our survey vessels. This shows interest in the service for which perhaps the men are not always given full credit. * * * *

The use of power driven sounding machines on all sounding launches greatly increased the efficiency of the party. * * * *

The new manuals for the various classes of field work are a decided advantage in executing the work and a more uniform product should result as the officers become more thoroughly acquainted with their requirements. * * * *

Assistance was rendered by towing into port a small fishing vessel, caught in a bed of kelp, with a broken crankshaft. Also a larger vessel was towed into Wrangell from Sumner Strait with broken Diesel fuel pump.

FROM SEASON'S REPORT (1929) SHIP SURVEYOR
R. R. Lukens, Commanding

On Sunday morning, May 26th, while at the cannery dock in Zachar Bay, a radio message was received from Larsen Bay stating that the Alaska Steamship Company's S.S. ALEUTIAN had sunk near Amook Island, Uyak Bay, and requesting that the SURVEYOR transport the passengers and crew to Seward. The SURVEYOR and HELLANTHUS were underway within fifteen minutes and proceeded to Larsen Bay, where some of the survivors had arrived about two hours previously. At 11:15 A.M., a cannery tender arrived with all the crew and passengers of the ALEUTIAN. These men were taken aboard the SURVEYOR and after people from shore arrived, the ship got under way for Seward with 118 passengers aboard. After a rough trip she arrived at Seward at 6:00 P.M., May 27th, and discharged the passengers.

After fueling, the ship returned to the working grounds on May 29th and began surveys to determine whether or not the ALEUTIAN had struck an uncharted rock.

Captain Nord, of the ALEUTIAN, seemed positive that he was in mid-channel when the vessel struck. He stated that he was heading for the left tangent of Alf Island, and according to the course steered, this would put him in mid-channel. The old survey showed neither dangers or indications, but still the soundings were rather widely spaced and it was possible that a pinnacle rock might have existed.

Fortunately, we had on board copies of the old sheets and triangulation data. Old stations were recovered and hydrography started on the afternoon of the first day. After a careful lead line survey of the area, no obstructions were found. On Monday, June 3rd, the area was wire dragged and still no danger was located. After finishing the drag work, I took advantage of low tide and examined the rock awash one-quarter mile off the Amook Island shore. Although it was covered about three feet, we were able to see plainly that the rock had been badly spalled and fractured. A long piece of angle iron was also visible around the base of the rock. This proved conclusively that the ALEUTIAN had struck the charted rock, and that she had not been on the track reported by Captain Nord.

On Sunday, June 9th, one of the lowest tides of the year occurred and advantage was taken of this to examine the rock. At this low tide the rock was bare about four feet and the path of the ship where she crashed along the east side of the rock was easily traced. There were many rivets and small pieces of steel plating scattered over the rock. It was evident that the ship had been ripped open from stem to stern. She was going full speed (14 knots) when she struck. Some time was spent sounding and dragging a lead line in an attempt to locate the hull, but it was not found.

It was fortunate that the Coast and Geodetic Survey had a party in this vicinity for I am thoroughly convinced that had it not been for our prompt investigation, the verdict would have been "Another uncharted rock".

* * * * *

On September 5th, while anchored in Halibut Bay during a southeast storm, a radio message was received stating that the American S.S. "GOLDEN FOREST" was ashore on the west side of Shelikoff Strait, probably on Cape Ilktugitak. My services were offered but no assistance was asked at that time. On the following day a request was received for medical aid and at 1:00 A.M., the ship got under way for the scene of the wreck. The master of the "GOLDEN FOREST" was not sure of his position, but radio bearings taken by this vessel placed her unmistakably on Cape Ilktugitak, and at about 6:30 A.M., the "GOLDEN FOREST" was sighted. The Canadian salvage vessel, the "SALVAGE KING", was standing by.

Two men requiring medical attention were brought aboard. One from the "SALVAGE KING" was treated and returned to his ship, while the one from the "GOLDSN FOREST" was retained aboard for treatment and afterwards sent to Port Townsend via the S.S. "CATHERINE D" from Alitak Bay.

The "GOLDEN FOREST" was hard and fast aground. She had grounded on the top of a spring tide and being in an exposed position, there appeared to be little chance of her ever getting off.

* * * * *

The ship was fueled at Seward, and after returning a number of oil drums to the Standard Oil Company, the voyage was continued at 11:30 A.M. the same day. Due to heavy easterly weather, the course was laid via Elrington Passage and Cape Hinchinbrook. After passing out of Hinchinbrook Entrance a whole N.E. gale was encountered and the ship got a severe pounding. After about 25 hours, an anchorage in the lee of Kayak Island was made at 3:08 A.M., October 11th.

WE were able to make this anchorage by the aid of fathometer soundings together with radio bearings obtained on the radio beacon at Cape St. Elias. The contribution of these two instruments towards safety in navigation is almost beyond expression,,

* * * * *

When in Granville Channel we encountered the chartered launch of the EXPLORER, "CITY OF ANACORTES", drifting due to a broken oil pump. The launch was taken in tow and the pump brought aboard for repairs. As a matter of precaution, we kept the launch in tow until safely through Queen Charlotte Sound when she continued under her own power.

* * * * *

In the vicinity of Uyak Bay, Uganik Bay and Kupreanof Strait considerable trouble was experienced in finding the old stations due to the heavy deposit of ash from the Katmai eruption of 1912. This ash has the appearance of a fine yellow sand, but is very light in weight. In most places the deposit of ash is now overgrown with grass.

* * * * *

In many instances the old signals built in 1907 and 1908 were still standing and had it not been for these signals many of the stations would not have been found.

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The hydrography of Shelikof Strait was executed by the ship using the fathometer. The fathometer worked unusually well, and although the depths came at an awkward place (in the vicinity of 100 fathoms) little trouble was experienced. R.A.R. stations were established on Cape Karluk and Malina Point. The magnetophone was used in these installations and it proved to be very efficient and very easy to plant. A single life preserver is all that is required to float it.

* * * * *

In Alitak Bay the hydrography was finished with the exception of Portage Bay, the northeast arm. A resurvey of a portion of Moser Bay was made. This was necessary because of the stranding of the S.S. CHIRIKOF in Moser Bay in the early part of the season. The resurvey showed that there had been no changes since the original survey in 1906. Range marks have now been established by the local cannery company and in the future deep draft vessels should have no trouble in avoiding the shoal on which the CHIRIKOF grounded. The range marks were spotted by Mr. Meaney and built by the Alaska Packers Association.

* * * * *

The WILDCAT ran throughout the season without trouble, except for an accident with the light plant. For some unknown reason all four pistons collapsed. Spare parts were obtained at once, but it was nearly six weeks before this plant was in operation again. The mechanical gear for reversing the blades of the propellor worked splendidly all season. The SURVEYOR was in daily communication with the WILDCAT by means of radio. The launch is now an efficient surveying unit and affords very comfortable quarters for the officers and crew.

The HELIANTHUS was improved by the installation of a new 100 h.p. Stearns engine which proved to be very satisfactory. She has a speed of 10 knots and has excellent backing power, which makes her handle like a steam vessel. A power driven sounding machine was installed on her during the season, but the clutch will not stand up under the constant backing necessary in hydrography. The HELIANTHUS is most valuable as a base for triangulation or topographic parties.

* * * * *

In August on two occasions during these westerly winds, the atmosphere became filled with a fine dust until the visibility was reduced to about a mile or less. At first we thought that it was due to a volcanic eruption, but later decided it was caused by the strong winds picking up the volcanic ash from the ground.

* * * * *

The shipping people and the cannery interests are very appreciative of the work this Bureau is doing in charting western Alaska and were anxious to cooperate with the party in every way possible. The work of the Lighthouse Service in planting a buoy on the rock at Zachar Bay only a few days after it was located by this party created much favorable comment.

The crew was also an unusually good one and everything went along very smoothly. The difference between present conditions and those ten to twenty years ago is amazing. I well remember when sailing day was a bedlam. Half or more of the crew would be drunk and disorderly and much diplomacy and occasionally some force was required to get them aboard. For the last two years I have left Seattle with over seventy men, without a drunk, nor even a sign of liquor amongst them.

* * * * *

From a Previous Report

The navigation of the ship down the coast and into Dixon Entrance was a fine tribute to the value of the bathometer as used in connection with good charts.

After getting one bearing on Cape Edgecombe Light, nothing more was seen until some thirty hours later when Cape Chacon light was picked up just forward of the beam. Even if the light on Cape Chacon had not been seen the ship could have rounded it in safety by following the 100-fathom curve.

In this connection, it may be stated that it would have been more convenient had the 100-fathom curve been shown on chart 8102. When the use of the Fathometer becomes general, the depth curves in the greater depths will be of much assistance to navigators.

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HYDROGRAPHY - ECHO SOUNDING - SLOPE CORRECTIONS

Albert J. Hoskinson, Lieut, (j.g.) U.S. C. & G. Survey

The Ship FATHOMER worked in areas of very uneven bottom during 1928 and 1929, and many Fathometer soundings were taken in areas where slope corrections are very large. Numerous comparisons were made with wire soundings in an endeavor to work out a satisfactory slope for correcting Fathometer soundings. Several methods of determining the slope of the bottom were tried, none of which gave satisfactory results. The best results were obtained when several profiles of the bottom were made with wire soundings and these used for determining the slope, but in this area many of the slope corrections are absurd and very few of the Fathometer soundings after correcting for slope agree with the wire soundings taken at the same location. This disagreement may be due to either of two causes, first, that wire soundings were not taken close enough together to accurately determine the slope, second, that the echo picked up in the Fathometer is not always the one reflected from the position normal to the slope. Quite frequently in areas of steep bottom slopes two or more echoes can be heard in the ear phones and the assumption is made that the least depth is the correct value to be used. This echo is not always the clearest one and it is entirely possible that in some cases the correct echo may be inaudible due to a clearer echo from some other position on the slope.

It is the writer's opinion that the Fathometer is not adapted for sounding in areas where this type of bottom is encountered, if accurate depths are desired. But if the Fathometer is used in such areas, it appears that it would be better to leave the soundings uncorrected for slope as they would all be on the side of safety, while corrected soundings may be too deep.

Slope Corrections for Echo Soundings
Coast and Geodetic Survey Special Publication No. 165
By A. L. Shalowitz, Senior Cartographic Engineer

This publication discusses the problem of applying necessary corrections to the echo distance obtained by the use of the Fathometer on account of the sea bottom not being horizontal. The paper demonstrates mathematically and graphically the practical unimportance and futility of applying slope corrections within certain limits, thereby reducing to a minimum the laborious and costly process of methodically correcting echo soundings for bottom slopes. The publication is divided into two parts: Part 1 dealing with the problem of defining limits within which slope corrections may be disregarded and Part 2 dealing with the problem of considering those special cases where the scale of the survey and the steepness of the slope require a closer approximation of the true depths under the vessel. The whole complex problem is approached from the standpoint of the cartographer and the practical navigator rather than from the purely theoretical viewpoint.

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HYDROGRAPHY - ECHO SOUNDING - LIMITATIONS
C. A. Burmister, Lieut, (j.g.) U.S. C. & G. Survey

It has been observed a number of times, when making a hydrographic survey, using the Fathometer to determine the depths, that sudden stealings such as caused by a coral reef with steep edges will not be indicated in time to obtain actual location of least depths, especially if they are unexpected. When the general depths are around 25 fathoms and there is an abrupt change to half (or less) of that amount, the operator of the Fathometer will think that the apparatus is not functioning properly for a few moments. As such an obstruction is passed over, there will be no flashes, or may be there will be a flash at twice the true depth, and unless considerable experience has been had in observing, this will not be detected, even though there is really an indication by a flash - usually assumed to be a stay-at, or near, the true depth. On reaching the other side of the shoal, the apparatus resumes its proper functioning - so the operator believes and, at the time, thinks little of this short period of uncertainty, especially if there should be a flash indicating double the depth.

However, should the depth reduce to such an extent that there is only a depth of a few fathoms, and the change is abrupt, indications are often given by the fact that there are no other flashes than that at zero, though in many cases, such indications might be ignored.

In regard to shoalings of this type the one in Lat. 15° 59' .5 Long. 121° 41.3' on hydrographic sheets P1760 and P1765 may be cited as an example. The least depth is 5 fathoms. I was operating the Fathometer at the time and I believe I have had more experience than most of the officers. There was some uncertainty as no flashes were observed. Naturally I made a few adjustments to bring back the flash, listening in (with the head-set) at the same time. The adjustment had no effect, but the sound in the phones indicated very shoal water.

At about this time I heard the officer in charge on the bridge say he could see bottom. Where it not for this fact the ship could not have been stopped in time to prevent possible grounding and this shoal might not have been found as quickly, or as easily, as the ship work was done on P1763 before the launch work on P1760. In this case the depths changed very quickly from more than 25 fathoms to 5 fathoms. However, on running subsequent lines, I was able to obtain indications of this shoal, as I could judge about the time when the ship would reach this area.

It would appear, therefore, that at the times of any continued uncertainty investigations should be made at once, especially if the Fathometer has been functioning splendidly for some time, and there is no real reason why the apparatus should be blamed for the uncertainty. The probability is that the depth can not be indicated.

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HYDROGRAPHY - VELOCITY OF SOUND IN SEAWATER
COAST OF NORTHERN CALIFORNIA

R. W. Knox, Lieut, (j.g.) U.S. C. & G. Survey

A special effort was made during the entire 1929 field season to obtain numerous and accurate tests for the velocity of sound in sea water for the area covered by the DISCOVERER'S R.A.R. sheets. Opportunity for such tests was not frequent, nor in the most desirable locations, but it is believed sufficient tests were obtained to establish the actual velocities within narrow limits.

Two methods of determining the actual positions of the tests were used; the visual three-point fix and bomb distances from three stations. Lack of suitable mountain peaks for offshore signals during the early months of the season, combined with low visibility from August on, confined the velocity tests by the three-point fix method comparatively close to the shoreline.

As there were no suitable large-scaled projections available for the accurate plotting of the visual fixes taken in conjunction with the velocity tests, it became necessary to compute the positions mathematically. Inverse position computations were then make to determine the distances to the hydrophones. In all these tests attention was given to details: Fixes were taken at the instant and very near the overboard position of the bomb, corrections were made for the distance between this overboard position of the bomb and the ship's hydrophone with reference to the angle between the ship's head and the bearing of the hydrophones, the speed of the ship and bomb intervals were accurately known.

On September 21st while making velocity tests on sheet 43, scale 1:40,000, it was observed that the bomb distances from HAVEN failed to check the visual fixes by an amount too large to be assigned to the ordinary causes of such discrepancies. It was at first thought that the hydrophone had dragged to a new position. On H day, September 23rd, sheet 43, fourteen tests were made in the immediate vicinity of the hydrophone to verify its position. From the visual positions arcs corresponding to bomb distances were swung using a velocity of 1490 meters per second, a figure afterwards found to be correct. As the distances were all within 1500 meters, any probable velocity within rather wide limits could have been used without changing the results. These arcs were found to circumscribe the hydrophone at a mean distance of 253 meters or 0.17 seconds of time. This proved conclusively that the hydrophone was in its initial position and that an instrumental lag of 0.17 seconds existed in the shore station apparatus. On October 14th the lag was removed; the following message from the HAVEN operator giving the details:

"Made adjustment on relay magnet by bringing them closer together thereby increasing the pulling power. Made adjustment of tension spring so it would release armature at six mills increasing the potentiometer resistance one-half making total resistance approximately 220 ohms. Relay armature was acting sluggish so investigated and found bearings slightly dusty and too tight so released tension on them to speed up action. Made tests with spare hydrophone and stop watch to check speed and since change has been made find it working O.K."

DARTON.

On October 18th further tests taken in the same manner as before indicated the entire removal of the lag. It was assumed the lag of 0.17 seconds was present from the time the station was established until October 14th, and the records have been corrected accordingly.

SHEET 121:

On sheet 121 two groups of tests were made, in the northeast and southeast corners of the sheet. The former were not computed, primarily because the bomb positions - plotted with the final velocities - checked their respective visual positions within extremely close limits, and because of the time and labor required. Using the tests, in the southeast corner of the sheet, the mean velocity to both hydrophones, US.J, and CASPAR, was found to be 1480 meters per second. As it was found from subsequent tests that the velocity decreased with an increase of depth, the following values were arbitrarily used:

Depth - fathoms	Velocity - m/s
0 - 300	1480
300 - 1000	1479
1000 - 2000	1478

SHEET 122:

There were no rigid velocity tests obtained in the area covered by sheet 122, but about a dozen single angles to mountain peaks were taken on A and B days. These single angles agreed quite nicely with the positions as determined by bombs using the arbitrarily assigned velocities. As scaled from the smooth sheet the average discrepancy between visual arc and bomb position was about 75 meters, or 0.05 seconds of time, without regard to sign.

It was found that tests in depths of approximately the same order taken early and late in the season showed a variation in velocity of some ten meters per second. This increase is attributed to a warmer inshore water temperature due partly to a larger area of shoal water in the vicinity of the latter tests and partly to the seasonal increase in temperature. It was assumed the change in velocity was uniform, and an approximate mean of the velocities of sheet 121 and 123 was therefore used:

Depth - fathoms	Velocity - m/s
0 - 300	1483
300 - 700	1482
700 - 1100	1481
1100 - 1500	1480
1500 - 2200	1479

SHEETS 43 and 44:

Two groups of tests were obtained in the area covered by these 1:40,000 scaled sheets, and the mean velocity found to be 1490.7 meters per second for the northern group and 1490.1 for the southern. A value of 1490 was adopted for all work on these sheets.

SHEET 123:

Great importance was attached to the velocity to be used on Cordell Bank in the southeast corner of the sheet. This shoal makes up rather abruptly from 60 to 70 fathoms in the direction of DUNCAN; passes over a 280 fathom depth in the direction of HAVEN before shoaling, and is masked from FARALLONS by the Fanny Shoal. As it was impossible to obtain three simultaneous bomb distances, or even two when actually on the shoal, and as no shore signals could be seen, the following method of computing a velocity was resorted to: The Commanding Officer observed sextant angled between the lights on Point Reyes and the Farallons, and * Sirius and Point Reyes. The true bearings of the lights were computed and the position laid down. This position, combined with sextant angles between marker buoys, several bomb distances between these buoys and the hydrophones, and sun's azimuths between the same buoys were used to compute an actual velocity. Its value was 1489 meters per second. For this complete computation and accompanying diagrams see the descriptive report of sheet 123.

The offshore velocity tests were computed graphically from bomb distances to three stations. In each case a velocity was chosen that would cause the distance-arcs from the three stations to intersect in a point. With care in plotting and with time circles drawn with the accuracy with which those were on sheet 123, it is believed the velocity can be determined within a half meter per second. Of the total number of recorded three station fixes, eleven were selected for velocity determination. The mean velocity was found to be 1479 meters per second, with an individual variation of from 1477 to 1483 meters per second. These tests also formed the basis for the velocities used in the deeper portions of sheets 121 and 122.

The following velocities were used on sheet 123:

Depth - fathoms	Velocity - m/s	Depth - fathoms	Velocity - m/s
0 - 100	1490	1100 - 1300	1484
100 - 300	1489	1300 - 1500	1483
300 - 500	1488	1500 - 1700	1482
500 - 700	1487	1700 - 1900	1481
700 - 900	1486	1900 - 2100	1480
900 - 1100	1485	Vicinity of Cordell Bank	1489

There is included with this report the tabular results of tests selected for the determination of velocity for the past season, a resume of velocities used, and a chart showing the limits of the offshore sheets, position of hydrophones, location of velocity tests and the velocities used on each sheet. The fathom curves at which the velocities were assumed to have changed were sketched in and the areas of equal velocity thereby shown.

VELOCITIES USED

Sheet	Depth-fathoms	Velocity - m/s	Sheet	Depth -fms.	Velocity -m/s
43 44	all	1490	123	0 - 100	1490
				100 - 300	1489
121	0 - 300	1480		300 - 500	1488
	300 - 1000	1479		500 - 700	1487
	1000 - 2000	1478		700 - 900	1486
[illegible]				900 - 1100	1485
122	0 - 300	1483		1100 - 1300	1484
	300 - 700	1482		1300 - 1500	1483
	700 - 1100	1481		1500 - 1700	1482
	1100 - 1500	1480		1700 - 1900	1481
	1500 - 2200	1479		1900 - 2100	1480
				Vicinity of Cordell Bank	1489

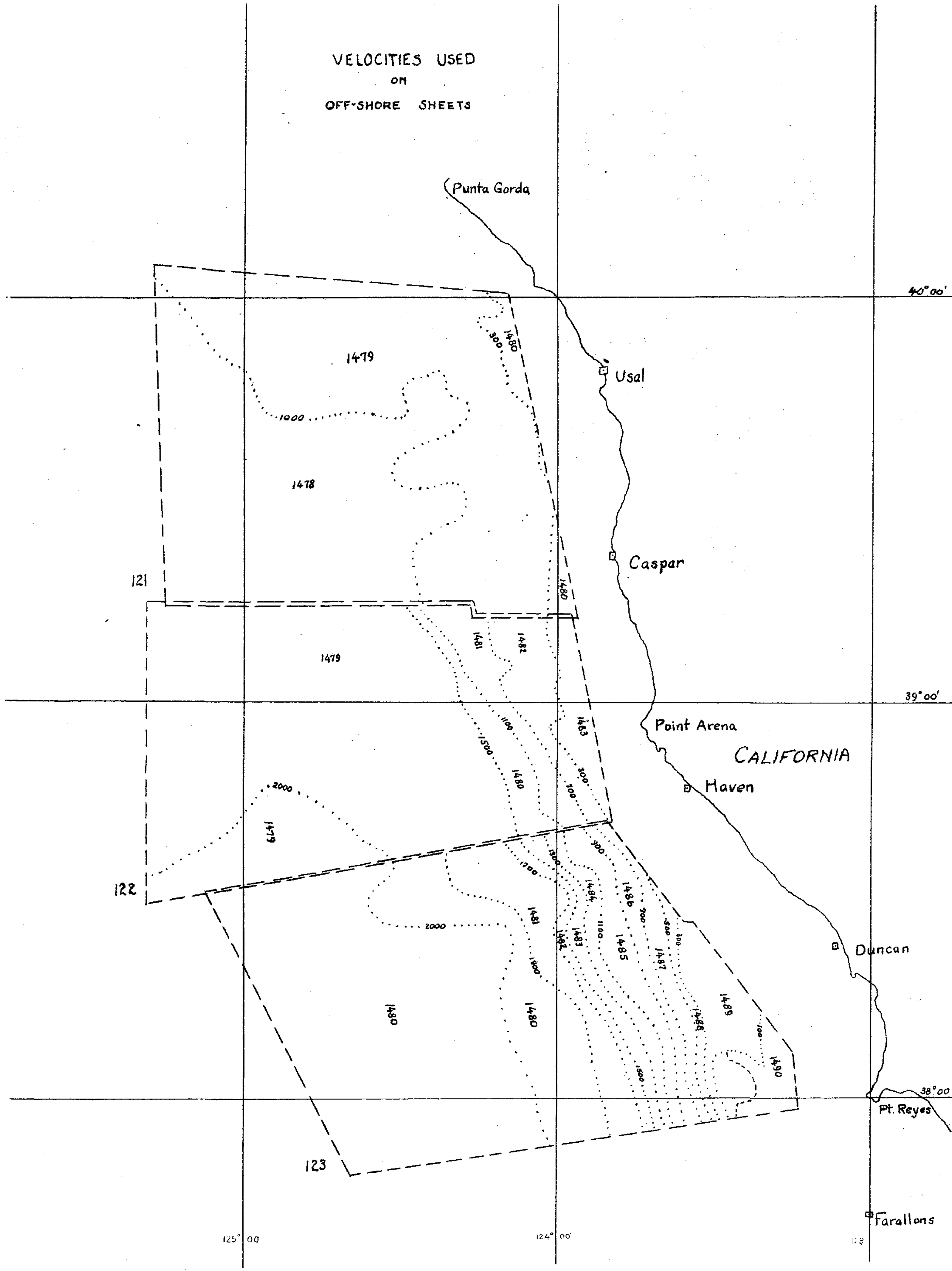
RESULTS OF VELOCITY TESTS

	Position	Date	Depth	Elapsed Time Usal	Elapsed Time Caspar	Velocity Usal	Velocity Caspar
Sheet	4L	6-7	136	37	8		1480.2
121	5L		240	37	10	1478.2	1477.9
	1M	6-17		43	10	1478.9	1477.9
	2M		86		11		1478.7
	3M		114	43	12	1478.2	1477.5
	7M		273		13		1477.5
	15M		238	44	14	1480.9	1481.0
	16M		182	45	13	1479.2	1480.2
	17M		147	44	12	1481.6	
	19M		172	45	13	1482.4	1481.5
	30M		323	47	18	1481.7	1480.7
	34M		212	47	15	1480.3	1481.1
			Average - - - - - - - -			1480.2	1479.6

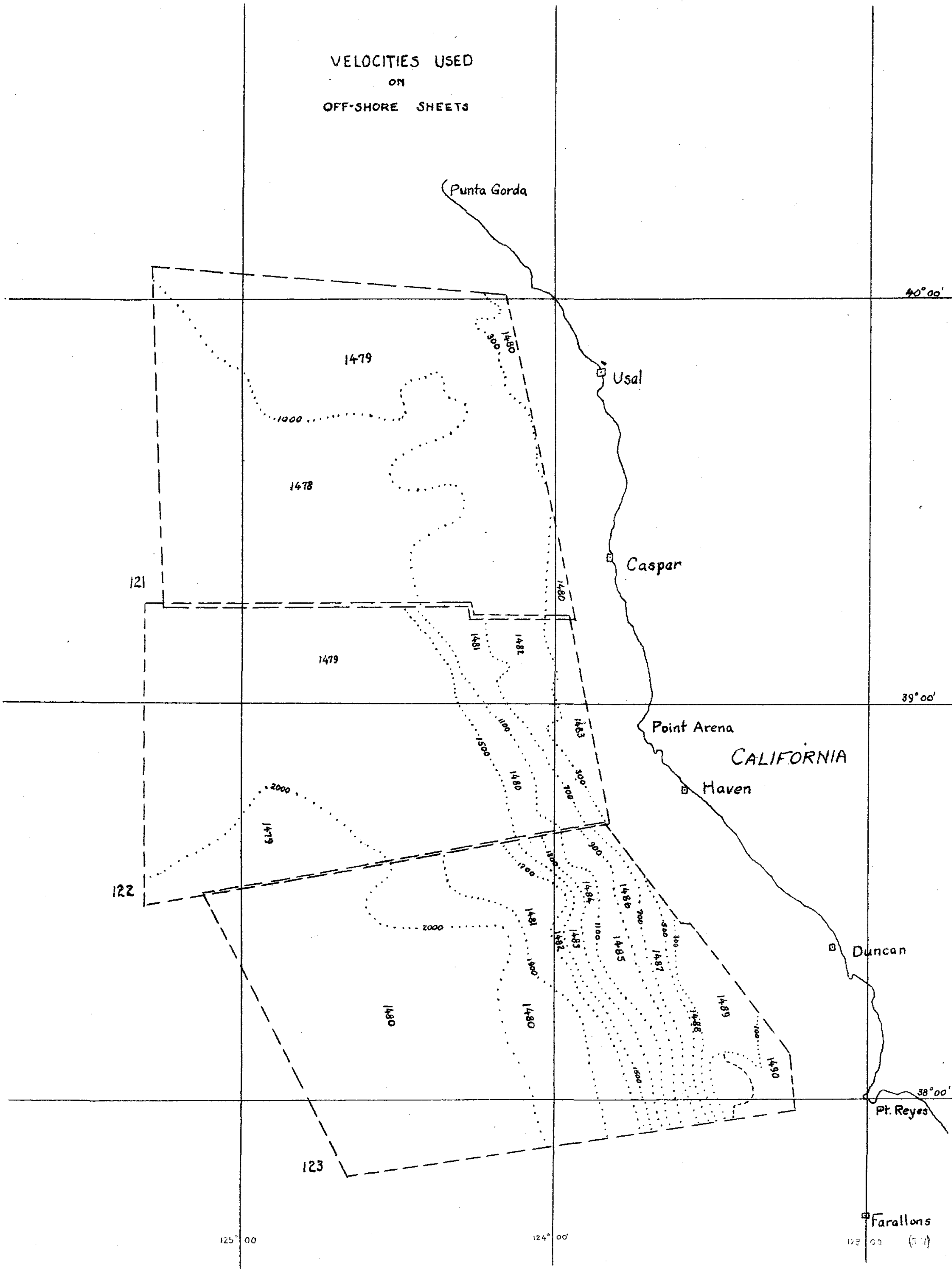
	Position	Date	Depth	Elapsed Time Duncan	Elapsed Time Haven	Velocity Usal	Velocity Caspar
Sheets 43, 44 & 123	15B	10-6	34	3	42	1478.2	1490.7
	1C	10-7	25	3	40	1491.9	1490.3
	2C		26	4	40	1482.2	1489.6
	3C		26	4	40	1489.4	1491.2
	4C			5	40	1489.3	1490.1
	9P		58	31	13	1489.8	
	10P		59	32	12	1484.5	1489.7
	11P		58	32	11	1488.7	1496.0
	12P		59	34	10	1488.3	1497.4
	13P			34	10		1492.2
			Average			1487.9	1491.9

	Position	Date	Depth	Duncan	Haven	Farallons	Velocity
Sheet 123	8M	10-21	1950	60	59	56	1479
	10M		2070	73	77	68	1477
	13M		2175	92	91	87	$1477\frac{1}{2}$
	8N	10-22	2168	94	89	91	1477
	11N		2115	76	75	75	1483
	17R	11-5	1920	63	73	55	1477
	18R		2035	69	76	61	1477
	19R		2000	75	79	68	1477
	3S	11-6	2050	83	71	92	$1480\frac{1}{2}$
	5S		2080	82	68	93	1482
	6S		2080	86	67	102	1483
			Average				1479

The velocities used by the Ship DISCOVERER are shown on the following page.


VELOCITIES USED
ON
OFF-SHORE SHEETS
Punta Gorda
Usal
Caspar
Point Arena
CALIFORNIA
Haven
Duncan
Pt. Reyes
Farallons
40°00'
39°00'
38°00'
125° 00
124° 00'
121
122
123
1479
1478
1479
1479
1480
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1000
2000
2000
1500
1100
300
700

VELOCITIES USED
ON
OFF-SHORE SHEETS



HYDROGRAPHY - R.A.R. AND SOUND WAVE PROPOGATION THEORY

From Season's Report (1929)
Ship PIONEER (O. W. Swainson, Commanding)

Three stations were established during the season; one at Point Reyes, one off the west side of South Farallon Island, and one outside Colorado Reef at Montara Point. The stations at Point Reyes and Montara Point were quite sensitive to sounds originating in water less than 100 fathoms deep, but would not very well pick up the sound of bombs exploded beyond the hundred fathom curve. The steep slope at the 100 fathom curve augmented by the twenty miles of shoaler water to the hydrophones caused the sound wave to break up before reaching the hydrophones. On the other hand, the hydrophone at the Farallon Islands was but a few miles from the steep slope and no trouble was experienced with its picking up the sound of bombs fired at the outer edge of the work, eighty miles distant and in 2000 fathoms of water. This station at the Farallones rarely failed to get the sound of the bomb. In fact, the sound of the oscillator, thirty miles distant, was received so loudly that it would trip the metronome.

During the offshore sounding, intersections were often obtained from three and sometimes four stations; the two PIONEER stations and the two DISCOVERER stations. The farthest distance at which a station received the sound wave was ninety-five miles. At this distance the station rarely missed the bomb. It is thought no trouble at all would have been experienced by the DISCOVRER'S stations in receiving the PIONEER'S bombs if Cordell Bank or any other shoal had not intervened.

The theory that the sound wave travels in a series of reflections from the ocean bottom and water surface seemed to be borne out by the following facts:

1. When there was an intervening shoal or broken bottom with a least depth of thirty fathoms, the wave seldom reached the hydrophone. If the wave passed in a direct line or along the water's surface, it would have passed over the shoal, but it was apparently broken up by imperfect reflection from the shoal or hitting the shoal on its path from a previous reflection.

2. The sound wave had difficulty in reaching a hydrophone when the bomb was exploded beyond a steep bank, such as was encountered near the 100 fathom curve. This clearly indicated that the wave front went below the depth of the source of the sound. Farallon Island hydrophone was near this steep bank and it was the only one that had no trouble in picking up all bombs exploded in deep water.

3. The net velocity between the hydrophone and the bomb was less when the bomb was fired in deep water than in shallow water. Distance in itself to phydrophone did not affect the velocity as shown by velocity to K V B from vicinity of Fanny Shoal, distant eighty miles, being nearly equal to that to K V H, a distance of twenty miles, and the maximum depth of water between the sound source and each of the two hydrophones about fifty fathoms. In deep water forty to fifty miles from the hydrophones, the velocity was four to six meters per second less. This shows that depth of water affected the velocity.

A summary of the accepted velocities used by the Ship PIONEER during the 1930 season is shown on an accompanying sketch.

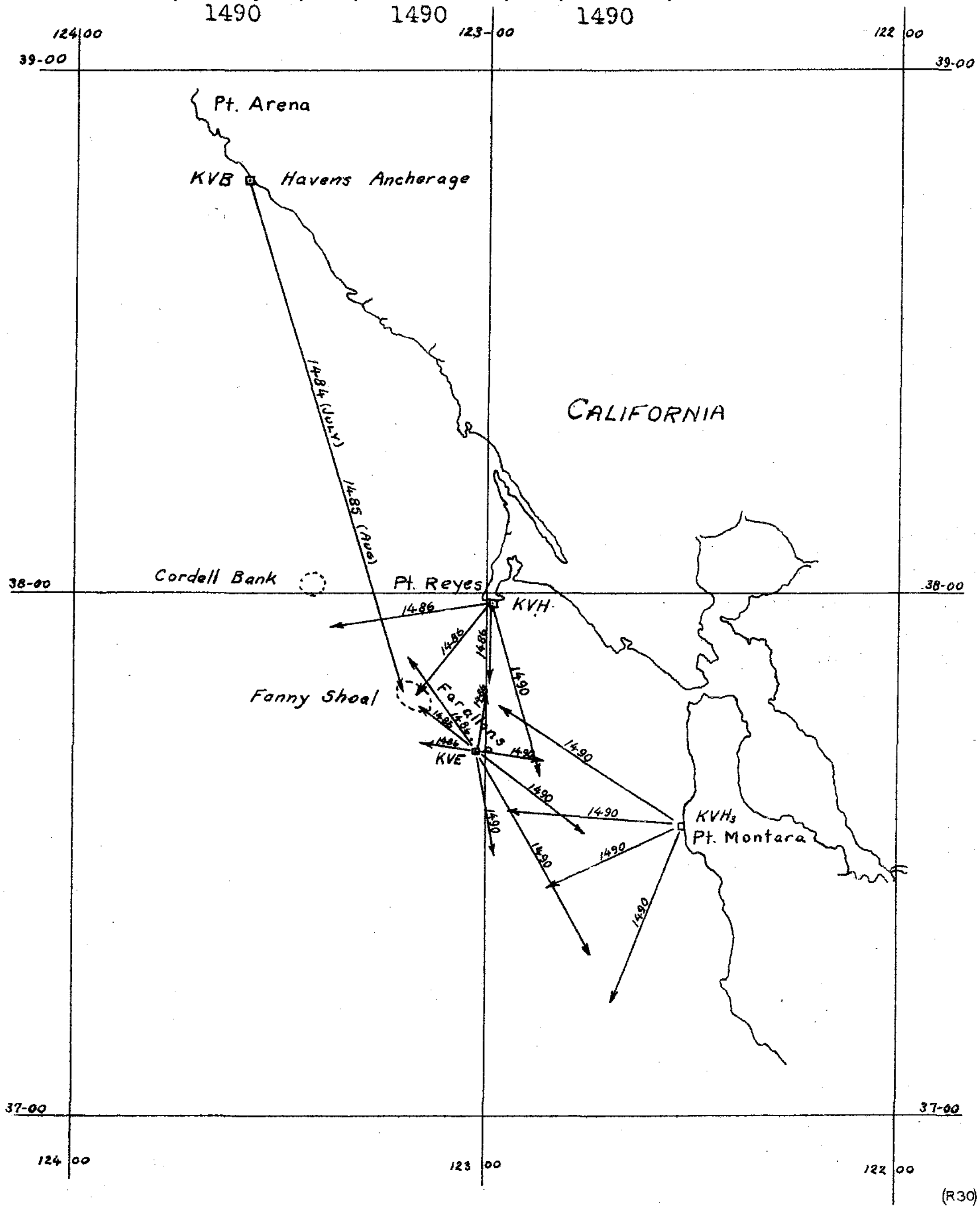
SUMMARY
ACCEPTED VELOCITIES

Area North and West of Farallones, including Fanny Shoal.

K V H	K V E	KVB	K V H_3
(Pt.Reyes)	(Farallones)	(Haven)	(Montara)
1486	1486	July. 1484 Aug. 1485	1490

Area East and South of Farallones

K V H	K V E	K V H_3
(Pt.Reyes)	(Farallones)	(Montara)
1490	1490	1490



(R30)

HYDROGRAPHY

DETERMINATION OF POSITION BY SUN OR STAR AND TWO FIXED OBJECTS.

F. B. T. Siems
Lieutenant-Commander, U. S. C. and G. S.

The survey of Cordell Bank was accomplished during a period of very poor visibility. Two buoys were planted about a mile apart in depths of 30 to 35 fathoms, and the geographic positions of these buoys were determined as will be later described. The development of part of the area of the Bank was controlled by the two buoys and the sun. Upon completion of this area, one of the buoys was shifted to a new location and this buoy with the other buoy and Sun then controlled the remainder of the Bank to be developed.

To obtain a fix while sounding, the following sextant angles were observed simultaneously:

(1) The horizontal angle R between the two buoys.
(2) The inclined or direct angle N between either one of the buoys and the Sun.
(3) The altitude of the Sun H.

The second and third angles listed above were used in deriving the horizontal angle X between the buoy and Sun, it being the base of a right spherical triangle with N and H as the other two sides, their relation being as follows:

$$\cos X = \frac{\cos N}{\cos H}$$

To plot the resulting fix, a three-arm protractor was set so that one movable arm representing the true north and south direction read the angle SUN'S AZIMUTH X, and the other movable arm read the angle R, between the two buoys. A series of lines parallel to the north and south direction were drawn on the boat sheet to orient the first mentioned arm of the protractor. In the method used on the smooth sheet, a courts protractor having lines drawn parallel to the fixed arm was used, the two movable arms being set to read respective directions to the buoys.

The inclined angle N was measured from a point on the horizon on the vertical axis of the buoy to the center of the Sun. If a point on the buoy below the horizon was used, the corresponding altitude of the Sun was measured to the level of the buoy.

The altitude of the Sun was never more than about 30° at the time of the year the survey was made. It is considered, however, that the horizontal angle X can be derived with sufficient accuracy with greater altitudes providing that inclined angles fall within a limiting range on either side of 90°, the range depending upon the altitude of the Sun. When the altitude of the Sun approaches 90°, fixing position by the Sun and two objects becomes indeterminate. As a rule the inclined angle between the buoy and the Sun which is nearer to 90° should be selected as involving the smaller correction in deriving the horizontal angle. Small inclined angles, however, are entirely satisfactory when the Sun is comparatively low in altitude.

By placing the buoys in a north and south direction with respect to one another, the area west and east of the buoys may be controlled during the forenoon and afternoon respectively. By placing the buoys in an east and west direction with respect to one another, the Sun and buoys could probably be used all day to control area north of the buoys.

The horizontal angle x between one of the buoys and the Sun was computed by calculating machine or by logarithmic tables and the Sun's azimuth was taken from a graph prepared in advance. The data for plotting were thus obtained in sufficient time to control direction of sounding line. For any extensive work, it would be advisable to use graphs from which the horizontal angle x may be read by inspection. Such graphs were later prepared by the party from which the horizontal angle could be read to the nearest tenth of a degree. Each graph represented an even degree of inclined angle of a series alongside each other ranging from 0° to 90° and from 90° to 180 in the reverse order. The abscissa of a point on the graph represented the altitude angle and its corresponding ordinate represented the horizontal angle.

The buoys were located by a combination of the following data. (See appendix to descriptive report for Sheet 123)

(1) Bomb distances from R.A.R. stations.
(2) Log distances between the buoys.
(3) Azimuths from one buoy to another obtained from angles observed to the Sun.
(4) Azimuths by Sun from ship's anchorage, the anchorage itself being located by angles observed between two lighthouses and a star on a clear night.

Referring to (3) of the above list, the azimuth of one buoy to another was determined by observing the Sun's altitude and the inclined angle between the Sun and a point on the horizon with which the two buoys were in range, then computing the horizontal angle and applying thereto by addition or subtraction as required, the Sun's azimuth. A series of these observations were made for both forward and back azimuths.

Although the visibility during the day did not exceed 1½ miles, on one of the nights while the ship was anchored on the Bank, it became very clear. Angles were observed between two distant lighthouses and between one of the lighthouses and star Sirius low in altitude. A series of inclined angles between one of the lighthouses and star Sirius were observed together with the Greenwich times of observation. The apparent altitude of the star, its azimuth and the horizontal angle for the mean instant of observation were computed. This furnished the azimuth of the anchorage to the lighthouse. The other data available in the triangle formed by the two lighthouses and the anchorage were the distance and azimuth between the former and their geographical positions, and the observed angle at the anchorage between them.

The triangle was first solved by approximating the back azimuth (lighthouse to anchorage). The difference between back and forward azimuth was then computed for the more refined distance and direction. A second computation of the triangle was then based on the new assumed value of the back azimuth and the value eventually derived for the back azimuth then agreed with the assumed value. The geographic position of the anchorage was then computed in the usual manner. (See computations attached to Descriptive Report for Sheet 123).

(From report of Commanding Officer, Ship DISCOVER, coast of California, season of 1929)

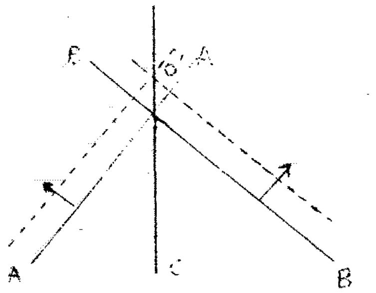
NAVIGATION--HYDROGRAPHY

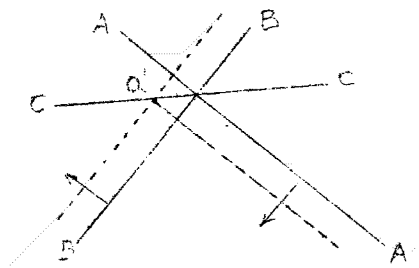
LINES OF POSITION -- SUMNER BISECTRIX

L. P. RAYNOR
Lieutenant, U. S. Coast and Geodetic Survey

The Hydrographic Manual (page 103) discusses the most probable position of the ship as determined by star sights, and for various figures, A, B, C, D, E of Fig. 29, Page 104. An interesting discussion of the reasons for the location of the most probable position is given in an article by Lt. Commander L. V. Kielhorn, U. S. Coast Guard, on "The Sumner Bisectrix," and appearing in the September (1928) issue of the U. S. Naval Institute Proceedings. This article shows that there is a simple geometrical solution for the position sought, and by following the rules given, this can be readily found. As this article mentions, the most probable line of position determined from two Sumner lines bisects the angle of intersection of these lines. I find it most easy to determine which angle is bisected by following a simple rule which may be most easily explained by diagrams:

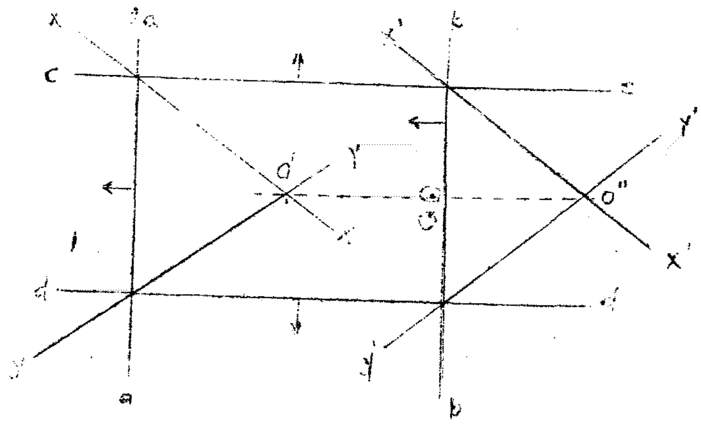
In each case A-A and B-B are the Sumner lines, the arrows showing the direction of the celestial objects observed. One can draw the dotted lines either mentally or lightly with pencil, after asking one's-self how a systematic





error will effect each Sumner line, and remembering that this error will affect each line in the same direction, either towards or away from both objects observed. The intersection of these dotted lines is at O', which shows the line must pass through O' and be the line C-C in both cases.

Applying the foregoing rule to Case D of Hydrographic Manual simplifies considerably the determination of the most probable point; first, find the Sumner Bisectrix for line a-a and c-c, which will be along line x-x; the Sumner Bisectrix for a-a and d-d is the line y-y; their intersection O' is the most probable position for the three lines in question. Similarly, O" is the most



probable location for the three lines b-b, c-c and d-d, while O at a point midway between O' and O" is the most probable position of the four lines, assuming that all sights have the same value.

HYDROGRAPHY

Comparison of Velocity of Sound Tables of British Admiralty with Those of the U. S. Coast and Geodetic Survey

Jerry H. Service

In both cases the tables were computed from the relation that the velocity of propogation of wave motion in a given medium is equal to the square root of the elasticity - to - density ratio for that medium. (Page 4, Special Publication No. 108). Since density values of very great accuracy are available, the velocities computed by this method are limited in their accuracy by the accuracy of the elasticity value used. Both services used the same density values. Also both used the elasticity values measured by Ekman, but where the Coast and Geodetic Survey used them by a method involving a minimum of computing labor, which probably introduced small errors due to rounding off the last digit, the British Admiralty has used Ekman's data directly.

When we prepared Special Publication 108 we considered using Ekman's results directly, but estimated that velocities so computed would not differ from those computed by the shorter method actually used by more than the possible errors due to errors in the elasticity measurements. The attached comparisons seem to prove that this estimate was correct. Edman states that his elasticity values are probably never in error by more than 1 per cent, which means that velocities computed from them by the most exact method would probably never be in error by more than 1/2 per cent or 4 fathoms per second. That is to say, the B. A. velocities, which were computed by the most exact method, may be in error by as much as 4 fathoms per second. It will be seen in the following comparisons that: (1) The Coast and Geodetic Survey tables never disagree with the B. A. tables by so much as 4 fathoms per second; (2) the Coast and Geodetic Survey tables involve less labor in their application to our work than do the B. A. tables.

COMPARISON OF TW0 SETS OF TABLES WITH EACH OTHER

Source	Temp. C°	Salinity Pts. per 1000	B.A. Tel. fms/sec.	C.& G.S. Vel. fms/sec.	B.A.-C.& G.S. fms/sec
Surface	0	32.0	789	791	-2
"	0	36.0	791	793	-2
"	10	32.0	811	813	-2
"	10	36.0	814	816	-2
"	20	32.0	829	829	0
"	20	36.0	831	833	-2
"	30	32.0	842	843	-1
"	30	36.0	845	848	-3
300 fms.	5	34.0	807	807	0
" "	20	34.0	835	835	0
1100 fms.	0	32.0	809	808	+1
" "	0	36.0	811	811	0
" "	6	32.0	823	822	+1
" "	6	36.0	825	826	-1

Source	Temp. C°	Salinity Pts. per 1000	B. A. Vel. fms/sec.	C.& G.S. Vel. fms/sec.	B.A.-C.& G.S. fmS/sec
2100 fms.	2	32.0	831	830	+1
" "	2	36.0	834	833	+1
3300 fms.	0	35.0	850	851	-1
4300 fms.	0	35.0	868	867	+1

Mean discrepancy 1 fm/sec.

COMPARISON OF COMPUTING LABOR INVOLVED IN USING
THE TWO SETS OF TABLES IN REDUCING SOUNDINGS

Given salinity of water 34°/oo

Required velocity of sound to use in soundings of about 1000 fathoms for layer temperature as given below:

Computation by C. & G. S. Tables

Depth	Temp. deg.C.	Table 13	Table 10	Layer Vel.
		fathoms/sec.		
100 fms.	16	821	3	824
300 fms.	10	817	2	819
500 fms.	8	815	2	817
700 fms.	6	815	2	817
900 fms.	4	815	1	816

Mean = velocity for reducing soundings 819 fas/sec.

Computation by B. C. Tables

Depth	Temp, deg. C.	Table 2	Table 3	Table 4	Layer Vel.
		meters/sec.			
100 fms. = 183 m.	16	1506.8	-0.8	+3.3	1509.3
300 fms. = 549 m.	10	1486.5	-0.9	+9.9	1495.5
500 fms. = 915 m.	8	1479.0	-1.0	+16.5	1494.5
700 fms. = 1280 m.	6	1471.1	-1.1	+23.2	1493.2
900 fms. = 1646 m.	4	1462.9	-1.1	+29.8	1491.6

Mean = velocity for reducing soundings (1496.8 m/sec.
(818 fms/sec.

Note: A comparison between the values determined by the DISCOVERER and the PIONEER, during their 1929 season on the California coast, and the British Admiralty Tables (area No.18) covering this locality, are shown:

Depth Fathoms	Sounding Velocity per second DISCOVERER	PIONEER	B. A. #18
100	809	814	817
300	808	811	812
500	808	810	810
700	808	810	810
900	809	811	810
1100	810	812	811
1300	811	813	812
1500	812	814	813
1700	813	816	816
2000	815	817	817

SHELL MOUNDS OF THE PACIFIC COAST AND THEIR RELATION TO THE RATE OF EROSION

Curtis Le Fever, Ensign, U.S. C. & G. Survey

While engaged in topographic work along the Oregon coast from Yaquina Head south to Coos Bay in 1928, I noticed some unusual deposits of broken shell in the shape of mounds, or, in some cases, circular rings with depressions in the center. These mounds were on top of the low bluff or close to the mouths of streams but were always found close to the surf. Many of these deposits that were located on top of the bluff were partially carried away by caving due to surf erosion. This caving left a cross-section of the mound and in one case bones of a small animal were found projecting from the cross-section.

While in the vicinity of Heceta Head, Oregon, I met a geologist, Mr. Warren D. Smith of the University of Oregon. He expressed the belief that the shell deposits were placed there during the period of the American Indian, being perhaps the refuse from tribal feasts on the shell fish from the surf-covered rocks below. There are several evidences, however, which tend to disprove this assumption.

The mounds are very numerous along this part of the coast and each contains a large quantity of shell. Some of them seem to have been as much as twenty-five feet in diameter and three or four feet deep. The shells undoubtedly are the refuse heaps from the camps of a people who were fishers and hunters only, and who depended chiefly for their nourishment upon the shell fish from the bared rocks along the coast. These shell mounds appear to be very ancient, for in most instances they are covered by as much as six inches of soil. Also, there is black soil among the shells, showing they have partially decomposed.

These mounds greatly resemble those described as existing along certain parts of the coast of northern Europe, the shores of the Baltic Sea. They are called "Kitchen Middens" (Kjoken modings), the refuse heaps of the earliest kitchens which smoked in these regions. The Kitchen Middens were left there by what is known as the second race of men, those of the polished stone age, the Paleolithic Era. These people lived along the sea and obtained their food from the shallow water and exposed rocks. They had no means or knowledge of obtaining food otherwise. The shell mounds of the Pacific Coast may be as ancient as those of Europe. If so, this probably could be determined by careful study and investigation.

The shell deposits have a direct relation to the comparative rate of surf erosion along the Pacific Coast. While working along the California coast from Punta Gorda south to Bodega Head, I examined several locations where I thought shell remains might be found. Only in two or three cases did I find what seemed to be shell mounds. These are on the edge of the bluff and are disappearing with the erosion of the coast line. Indications are that the rate of erosion along the California coast examined has been greater than along that part of the Oregon coast examined.

TOPOGRAPHY

DISTORTION OF SHEETS AND ADJUSTMENT OF TRAVERSES

L. S. Hubbard, Lieut, (j.g.) U.S. C. & G. Survey

DISTORTION OF TOPOGRAPHIC SHEETS

In Alaska where fog and drizzle are common, much distortion of topographic sheets results. During the season of 1929, the sheets on the SURVEYOR were distorted on an average of 4 meters per nautical mile, the short way of the sheets, and 12 meters per nautical mile the long way of the sheets. The axes of expansion and contraction were parallel to the edges of the sheet, of course, because the weave of the cloth backing the sheets was parallel to the edges.

The constant contention with distortion led to several practices to facilitate compensating for the errors due to distortion.

Systems of Coordinates and Units of Distortion.

When estimated the amount of distortion between two points, the instructions of the topographic manual call for the use of units of distortion consisting of the amount of distortion in meters, per thousand meters, applied to axes parallel to the edges of the sheet. Instead of these units, however, the amounts of distortion per minute of latitude and per minute of longitude were used as units. This made measuring distances between points a matter of counting squares on the sheet, quite an advantage in the field.

With an askew projection having unequal distortion at right angles, the squares of latitude and longitude become lozenge shaped, with non-rectangular corners. These units of measure will not then be along coordinates in the true sense of the word. Measuring along the parallels of latitude and longitude, however, will give correct results.

Three Point Problem on Distorted Sheet.

To work three point problems on a distorted sheet, the true positions of the three stations used for control must be estimated, as illustrated in the topographic manual. The amount of displacement of each of these signals depends upon its distance from the plane-table position. Estimate the coordinate distances as explained previously and multiply each by its unit of distortion. The combined coordinate displacements give the estimated position of the station.

Traverses on Distorted Sheet.

In running traverses it is advantageous to orient on the plotted and distorted position of the station towards which the traverse is run, instead of on its estimated true position, for then cuts in the general direction of that station will plot about as they should on the distorted sheet. This is in accordance with the instructions of the topographic manual. In running traverses along a winding shoreline, however, it is not usually possible to see the station toward which a traverse will run. Orienting on the distorted position of some other station will not give the sane angular difference in azimuth that exists between the true and the plotted positions of the station toward which the traverse runs, except in the unusual case where the back station is 180° in azimuth from the terminal station.

It is simpler in this case to put the plane-table in its true azimuth by estimating the true position of the back-sight station and sighting on it. The traverse is then run without correction for distortion. It will end at what would be the true position of the terminal station. The traverse can now be adjusted to its distorted position on the sheet -- as it should be to fit in with the distorted projection.

ADJUSTMENT OF TRAVERSES

Closures Due to Erroneous Distances.

In running along traverses the closing error will often be due solely to a constant personal equation in reading the rod distances. If consistently read short in distance, for example, the traverse will place all points in the true azimuth from the initial position but short in distance. This is equivalent to having a true representation of the shoreline, but on a smaller scale than that of the projection. The adjustment at each intermediate station will then bear the same ratio to the total closure that the straight distance from the intermediate station to the initial station bears to the straight distance from the terminal station to the initial station.

At a point in a bight, where the traverse reverses on itself, this method is more accurate than making the amount of adjustment proportional to the distance along the shore. This is so because when the traverse backs on itself the constantly short readings of the rod gradually reduce the amount of error. If the adjustment were made in proportion to the linear distance along the shore, the amount of error would be increased.

Closures Due to Distortion.

In a long traverse running nearly in a straight line between the initial and terminal stations, adjustment due to distortion may be made in direct proportion to the distance from the initial station.

When the traverse, however, runs appreciably away from the direction between the initial and terminal stations, the distorted positions of salient intermediate points should be determined by the application of the distortion units to the coordinate distances and the intervening traverses adjusted to these points. This is applicable when the distortion factors are unequal.

Closures Due to Both Erroneous Distances and Distortion.

The error of closure due to erroneous distances is constant in any direction, while the error due to distortion is one value in one direction and another value entirely in the direction at right angles to the first. In long traverses, therefore, it is often advisable to adjust the combined errors in separate steps at salient points. Applying the distortion correction to the terminal station leaves the remainder as the distance error of closure. The adjustments at intermediate points can now be readily determined by the previously mentioned methods.

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SOME PERSONAL RECOLLECTIONS OF OVER TWENTY YEARS AGO

H. A. Seran, Lieutenant-Commander, U.S. C. & G. Survey

About 8:00 o'clock in the evening of June 30, 1907, direct from a fresh water college in Ohio, I reached Washington, D. C., for the first time. An appointment as Aid in the Coast and Geodetic Survey and instructions to report for duty on July 1st were carefully folded in my pocket.

Upon reporting to the Assistant Superintendent and taking the oath of office, I was ordered to duty in the Computing Division. The Computing Division in those days was an entirely different division from what it is to-day. Among others was Mr. Doolittle, a famous computer and the originator of the Doolittle method of solving equations. He was at this time quite old and in order to know when to stop work in the afternoon, he had an alarm clock in his office which sounded off at 4:30. Needless to say, this alarm could be heard throughout the Division. It may have been the forerunner of the signal which is given on the Auto-call to-day, which tells those who have not already done so to put on their hats, coats and galoshes preparatory to trying to work their various ways home through the jam of traffic, red and green lights, busses, street-cars and trucks. Mr. Doolittle always wore carpet slippers in the office. That type of footwear must be extinct as the dodo bird to-day for it is never seen except in fancy dress costume.

Another computer was Mr. Dennis. Years before he had been in the field force, and among others who had served in his party was the then Superintendent, Mr. O. H. Tittmann. Two lady computers were very much in evidence, Miss Beall and Miss Pike. The former was engaged principally upon astronomic computations and the latter in the computations in connection with precise levels. The Chief of the Computing Division at that time was J. F. Hayford, afterwards Dean of the School of Engineering at Northwestern University.

For a reason which seemed plausible at that time, but which would be regarded as foolish to-day, smoking was not permitted within the sacred confines of the Division. Strange to say, not many of the computers smoked, so the rest rooms were never too crowded to find space when the craving became insistent.

The Chief of the Computing Division called the Chief Computer, A. L. Baldwin, now the genial district manager of the Northwestern Life Insurance Company, and told him to put me to work. Mr. Baldwin passed me a bunch of record books, a cashier of field computations, a progress sketch and a copy of Wright and Hayford's "Methods of Least Squares" and told me to adjust that scheme of triangulation. The triangulation was a small scheme up the York River, Virginia, which had been observed by the present Chief of the Division of Geodesy, Captain Bowie. How easy it was for Baldwin to say that, but what consternation it caused in my mind. Adams Manual on Triangulation Adjustment had not been written or even thought of at that time, and as I had had no instruction in least square adjustments, I had to do no small amount of digging to find out just what I was supposed to adjust and how I was to adjust it.

There were eight other Aids who, like myself, had just been appointed and we all struggled together. Kurtz, Maynard, Stanton, Swick, Wells, Colbert, Garner, Purton and myself were scattered all over the Division, trying to look busy, but more engaged in trying to size up the whole situation.

Fortunately, we all received orders to the field during the month of July before the specture of least squares had completely squelched us.

Captain Heck in those days was wiredragging New England coasts in the summer and Florida coasts in the winter and always had a bunch of youngsters in his party. Four or five of our bunch were ordered to his party; the others were scattered all over the States. Purton and I drew orders to report to the Commanding Officer of the Schooner Matchless at Saxis, Virginia, for duty. That party was engaged in a hydrographic survey of Pocomoke Sound on the Eastern Shore of Virginia, at the same time orders were issued to Captain O. W. Ferguson to proceed to Saxis and relieve Captain Vinal as Commanding Officer of the Matchless. Purton and I were to receive our training in Coast Survey ways and methods under one whose appointment in the Service was reputed to be due to his ability as the best precise leveler in the United States.

The steamer to Saxis sailed from Baltimore in the late afternoon. Captain Ferguson, Purton and myself had gone to Baltimore earlier in the day for a final try-on of uniforms which were being made for us by the New York Clothing House - our old friend Jessie Rosenfeldt, whom practically all officers meet sooner or later.

We reached Saxis wharf, Virginia, about noon the next day. The Matchless was anchored about a quarter of a mile off the wharf but Captain Vinal, who had been informed of our arrival, had a small boat awaiting us. This permitted us to go directly aboard.

To a lad coming from the fresh water lakes and rivers of Ohio, the Matchless appeared wonderful. Retrospection shows the dark bilges and forecastle, the stuffy and smelly wardroom and cabin, the inadequate toilet facilities and other antiquated and unpleasant features, but at the time she looked like a yacht to me.

In order to give me a proper initiation, while sleeping with my port open, the first night the Matchless swung to the tide and shipped a few gallons of Pocomoke Sound water into my bunk, drenching my bed and myself and making it necessary for me to crawl in with Purton for the balance of the night.

Our first working day Purton and I were sent out with the launch hydrographic party for instruction in measuring angles with a sextant. Jim Marsh, the Mate on the Matchless, was in charge of the hydrography and he kept Purton and me checking the angle he was measuring for a couple of days before he would allow us to shoot an independent angle. After about 15 minutes' practice we both assured him we were able to carry on, but he only smiled. To look back on it now I'm not at all certain it would have been safe to have taken us at our words, altho subsequent experiences in the Philippine Islands with native members of the crew who spoke very "few Englishes" who could shoot sextant angles with the best of them make me think that possibly we would have gotten along all right.

Our first Sunday aboard we appeared on deck in our new uniforms, which had arrived only the night before. Say what you please, the old close-fitting blouse with its tight collar was a neat appearing rig. Purton and I would not have exchanged places with the President of the United States that day. True Purton heard some scurrilous remarks on the forecastle deck, but we were in much too good a humor to take them seriously.

We remained at anchor off Saxis about four months after our arrival until the survey of Pocomoke Sound was completed. During our stay there we managed a trip or two to Chrisfield and also Pocomoke City, Chrisfield was a city built largely on oyster shells and the buzzards were so thick overhead that a random shot in the air most likely would have brought one tumbling down. Pocomoke City was a great cannery center and at that time the county fair was held there. The Jamestown Exposition was held that year and I took a few days' leave for a "look see". Memory of the Exposition is pretty dim, so there must not have been much of interest. I stayed at the Inside Inn and well remember the quarter mile or so of mud flats that stretched Bayward in front of the Hotel at low tide.

When the Pocomoke Sound survey was finished we received orders to proceed to Solomon's Island, Maryland, for general surveys around the mouth of the Patuxent River. Our little cruise across the Bay was uneventful, altho we ran into a head wind and made very little progress against it. At that, we reached the harbor off Solomon's early the next morning and dropped anchor. I came out of my bunk in a hurry on the way in when I heard the leadsman sing out "3 feet". We were actually skirting the edge of the middle ground so closely that he got that sounding. Captain Ferguson went ashore soon after we arrived and arranged for a berth at the dock. We moved to the dock that morning and settled down to a life of Reilley for some time.

On this survey we had both hydrography and topography to do. As neither Purton nor I had ever run a plane table, Captain Ferguson's first work was to give us some instruction. After a day or so he sent us both out, each with a plane table outfit - needless to say, it took us some time to get onto the hang of things, but in due time things were humming, with two topographic parties and one hydrographic party leaving the Schooner's side at 8 o'clock each morning.

Before this project was completed we received hurry-up orders for a survey of St. Mary's River near the mouth of the Potomac River. Early in January, 1908, we sailed from Solomon's Island to Miller's Wharf, Smith Creek, and in the dead of a severe winter we tried to do hydrography and topography. To sketch topography when your fingers are so cold that they can not grasp the pencil is some difficult task, and artistic effects under such circumstances are out of the question. To sound through ice so thick that the lead can hardly break through it would not be regarded as good, or even passable practice, to-day.

Purton and I were relieved from duty on the Matchless while this work was under way by Eawley and Siems. Our first intimation that they were coming was when they blew aboard about 2 o'clock one morning looking for a place to sleep. Purtom and I were ordered to Washington office en route to the West Coast. Purton was assigned to the McArthur and I to the Patterson. On my way to the West Coast, some leave was taken and this, my first visit home after entering the Survey, was a memorable visit. You may imagine the way I described the work of the Coast and Geodetic Survey to those in Minerva, Ohio, to whom a theodolite was some sort of a lantern, and a sextant some sort of an immoral instrument. My prospective trip to Alaska caused a great deal of comment and envy, especially among the fellows with whom I had associated in high school days.

The complement of officers on the Patterson the season of 1908 was greater than she could accommode. Thirteen wardroom officers were assigned to the ship, which had only ten single staterooms. That meant that the three junior officers had to sleep on cots in the wardroom and pile their clothes wherever possible. As I was one of the three, I don't recall my first ocean cruise as a cruise of joy or pleasure. To add to our discombort, the cots had to be clear of the wardroom deck by 8 o'clock in the morning. As one of us had the mid-watch from midnight to 4 A.M., his sleep that night was nothing to brag about.

Of the officers aboard the Patterson that year, few remain in the Service. Captain Hodgkins passed away some years ago; the Executive Officer, Clifford Quillian, is in the insurance business in Seattle and maintains contact with the most of the personnel around Seattle; the second officer, Henry Beck, is Superintendent of Lighthouses in Charleston, S. C.; the four mates, Stanford, Whitehead, Thomas and Duffy, have scattered to heaven knows where; the doctor, Marchand, is in one of the Departments in Washington; the Chief Engineer, John Wyer, is on duty in the Philippine Islands; of the six Aids, Stanton, Wells, McChristie, vinal, Franks and myself, I am the only one left in the

Service, and the only one of the others with whom I have maintained any contact at all is Franks. He is now with a firm of construction engineers in Chicago.

The orders that year called for our sailing from Seattle on March 1st and proceeding to Dutch Harbor via Kodiak. The Yukon, which had been laid up at Dutch Harbor for some years, was to be placed in commission, brought to Kodiak Island, and used on the surveys that year. We did not sail on March 1st, and on March 2nd we commended receiving telegrams from the office wanting to know the reason for the delay. We finally got away from Seattle on March 8th. We stopped at Victoria, B. C., to stock up the wine mess - another old institution that has gone the way of corsets, petticoats, etc. - and also stopped at Alert Bay for coal. From Dixon Entrance we sailed direct for Kodiak. After a brief stop at the town, at which time Vinal was put ashore in the company house on account of being ill, we went on to Dry Spruce Bay where a camping party was established wo work while the ship went on to Dutch Harbor. Quillian was left in charge of the camp, with Wells as topographer and Stanton and McChristie to aid him with the hydrography, triangulation, signal-building, etc.

The Patterson reached Dutch Harbor on April 16th, after an exceedingly rough trip. Frequent anchorages were necessary along the coast and outlying islands. At that time there were six feet of snow on the lowlands; some of the drifts reached to the eaves of the houses. Under such conditions the work of placing the Uukon in commission got under way rather slowly and it was not until the middle of May that we were able to launch her and commence thinking of the return trip.

For some unknown reason, Captain Hodgkins decided to leave Dutch Harbor on Sunday and about eight o'clock that morning gave orders to get everything ready for getting under way. Practically the entire crew refused to turn to - this resulted in his setting the whole bunch ashore at Dutch Harbor only a few days after the monthly mail steamer had left for Seward. With the aid of the cooks, messboys, etc., the launches were hoisted, ship prepared for sea and we left Dutch Harbor in the afternoon. The Yukon trailed along behind the Patterson. Mate Whitehead had been placed in charge of the Yukon and Mate Thomas and Aid Franks detailed to the Yukon for the return trip.

Our month's stay in Dutch Harbor was rather pleasant. There were three employees of the North American Commercial Company - the only inhabitants of Dutch Harbor - living in the company house and we did considerable entertaining back and forth. Among other things, the Company provided a billiard table so billiards were in order practically every night. We also managed a few stag dinners which, with the embellishments that were possible in those days, resulted in lots of fun and usually a headache the next day.

After a more or less uneventful return trip, the Patterson and the Uukon reached Uyak Bay some time the early part of June. The Yukon was left in Uyak to make a hydrographic survey of the inner harbor, while the Patterson went on to Kodiak for coal and mail. Mate Thomae was placed in charge of the Yukon for this work with Franks and myself to assist him. The Yukon barely sat on the top of the water and at times at anchor she would get caught between wind and tide and just about roll us out of our bunks.

The Patterson returned from Kodiak in about a week with our first mail since leaving Seattle. On board the Patterson as a passenger was Captain H. C. Denson, who was to assume command of the Yukon, and Aid E. C. Kinnear, who also was assigned to the Yukon. Kinnear had come to Kodiak on the Explorer.

Denson having command of the Yukon gave rise to a very funny situation which caused amusement to all of us throughout the season. Captain Hodgkins flew a blue pennant on the mizzen of the Patterson to indicate and signify the "Senior Officer Present". There were four ships working in that section of Alaska that year. In addition to the Patterson there were the Explorer under the command of Dibrell, the McArthur under the command of Rhodes, and the Yukon, under the command of Denson. The Yukon was by far the smallest unit; she was little more than a launch. As soon as Denson assumed command, he hoisted a red pennant to signify the second in command. All during the season then the Patterson cruised with a blue pennant and the Yukon with a red one.

At the close of the season, on account of the crowded condition of the wardroom of the Patterson, permission had been received to return the officers of the Yukon and the surplus officers of the Patterson to Seattle on commercial steamer. Hence, Denson, Stanton, McChristie, Kinnear and I had the fun of traveling on the old Portland. We were in Valdez on October 24th and it was 25 below zero.

Seattle looked good to us, even though the usual rain obtained when we landed.

There were a lot of young officers in Seattle that winter and we had a delightful time. Thanks to Mrs. Bender, the step-daughter of Captain Hodgkins, we soon had loads of friends. Dinner parties and dances were frequent. In a month or so our social whirl was rudely shattered by orders for field work during the winter. The Patterson was to engage in current observations off Muckilteo, the McArthur was to take up a survey of Port Angeles, the Gedney was to revise the surveys of Tacoma and the Explorer was to proceed to San Francisco for surveys in the vicinity of the Farallones. With this scattering of the ships and subsequent detachments and shifts of officer personnel, the bunch soon was scattered; some never have met again to this day.

As I have been writing these lines, I've tried to think of the funniest incident that happened on my first Alaskan cruise and I believe the following wins, hands down: The wardroom mess of the Patterson had purchased a phonograph and a number of records before leaving Seattle. We had among other records one of "The Sextet from Lucia" - a 12 or 14-inch record - and "Red Wing", a 9-inch record. The phonograph was secured at the after end of the wardroom where there was little light. Someone had been playing the record of the "Sextet from Lucia" and had not removed the record. Dr. Marchand some time later decided he wanted a little music. He picked up one of the 9-inch records, placed it in position, started the phonograph, said something about being tired of the "Sextet", took off his 9-inch record, and spent some time looking for "Red Wing". When he had found it, he put it on the phonograph again, started it, and to his consternation, the same strains of the "Sextet from Lucia" were heard. It was a long time before he recovered from the shock or before he could be kidded about his fondness for Grand Opera.