

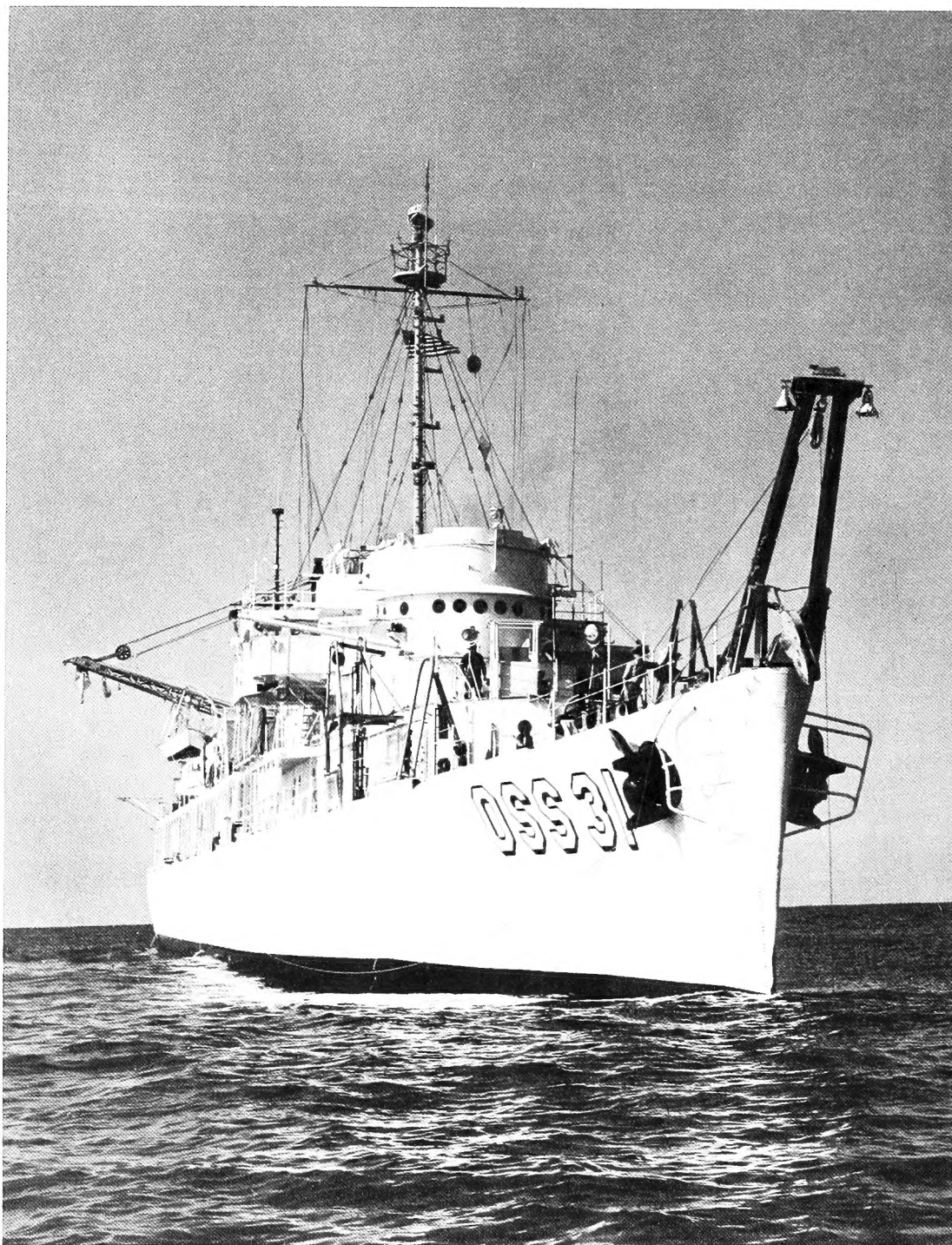
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NAUTICAL CHART MANUAL

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NAUTICAL CHART MANUAL

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PRACTICAL GUIDANCE
FOR CARTOGRAPHERS AND ENGINEERS

ENGAGED IN
CONSTRUCTING AND REVISING NAUTICAL CHARTS

EMPHASIZING
DETAILS OF CURRENT PRACTICES

AS DEVELOPED BY THE
COAST AND GEODETIC SURVEY

SIXTH (1963) EDITION

Edited by
WALLACE A. BRUDER
*Assistant Chief, Nautical Chart Division
Office of Cartography*



Publication 83-1

U.S. DEPARTMENT OF COMMERCE

Luther H. Hodges, *Secretary*

COAST AND GEODETIC SURVEY

H. Arnold Karo, *Director*

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PREFACE

This sixth edition of the Nautical Chart Manual has been prepared as a practical instruction guide to cartographers and engineers in the construction and revision of nautical charts. To serve this purpose it must present the basic essentials of chart construction and the details of current charting practices of the Coast and Geodetic Survey, U.S. Department of Commerce.

Due to the inherent variables of chart usage and need, no two charts may ever be exactly similar in character and scope. The economic importance and development of an area, the number and kinds of dangers therein, and the scale requirement are some of the variables that make a nautical chart an individual work that must, however, conform to general standards.

The primary purpose of this Manual is to define these standards in a manner that, when applied, insures accuracy, completeness, uniformity, and simplicity in the general appearance of the nautical charts issued by the Coast and Geodetic Survey.

The first edition of this Manual, a 34-page pamphlet entitled "Rules and Practice Relating to Construction of Nautical Charts," by George L. Flower, Chief, Drafting Section, was published in 1920. In 1944, Mr. H. R. Edmonston, Assistant Chief, Nautical Chart Branch, reconstructed and expanded this Manual to 55 loose-leaf pages, including for the first time, the symbols and abbreviation sheets. Three subsequent editions, each entitled "Nautical Chart Manual," by H. R. Edmonston, Chief, Nautical Chart Branch, were published in 1948, 1952, and 1956. This 1963 printing, the sixth edition, under the administration of CDR Marvin T. Paulson, Chief, Nautical Chart Division, was edited by Wallace A. Bruder, Assistant Chief, Nautical Chart Division. This sixth edition includes extensive revisions, reconstructions, and additions by the entire personnel of the Nautical Chart Division and brings the instructions and other details up to present practice.

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NAUTICAL CHART MANUAL

INTRODUCTION

In the early 1800's some interior territory and 16 States along the eastern seaboard comprised our Nation. Commerce between the States was mostly waterborne. Foreign trade, necessary for the survival and expansion of our national economy, was entirely by sea.

Lack of nautical charts—the most fundamental of navigation instruments—made navigation dangerous in the unknown waters of our coasts and harbors. Inadequate sketches of a few isolated areas, and written descriptions such as Blunt's Coast Pilot, were the only information available. Shipwrecks were common, insurance rates high, and products correspondingly overpriced. Maritime commerce, as a means for the development of our natural resources, was deterred by these unknown dangers. Safe navigation of our coastal areas and harbors became a serious, urgent problem.

Thomas Jefferson, among others, had foreseen the need for comprehensive, reliable nautical charts to safeguard shipping, and considered the Government responsible for producing them. On February 10, 1807, Congress passed an act authorizing President Jefferson to start a national hydrographic survey . . . "to cause a survey to be taken of coasts of the United States, in which shall be designated the islands and shoals and places of anchorage. . . ."

The "Survey of the Coast" (name changed to "Coast Survey" in 1836, and to today's "Coast and Geodetic Survey" in 1871) began making hydrographic surveys in 1834. The earliest nautical chart, a black and white print made in 1839 from a stone engraving, showed Newark Bay, but gave little detail. Although lacking detail, this first chart established the policy of exceptional cartographic accuracy that is a continuing characteristic of the Coast and Geodetic Survey's modern detailed nautical charts.

Today, the activities of the Coast and Geodetic Survey in the field of engineering, science and higher mathematics provide data vital to the development of navigation, industry and national defense. Remaining high among the varied functions of this technical Bureau is the responsibility of conducting surveys and publishing nautical charts of the 2½ million square miles of coastal waters of the United States and its possessions in order to provide navigational safety.

One of the most important aids the mariner needs for safe navigation is the modern nautical chart. It is constantly used to plot positions and courses and is considered so indispensable in the United States that the Code of Federal Regulations requires vessels to have charts of the waters on which they operate available for convenient reference at all times.

Among the more important improvements made in compilation and reproduction methods and materials in recent years are: generalization of hydrographic and topographic detail for greater legibility; addition of selected topographic detail to aid navigation by radar; plotted Loran lines for more accurate position determination; detailed fine-line depth curve development of submarine relief; development of three types of folded charts for small-craft use; extensive use of dimensionally stable plastics; and the standardization of symbols and use of accentuating colors.

Illustrations in Chart No. 1, "Nautical Chart Symbols and Abbreviations," and Figures in the Appendix are referred to parenthetically throughout this Manual.

CLASSIFICATION OF CHARTS

Nautical Charts vary in scale with the importance of the area, purpose for which the chart is designed, and necessity for showing clearly all the dangers within that area. In the following five classes of charts, scales and style have been particularly adapted to their intended use.

1. *Harbor Charts* are published at scales larger than 1:50,000, depending on the size and importance of the harbor and the number and kinds of dangers existing. They are intended for navigation in harbors and smaller waterways, and for anchorage.

2. *Small-craft Charts* are published at scales of 1:80,000 and larger. They are issued folded, are designed for easy reference and plotting in close quarters, and emphasize small-craft detail, including large-scale insets of small-boat harbors, tide, current and weather data, whistle signals, marina facilities, anchorages, courses and distances. These folded charts are published in three types and identified by the letters "SC" following the chart numbers. (See pg. 89.)

3. *Coast Charts* are published at scales from 1:50,000 to 1:100,000. They are intended for close coastwise navigation inside outlying reefs and shoals, for use in entering bays and harbors of considerable size, and for navigating the larger inland waterways.

4. *General Charts* of the coasts are published at scales from 1:100,000 to 1:600,000. They are designed for coastwise navigation when a vessel's course is well offshore but where her position can be fixed by landmarks, lights, buoys and characteristic soundings.

5. *Sailing Charts* are published at scales of 1:600,000 and smaller. They are used for offshore sailing between distant coastal ports and for plotting the navigator's position out of sight of land and as he approaches the coast from the open ocean. They show offshore soundings and the most important lights, outer buoys, and natural landmarks which are visible at considerable distances.

LORAN CHARTS

Loran lines of position and skywave correction values are shown on over fifty selected charts. The various rates are reproduced in subdued colors on the printed chart.

SPECIAL-PURPOSE CHARTS

The Bureau publishes a number of charts for special purposes of the Navy. The designation of these charts is "FOR OFFICIAL USE ONLY". As they are not to be sold to the public, no price will be shown thereon.

NAUTICAL CHART TERMS

I

Standard and Aid Proof

For every chart published by this Bureau, the Nautical Chart Division maintains a *Standard* and an *Aid Proof* on which is noted all charting information received. A short description of each follows.

STANDARD

A *Standard* is usually a copy of a New Edition or New Chart on which is indicated all new information, except aids and certain other data, to be applied to the chart before subsequent printings.

AID PROOF

An *Aid Proof* is a copy of the latest print on which are indicated all changes in aids to navigation and important corrections that must be applied to the printing plate before the next printing. The majority of these changes are applied by hand to the existing stock of charts before issue to the public. Information regarding changes to aids is derived principally from Notice to Mariners.

MATTE PRINTS

Matte Prints are photoprints of the compilations of New or Reconstructed Charts made from the first, unretouched negatives. Two prints are furnished the Nautical Chart Division, one for use as a temporary Standard, the other as a temporary Aid Proof.

When a New or Reconstructed Chart is printed, all revisions indicated on the temporary Aid Proof are transferred to the new Aid Proof. A check is made to assure that all information on the temporary Standard is indicated on the chart History. The temporary Aid Proof and Standard are then destroyed.

ADVANCE PRINTS

At the time of making the above Matte Prints, stable-base film positive prints are made from the unretouched negatives of New Charts and Reconstructed Charts. These positives are forwarded to our District Officer, the Coast Guard, and the Corps of Engineers for advance inspection and return prior to printing the chart.

II

Compilations

All information shown on the charts, except revisions applied directly from air photographs to Drawings by the Division of Photogrammetry, is compiled by the Nautical Chart Division and furnished the Reproduction Division in one of the following categories:

NEW CHARTS

Compilations of *New Charts* are drawn on sheets of transparent stable plastic. Black ink is used for black plate information; green ink is used for detail to be printed in magenta.

Type should be placed directly on compilations of New or Reconstructed Charts that are to be engraved on glass, and on smooth-drafted compilations intended for direct reproduction. An optional method, requiring advance approval, is to place the type on a transparent overlay.

RECONSTRUCTED CHARTS

When the accumulation of new information is sufficiently extensive to affect most of an existing chart, the chart may be completely recompiled on a new projection. This *Reconstructed Chart* is processed in the same manner as a New Chart.

When only the topography is to be reconstructed, a projection is drawn on a sheet of transparent stable plastic and the new topography is compiled on it in black ink. This is then combined with the present hydrography to make a composite compilation.

Minor corrections to other color plates shall be made in green ink on the reconstruction compilation.

DRAWINGS

At the completion of the paper press run of all black and magenta nautical chart printings, an impression of each of these two colors is printed on separate sheets of matte finish transparent plastic. These prints are forwarded to the Nautical Chart Division where they are designated as *Drawings* and filed for use in revising subsequent chart printings. Revisions to the black Drawing are made in red ink. Revisions to the magenta Drawing are made in green ink.

III Proofs

FILM POSITIVE PROOF

After the Reproduction Division has completely revised the negatives, including the application of all revisions received subsequent to Drawing (or Compilation) date, the Nautical Chart Division is furnished a stable-base film positive proof. This transparent print is copy-checked against the original Drawing, all corrections indicated thereon, and returned to the Reproduction Division for correcting, plating, and printing.

BLUE RING COPY

It shall be the responsibility of the Nautical Chart Division to furnish the Distribution Division with *Blue Ring Copies* of nautical charts. All areas on these copies in which changes have been made subsequent to the last print shall be outlined in blue pencil. The Distribution Division will duplicate the *Blue Ring Copy* for the following Divisions of the Bureau and organizations:

1. Administrative and Technical Services Division—one copy, Alaska only.
2. Aeronautical Chart Division—one copy, Alaska only.
3. U.S. Naval Oceanographic Office—one copy of every chart.
4. Canadian Hydrographic Office—one copy, east coast north of Boston, west coast north of Oregon—Washington state line, and Alaska.
5. British Admiralty—one copy of all New Charts and New Editions.

IV Chart Printings

The interval between printings of a chart is determined by the Exhaustion Report, furnished by the Distribution Division, or by the amount and type of revisions indicated on the Standard and Aid Proof.

Printing dates are always the Monday following the Saturday date of the last-applied Notice to Mariners.

Chart Printings fall under the following classifications:

NEW CHART

A *New Chart* is constructed to satisfy the needs of navigation in a particular area. It is laid out in conformity with a broad scheme to meet future needs in the adjacent areas and is designated by a number not assigned in recent years. The date on which a New Chart is first printed appears in the center of the upper margin of the chart as the first edition date, and remains there for the life of the chart, thus:

1st Ed., Sept., 1960

It appears also in the lower left-hand corner, thus:

1st Ed., Sept. 5/60

NEW EDITION

A *New Edition* is a printing of an existing chart which contains changes of such importance to navigation that all previous printings are made obsolete. It includes all chart corrections published in the Notice to Mariners and all other corrections which were too extensive to be applied to the chart by hand and which are not ordinarily published in the Notice to Mariners. The date of the *New Edition* replaces all dates in the lower left-hand margin, thus:

2nd Ed., May 13/63

A *New Edition* may also be a printing of an existing chart containing an unreasonably large number of non-critical hand corrections which in the past would have been a *New Print* that canceled all prior prints in the agents' hands. Ordinarily this designation is made at the time of forwarding the Drawing to the Reproduction Division. However, if an additional number of corrections should subsequently be received which justifies changing a *New Print* drawing in Reproduction to a *New Edition*, this may be done up until the preliminary aid check is made.

NEW PRINT

When changes or corrections of a minor character are made to a printing, the issue becomes a *New Print*. A *New Print* includes all changes published in the Notice to Mariners since the preceding issue of the chart.

The date of a *New Print* is added to the edition date at the lower left-hand corner of the chart. It replaces any print date already charted, thus:

1st Ed., Sept. 5/60; Revised 1/14/63

Occasionally, a chart sent to reproduction as a *New Print* must be recalled for application of newly acquired critical information that requires it to be reclassified as a *New Edition*.

REPRINT

When the supply of a chart approaches exhaustion and unimportant or no changes are indicated on the Standard or Aid Proof, a *Reprint* is ordered. The issue is an exact duplicate of the current issue with no changes in printing or publication dates.

TIDE-OVER OR EMERGENCY RUN

When an unusual or unforeseen demand for a chart necessitates a printing before extensive revisions in work can be applied to the printing plates, the current chart is reprinted as above and referred to as a *Tide-Over*. Should it be necessary to make any corrections at this time, the *Tide-Over* would be a *New Print*, or, if warranted, a *New Edition*.

PUBLICATION NOTE (See Fig. 3)

When space permits, the following publication note shall be centered in the lower margin:

Compiled and printed at Washington, D. C. by
U. S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary
COAST AND GEODETIC SURVEY
H. Arnold Karo, Director

If there is insufficient space for the above 5-line note, the following publication shall be used:

Compiled and printed at Washington, D. C. by
U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

V**Correction Note and Date**

Charts, before being issued from this office, are corrected by hand for information received and for changes in aids to navigation, newly discovered dangers, important changes of channel depths, etc., published in boldface type in the Notice to Mariners.

The number and date of the last Notice to Mariners used is stamped in the lower margin of the chart, thus:

<p>CORRECTED THROUGH NOTICE TO MARINERS NO. 2 JAN 12 '63 U. S. C. & G. S WASHINGTON, D. C.</p>
--

VI**Sample Copy**

A *Sample Copy* is a copy of a chart furnished by the Distribution Division and forwarded to the Nautical Chart Division for indication of all corrections which must be made by hand to all copies of the chart before issue. Upon completion of the correction indications, the *Sample Copy* is returned to the Distribution Division where all hand corrections are made and the chart distributed.

Small-craft Charts are not hand corrected and therefore do not require a *Sample Copy*.

RULES AND PRACTICES

The rules and practices set forth herein are those which meet the present conditions and requirements of the Coast and Geodetic Survey. Every effort has been made to bring them into agreement with those of other charting and mapping agencies of the U.S. Government and the International Hydrographic Bureau.

Although it is desirable that the treatment and appearance of all charts be uniform, the various methods of compilation, drawing and reproduction make this extremely difficult to accomplish. Changing requirements have a marked effect on the treatment of detail on a chart.

There are certain rules which can be formulated to govern, to a large degree, the construction and revision of a Nautical Chart. The following rules and practices have been standardized as much as possible and when revisions are necessary special instructions will be issued.

I

General Practices

GEOGRAPHIC DATUMS

Because of redeterminations of the dimensions of the spheroid at various times, and due to the adjustment of additional triangulation nets, several datums have been available for survey operations.

Two spheroids of reference, Bessel's and Clarke's, have been used by this Bureau in its geodetic triangulation. However, various datums have been used on each. The old Bessel's Datum was used from 1834 to 1844, and Bessel's spheroid of 1841 was used until 1880 when Clarke's spheroid of 1866 was adopted. The datums on Clarke's spheroid have been:

Clarke's Datum	1880-1901
U.S. Standard Datum	1901-1915
North American Datum	1915-1927
North American Datum of 1927	

The North American Datum and the U.S. Standard Datum are the same, the only difference being the name. The term U.S. Standard was changed when the datums of Canada and Mexico were tied in to the U.S. network in 1915, making it, as the name implies, a North American Datum.

In 1899 an adjustment of the first-order triangulation in the United States was begun, based on station *Meades Ranch* in Kansas. This station was selected because of its location near the center of the area of the United States and because it was on two major arcs of triangulation extending across the country at right angles to each other. Another advantage of adopting this origin was that no change was required in the network that had been extended to that point from the New England States and other coastal states southward to North Carolina. In 1927 a new unified adjustment was made, also based on Δ MEADES RANCH, readjusting positions in the east as well as the west. See the Hydrographic Manual for additional details (Publication 20-2, pages 235-236).

The North American Datum of 1927 is the standard datum for nautical charts. With few exceptions, all charts of the continental United States and Alaska are on the North American Datum of 1927. Therefore, "N.A. Datum of 1927" need not be shown on these charts. However, the older surveys are not on this datum and care must be exercised to see that they are properly corrected before application to the charts.

The Old Hawaiian Datum is the geographic datum authorized for the Hawaiian charts.

In the Caribbean area, charts are on the Puerto Rico Datum.

The polyconic projection is now used for all field sheets. The fact that the projection lines are not straight or parallel should not be overlooked when correcting the older surveys to N.A. Datum of 1927.

Differences between the old and new (1927) geographic coordinates of the triangulation stations shown on the sheets should be used when making corrections. An up-to-date file of the geographic coordinates of triangulation stations used on survey sheets is maintained in the Nautical Data Branch.

ISOGONIC LINES

Isogonic lines shall be shown on those charts on which a variation of 1° will, in general, result in a distance between the lines of less than 12 inches.

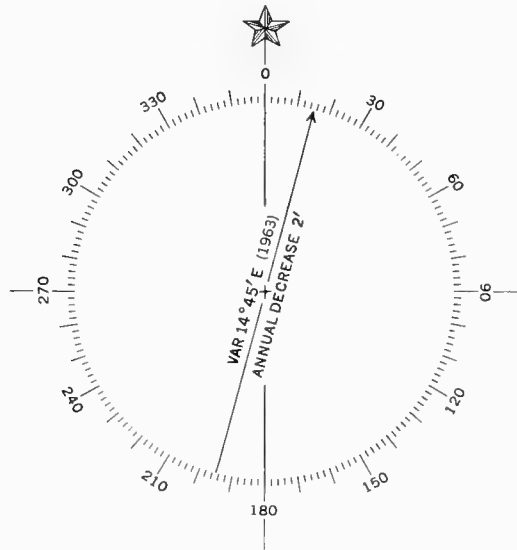
COMPASS ROSES (U)

Compass roses are placed on the charts to facilitate plotting bearings and laying out courses. The magnetic variation is changing constantly due to the fluctuations of the earth's magnetic fields. Because of this fluctuation, compass roses are brought up to date on the charts whenever it is necessary to make a new printing plate. The roses now being used on the charts of this Bureau were constructed on glass by the Bureau of Standards and are considered very accurate. They consist of an outer circle in degrees, with zero at true north, and an inner circle in points and degrees with the arrow indicating magnetic north. See Chart No. 1 for example.

Compass roses should be located on the chart so as to be convenient to the most important navigational areas, and at such intervals that any part of the water area is within the reach of a parallel ruler. In some cases it will be necessary to remove topographic features when compasses are placed on land areas. In no case should compasses be so placed as to cover or even be close to any danger in the water area. They should not be placed at the entrance to a harbor. When placed in the water area, every effort must be made to see that soundings do not fall on the graduations or figures. A new selection of soundings must be made if necessary.

Compass roses shall be printed in magenta. On loran charts on which one rate is in magenta, the compasses shall be printed in black.

In general, on charts showing isogonic lines, the compass rose shall consist of a compass circle with zero at true north, and a centerline oriented in accordance with the direction and amount of variation. Along this line should be shown the amount of variation, the year determined (in parentheses) and the annual change. Variations shall be given in units of 15' only.



Compass Rose for Charts with Isogonic Lines

LOCAL MAGNETIC DISTURBANCE

Local magnetic disturbance, which causes noticeable deflections of the compass, is a fairly common occurrence in shallow water and in proximity to mountain masses. It is believed that disturbances need not be considered in depths greater than 500 fathoms. Notes in magenta calling attention to local magnetic disturbance should be placed on the charts. These notes should be based on information furnished by the Division of Geomagnetism. (Fig. 13)

In general, disturbance notes (printed in magenta) shall be used where deviations of 2° or more from the normal value of magnetic declination exist (except that in Alaska a lower limit of 3° shall be used).

Examples

LOCAL MAGNETIC DISTURBANCE

Differences from normal variation of as much as 5° have been observed in Gastineau Channel in the vicinity of Lat. 58°15'.

LOCAL MAGNETIC DISTURBANCE

Differences of 12° or more from normal variation may be expected in X Channel in the vicinity of Z Point.

When limited by space, the full note should be placed elsewhere on the chart and the following reference note shown (in magenta) in the area of disturbance:

LOCAL MAGNETIC DISTURBANCE

(See Note)

STATE PLANE COORDINATES

In areas where the Corps of Engineers and other agencies use State Plane Coordinate systems as survey control, the coordinates shall be shown by dashed ticks in the borders of New Charts and of charts being corrected. These ticks, at selected intervals, shall consist of three dashes, with a total length of 4.0 mm. and a line weight of .005 inches. Where a chart is of sufficient east and west extent to indicate grid curvature, intermediate ticks shall be used; intermediate ticks should preferably be selected to fall on land, but where needed to control major channels (or on special request by local users) such ticks may be charted in water areas. In the latter case the chart notes shall include this symbol and its explanation.

The border ticks shall be labelled to indicate clearly the interval used. The last three digits of the grid value shall be omitted. The remaining significant digits shall be placed parallel to the grid tick rather than to the neatline (See Fig. 4). By connecting the ticks with straight lines they can be used for control of Corps of Engineers' surveys.

When a State Plane Coordinate Grid is indicated, the following note format shall be placed on the chart:

PLANE COORDINATE GRID

Oregon State grid, north zone, is indicated by dashed ticks at 5,000-foot intervals.

Charts now showing dotted ticks for Plane Coordinates are to be changed to dashed ticks and new labelling only when the chart is reconstructed.

SCALES (Figs. 6, 7, 8)

A chart constructed at a scale of 1:80,000 or larger should have on it two sets of graphic scales. Each set consists of a scale of nautical miles and a scale of yards. One of the sets should be at the top of the chart and the other at the bottom, and on opposite sides if possible. On Intracoastal Waterway Charts a graphic scale of statute miles is added between these for nautical miles and yards.

A complete border scale should be placed on all conventional charts at the scale of 1:50,000 and smaller.

The type of projection, scale of chart, and the latitude at which the scale was computed, shall be given in the title of all charts. The scale at the middle latitude of the series shall be given when the projection was computed on a latitude falling off the chart.

BORDERS

The border of a chart is either a neatline or a border scale defining the limits of the area charted. Outside the neatlines, and separated by a space in which the projection numbers are placed, are two parallel lines, one fine and one heavy, drawn close together. See Figure 4 in the Appendix.

On an average chart, the degree numbers shall appear at least twice for latitude and twice for longitude. The border subdivisions on charts whose scale is larger than 1:50,000 shall be shown at the border by lines 2 mm. long outside the neatlines. Additional subdivisions of latitude and longitude are to be added in accordance with Figure 4 in the Appendix.

When the projection is skewed (Fig. 4A), one minute of latitude and of longitude shall be subdivided into seconds in at least one place within each chart panel, preferably on land area clear of pertinent detail. The numerals and ticks may be placed on either side of the projection lines. Subdivision intervals shall be in accordance with those shown in Figure 4.

DIMENSIONS OF THE EARTH (CLARKE'S SPHEROID OF 1866) AND UNITS OF LENGTH

The following values are used by the Coast and Geodetic Survey in its computations. They were taken from Special Publication No. 138. (See also Figures 29-34, 37)

Equatorial radius.....	6 378 206.4 meters
Polar semi-axis.....	6 356 583.8 meters
1 kilometer.....	0.621 370 statute mile
	0.539 593 nautical mile
1 meter.....	0.000 621 370 statute mile
	0.000 539 593 nautical mile
	39.37 inches
	3.280 833 3 feet
1 statute mile.....	1 609.35 meters
	1.609 35 kilometers
	0.868 393 nautical mile
	5 280 feet
1 foot.....	0.304 800 61 meter

NAUTICAL MILE (INTERNATIONAL) (Figs. 33, 34)

To conform to international usage in computing distances and speeds, the value of 1 852.0 meters or 6 076.115 49 feet (approximately) shall be used for a nautical mile.

PANTOGRAPH

The formula for the pantograph setting to be used in making a reduction is as follows:

$$s = \frac{b \times 960}{a}$$

a=distance between any two points as scaled from the sheet to be reduced.

b=distance between same two points as scaled on the drawing.

s=setting for each of the pantograph arms.

960=factor of pantograph.

Limit of reduction by the pantograph is about 1/20. If the setting is less than 45.0, which is too small to be set on the pantograph arms, two reductions must be made. If the first reduction is $\frac{1}{4}$ or 1 to 4,

the first setting will be $s_1 = 960 \div 4 = 240$

the final setting will be $s_2 = s \times 4$.

II

Specifications and Source Material

CHART SPECIFICATIONS

When a new chart or the reconstruction of an existing chart is assigned, Form C&GS-8324, "Chart Specifications" containing the general specifications for the chart will be furnished. It includes the title, limits, size, scale, kind of projection, plane of reference and other detail. The specifications must be followed carefully unless an amendment is authorized by the Chief of Division.

EVALUATION OF CHARTING MATERIAL

Charting material consists principally of topographic and hydrographic surveys made by this Bureau supplemented by miscellaneous surveys made by other organizations. All material must be examined critically, and particular attention must be directed to the actual date of survey, geographic datum, depth unit, plane of reference, purpose and character of the survey, and whether original or compiled. The latest information does not necessarily supersede all earlier data. In unchanging areas, all well-controlled hydrographic surveys of other organizations should be combined with the basic surveys of this Bureau. In localities under constant and extensive change, only the latest information should be used. Shoal soundings over obstructions or rocks must not be rejected without convincing proof that the dangers have been removed. In regions where some areas are undergoing change while other areas remain unchanged, partial rejection of the various surveys may be necessary. The proper acceptance, rejection, and coordination of available information constitute the supreme test of the cartographer's skill.

ORIGINAL SOURCES

The original source material is to be used in the compilation of New Charts and in correcting existing charts. Large-scale charts that have been corrected from original source material become source material for small-scale charts. In such case, the original source material is referred to only where necessary to check information questioned.

All available sources of information should be used in the construction of a chart, including the following:

1. Original C. & G.S. topographic and hydrographic survey.
2. Descriptive reports accompanying such survey.
3. All chart letters regarding area of chart.
4. Corps of Engineers Surveys.
5. Corps of Engineers Annual Reports.
6. U.S. Geological Survey quadrangles.
7. General maps from map files.
8. Chart of the area made by other nations.
9. Coast Pilots.
10. Light and buoy list (U.S. Coast Guard).
11. Notice to Mariners when conflicts arise between surveys and existing charts.
12. Air photos which supersede surveys.
13. Triangulation records.
14. Descriptions of triangulation stations.
15. Port Series publications.
16. Aid Proofs.
17. Standards.
18. Corps of Engineers Project Maps (in book form).
19. Corps of Engineers District Intracoastal Waterway Maps.
20. Corps of Engineers Mississippi River Commission Maps.
21. List of Bridges over navigable waters.

Cartographers should not hesitate to initiate a letter of inquiry whenever information is lacking, or when existing information requires checking.

III

General Instructions

BASIC REQUIREMENTS

Accuracy of position, legibility, and uniform consistency in selection and placing of names, notes, and other details on the charts, are the chief requirements in nautical chart compilation.

New or revised charts are not ordinarily smooth drafted in the Nautical Chart Division. Special charts, for which there is an urgent need, are smooth drafted for direct reproduction. They are referred to as PROVISIONAL CHARTS and are so labeled in the title. These charts will be engraved in the Reproduction Division when time permits. A chart constructed from unverified information will be labeled PRELIMINARY CHART.

Compilations and Drawings of charts which are not smooth drafted must be kept reasonably clean. Lines and figures must be sufficiently bold to photograph well.

The selection and placing of names is the responsibility of the cartographer. For this reason, all compilations, before being forwarded to the Reproduction Division, should include all type necessary to the final chart.

Compilations of new or reconstructed charts must be drawn in black ink, except that the geographic names and the position intersections and descriptions of aids and landmarks should be shown in blue as a guide for the application of the printed type. When a type overlay sheet is used, the Reproduction Division paints out unimportant detail on the black base negative to clear for type.

When starting a new chart, or making extensive revisions to an existing chart, it has been found advisable to plot first all landmarks and fixed aids to navigation. Then a ready check of their plotting can be made by comparison, if the positions of such aids are indicated on pantograph reductions, film positives, or any other reductions of the survey sheets necessarily made for use in the construction of the chart.

CORRECTIONS TO DRAWINGS

Corrections must be applied to all charts affected in the order of their scales. The corrections should be made first to the Drawing for the largest scale chart. It is the responsibility of the cartographer to follow this procedure unless otherwise ordered by the Chief of Branch.

When making erasures on Drawings, care must be exercised to see that no more of the printed chart is removed than is to be replaced by new work. Erroneous erasures must be redrawn in black ink. Failure to observe this will cause unnecessary recutting on the negatives.

Corrections to existing charts shall be made on Drawings as follows:

1. Additions and revisions for the black printing plate shall be indicated in red ink.
2. Deletions in areas not otherwise changed shall be crossed out in blue ink. Deletions in close proximity to a correction should be scraped out.
3. Revisions to a color plate shall be indicated in green ink. Where a magenta print on acetate accompanies a Drawing, all corrections to the magenta printing plate shall be indicated in green ink on the magenta print.
4. For accentuation to the engravers, the verifier should encircle all corrections specified in items 1-3, using a vermilion red pencil. The verifier should also draw red leading lines from the corrections to the margin of the Drawing or magenta print.
5. The compiler shall revise all navigational aids as indicated on the Aid Proof.
6. The low water line shall be shown by a dotted curve. Where necessary to clarify for reproduction, the compiler shall label low water areas "G" (for green) and land areas "B" (for buff).
7. All closed depth curves are to be indicated, at least partially, in the proper symbol to indicate clearly to the engraver which symbol is to be charted. A solid line connection between two portions of a chartered curve may be used if it is self-evident which symbol is represented. Other depth curves shall be drawn in fine, solid lines.
8. Corrections to the border format shall be made by the Aids to Navigation Section.
9. Corrections to topography made in the Division of Photogrammetry shall be examined by the compiler and revised as necessary to conform with other changes.
10. A printed copy of the chart must be consulted to avoid making corrections that would conflict with color information. When noted on the Standards, special care must be taken to avoid color conflicts on several charts which are used as bases for overprinting special Oceanographic Office anchorage charts.
11. A comparison and agreement must also be made with all overlapping charts of the same and larger scales.

SUPPLEMENTAL CORRECTIONS

Corrections to Drawings or Compilations on which reproduction work has been started are to be encircled boldly in green pencil. A leading line is to be drawn in green therefrom to the following marginal note in green: "New work by ----- Date -----"

DISPOSITION NOTATIONS

Explanatory notations as to the disposition made of the material available for the correction of a chart must be lettered by the cartographer on Blueprints, Letters, etc. For example, "Not used; see Letter 377 (1962)". When a Blueprint, Letter, or other similar authority is applied to a chart, the compiler must write on the authority the words "Applied to Chart No. ----" with the date and his initials.

BLUEPRINT CLARIFICATION FOR MICROFILM

When applying a rock, wreck, obstruction or the least depth on a shoal from Blueprints to Aid Proofs or chart Drawings, a detailed enlargement of the feature being charted shall be indicated in the margin or other clear area on the Blueprint. A leading line shall be drawn from the enlargement to the feature. This is necessary so that the feature's position and value can be clearly read from a microfilm copy of the Blueprint.

LOGARITHMIC SPEED SCALE

The logarithmic speed scale (fig. 37) is to be shown on all charts of 1:40,000 and larger scales.

ANCHORAGE CHART FILE

Compilers should consult U.S. Naval Oceanographic Office anchorage charts on file in Standards Section and use chart copy as a guide to avoid interference between anchorage overprint data, charted details and corrections added to the base chart Drawing.

OVERLAPPING CHARTS

Minor aids and other details on small-scale charts should be omitted when such information is completely shown on larger scales. This procedure makes it necessary for the mariner to use the more adequate large-scale chart. A note calling attention to the fact that such information has been omitted should be prominently shown. Removal of this information from existing charts may be made only with prior approval of the Branch Chief.

Overlapping portions of charts of the same scale should be identical as far as is possible.

Hydrographic detail is not ordinarily shown in a body of water outside the area for which the chart is to be used or when the entrance is omitted from the chart. It is, however, shown in areas not covered by other charts of the same or larger scale. In all cases, the high water line must be shown.

REFERENCES TO INTRACOASTAL WATERWAY CHARTS

A reference note regarding the Intracoastal Waterway charts should be charted in black on the 1:80,000 scale Atlantic and Gulf Coast charts through which the Intracoastal Waterway passes. For example, the note on chart 1246 reads as follows:

INTRACOASTAL WATERWAY
Use chart 845-SC. The depths and
channel markers are not shown hereon.

INTRACOASTAL WATERWAY CHARTS

The note printed in magenta on the Atlantic Intracoastal Waterway charts gives the project depths and refers to the Notice to Mariners for the controlling depths. For example, the note on chart 843 reads as follows:

INTRACOASTAL WATERWAY

The Intracoastal Waterway is indicated by a magenta line. Distances are shown in International Nautical Miles.

INTRACOASTAL WATERWAY

Project Depths

12 feet Norfolk, Va. to Fort Pierce, Fla.
8 feet Fort Pierce, Fla. to Miami, Fla.
7 feet Miami, Fla. to Cross Bank, Florida Bay.

The controlling depths are published weekly in the Notice to Mariners.

INTRACOASTAL WATERWAY AIDS

Intracoastal Waterway aids are characterized by a yellow band or border. Proceeding from Norfolk, Va. to Key West, Fla.:

1. Aids with red reflectors are on the starboard side; green reflectors are on the port side.
2. Where the Intracoastal Waterway coincides with another waterway, the dual-purpose aids have distinctive yellow triangles on the starboard side and yellow squares on the port side.

The article for insertion in the Notice to Mariners is prepared from the Corps of Engineers' monthly report on the condition of the Waterway. This article must include detailed information regarding the available depths, such as: "A channel 60 feet wide, 9 feet deep, is available along the west side of the 5.0 foot shoal $\frac{1}{2}$ mile south of Beacon 128 (chart No. 834)."

The route lines shall be charted in magenta. When considered necessary, distances in nautical miles, and true course in degrees and minutes (15 minute intervals) may be shown adjacent to the route line, thus: 12M 008°15' TRUE.

NOTICE TO MARINERS

Information regarding important rocks, shoals, or landmarks which have been added to, or removed from the charts, should be furnished the Aids Section for publication in the Notice to Mariners.

ADVANCE NOTIFICATION OF ISSUE OF CHARTS

At the time a New Chart, Reconstructed Chart or a New Edition of a chart is forwarded to Reproduction, advance notification shall be published in the Notice to Mariners, calling attention to the approximate date the issue will be available.

COAST PILOT

The Coast Pilots of the Coast and Geodetic Survey are a series of nautical books that cover a wide variety of information important to navigators of United States coastal waters and intracoastal waters. Most of this book information cannot be shown graphically on the standard nautical charts and is not readily available elsewhere. Coast Pilot subjects include navigation regulations, outstanding landmarks, channel and anchorage peculiarities, dangers, weather, routes, pilotage, and port facilities. Coast Pilots are prepared from field inspection notes by special Coast Pilot ship or shore parties. The principal purpose of an inspection is to verify and revise statements in the Pilot and charted details. Cumulative Supplements, containing changes reported since dates of editions are published each year.

In addition to serving the navigator, Coast Pilots can be used to an advantage by the nautical chart cartographer. Cartographers should not overlook the abundance of information contained therein that can assist in evaluating the importance of individual features that can be shown on nautical charts. An examination of the Coast Pilot together with the Light List will aid considerably in selecting names and other features of importance to the navigator.

AERIAL PHOTOGRAPHS

The Photogrammetry Division shall make topographic corrections from aerial photographs on Drawings in accordance with the priorities established by the Exhaustion Report. The Chief of the Conventional Chart Branch, Nautical Chart Division, shall be responsible for the assignment of such charts.

COMPILATION REVIEW

Every chart must be thoroughly reviewed. Review must include every sounding, elevation, name, and hydrographic and topographic feature. Special care must be taken to see that every danger, danger curve, and channel is distinctly and correctly represented.

Slight and unimportant inaccuracies ordinarily need not be changed. For instance, soundings, the locations of which are in error by less than half the width of figures, need not be moved. No two cartographers will make the same selection of soundings in an area; therefore the selection of soundings should not be changed unless there is an opportunity for a distinct improvement.

The review of new or reconstructed charts shall be made on cellulose acetate overlays. If changes are necessary, the compilation must be returned to the original compiler for correction; otherwise, the same type of mistake might be repeated.

CATALOG OF CHART NUMBERS

A loose-leaf ledger is kept of all numbers, and letters used in place of numbers, which have been used as designations for charts and miscellaneous maps of the Coast and Geodetic Survey. It contains the title, scale and publication date of each chart, the dates on which superseded charts have been canceled, dates on which the limits of charts have been changed, and other pertinent information.

This record is to be used when selecting numbers for new nautical and aeronautical charts and miscellaneous maps. The numbers of charts which have been canceled for twenty years or more may be used again if necessary.

Cartographers should familiarize themselves with this record as it contains much useful information.

IV

Special Areas

RESTRICTED (P-9a), DANGER (P-9, magenta), AND PROHIBITED AREAS (Figs. 1, 12, 13) (P-25, G-12, G-46)

The outlines of restricted, danger, and prohibited areas shall be shown in magenta and the areas labeled RESTRICTED AREA, PROHIBITED AREA, etc., in accordance with the Code of Federal Regulations classification. Each classification shall include the Code section number, e.g., 204.15 and a reference to standard NOTE A (Fig. 13), e.g. "(see Note A)." Regulations governing an area may be added in the form of a note, when advisable.

A magenta screening (Fig. 1) shall be used, when necessary, to clarify overlapping areas.

ANCHORAGE AREAS (Figs. 1, 13, 14) (P-12)

The regulations for and descriptions of anchorage areas are published in the Code of Federal Regulations. Areas shall be shown by a solid magenta line on all charts which are expected to be used for anchorage purposes. Generally, they are labeled in the same manner as RESTRICTED AREAS, etc.

Anchorage regulations may be added in the form of a note on large-scale harbor charts, when advisable (Fig. 14).

SEAPLANE AREAS and ANCHORAGES (Fig. 13) (P-9)

The limits of seaplane areas and anchorages are shown by dashed magenta lines and labeled in accordance with the Code of Federal Regulations classification including, assigned section number, e.g., 207.50 and a reference to standard NOTE A (Fig. 12), e.g. (see Note A). Seaplane lanes are shown by dashed magenta lines and labeled SEAPLANE LANE A, etc., including section number and reference as above.

CABLE AREAS AND PIPELINE AREAS (Fig. 1) (P-7, -7a, -8, -8a)

In general, only those cable or pipeline areas which have been approved for charting by the Secretary of the Army shall be charted. These areas shall be shown on all charts which are expected to be used for anchorage purposes.

The limiting lines shall be charted in magenta and spaced 1,000 feet apart except on small-scale charts where a spacing of that width would not be of sufficient prominence. Areas shall be shown by symbol P-7a and labeled CABLE AREA or PIPELINE AREA in magenta (black when the chart does not have a magenta printing plate) in a position which will not obscure important hydrographic information.

Oil, gasoline, and natural gas pipelines not presently charted, shall not be charted unless requested by the Corps of Engineers.

Charting of transoceanic cable routes was approved in 1961 (CL. 742/61) as a possible means of preventing service disruption and cable damage by commercial fishing operations. Charting approval by the Secretary of the Army is not required. Symbol P-7 is used for such cable routes.

SPOIL AREAS (Fig. 1) (G-13)

Spoil areas are so designated on dredging sheets generally originating from Corps of Engineers after-dredging surveys. They may, however, originate on private or other Government agency surveys. These areas are for the purpose of depositing dredged material. The limits should be charted by a short-dashed line, (Fig. 1). All soundings and depth curves are to be omitted, the area labeled "Spoil Area" and tinted in the darkest blue shown on the chart.

*When advised that a spoil area has been discontinued, it shall be so labeled and retained on the chart until a survey showing results after final spoil deposit is available for charting.

*Comment: If Disposal Area designation is used, the above note may not be necessary.

DISPOSAL AREAS (Fig. 1) (G-Gc)

Disposal Areas are established or approved by the Corps of Engineers for depositing dredged material where existing depths indicate that the intent is not to cause sufficient shoaling to create a danger to surface navigation. Soundings and curves should be retained. Blue tint should not be added. The following note should be placed within the area, in black:

Disposal Area
 Depths from survey of -----
(Date)

DUMPING GROUNDS (Fig. 1) (G-Gb; P-11)

Dumping grounds are areas designated by the Corps of Engineers for dumping, by permit, various types of materials. Generally, such areas are well offshore or in deep water. If existing depths indicate that future dumping is not intended to cause shoaling sufficient to create a danger to surface navigation, soundings and depth curves may be charted within the area. The area is labeled "Dumping Ground" and tinted blue, if justified by the hydrography.

The following note shall be used when dumping regulations have been prescribed by the Corps of Engineers:

DUMPING GROUND
Regulations and permission for dumping in area (or areas)
indicated, may be obtained at the office of the District Engineer,
Corps of Engineers, city , state

When advised that dumping has been discontinued in an area, it shall be so noted and retained on the chart until a survey showing results after final dumping is available for charting.

FISH TRAP AREAS (Fig. 1) (P-10)

The Corps of Engineers, with the cooperation of the Coast and Geodetic Survey, has defined by geographic coordinates the limits of areas in which fishing structures may be placed in Chesapeake Bay and tributary waters. These coordinates are published in the Code of Federal Regulations, Title 33, Section 206.

The limits of other areas, although included in above publication, generally are not accurately defined and may require supplemental information from the Corps of Engineers for charting.

The limits of fish trap areas (Fig. 1) shall be shown on charts of 1:80,000 scale and larger. The following note is used on all charts:

FISH TRAP AREAS
Boundary lines of fish trap areas are
shown thus: — — — — (magenta line)
Caution: Submerged piling may exist
in these areas.

Due to the large scale, certain affected charts do not contain the entire area, so it will be necessary to define the limits as follows:

 SOUTH LIMIT OF FISH TRAP AREA — (magenta line)

FISH STAKES

Fish stakes should not be shown inside the limits of fish trap areas. Where no fish trap regulations have been established, fish stakes may be shown if known to be of a permanent nature or if they are a definite hazard to navigation.

RULES OF THE ROAD (Fig. 1)

The line of demarcation between the areas where the Inland Rules of the Road apply and the areas where the International Rules of the Road apply shall be shown on charts of 1:80,000 scale and larger, (Fig. 1). The note "USE INLAND RULES OF THE ROAD" shall be placed on the inshore side of the line.

Regulations governing the Rules of the Road are specified in U.S. Coast Guard publication CG-169 "PILOT RULES," which is on file in the Standards Section.

A note, stating the limits within which the Inland Rules of the Road apply, shall be used wherever it is found impracticable to use the line.

BREAKERS (A-12, O-25)

The word "Breakers" is used instead of the breaker symbol except in small, uncongested areas. Extensive breakers are shown by a dashed line with the word "Breakers" along the inshore side.

V

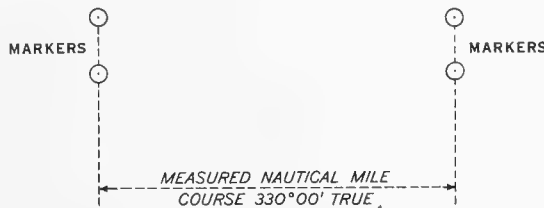
Courses and Ranges

COURSES (Fig. 1)

Courses shown on the conventional charts, including the conventional Intracoastal Waterway charts, shall be true and given in degrees and quarters. Courses shall be magnetic on all Small-craft charts and the folded Intracoastal Waterway charts. Speed trial courses shall be given in degrees and minutes.

TRIAL COURSE

When the measured distance on a trial course is within 10 feet of the standard value for a nautical mile (1852m. or 6076.1 ft.), it shall be charted as follows:



When the measured distance on the course differs from the standard value by more than 10 feet, the actual measured distance must be stated; for example:



RANGE LINES (Fig. 1) (P-1)

Ranges shall be shown by a solid line from seaward to the point where the vessel should leave the range. From that point the range shall be continued with a short-dashed line through the navigational aids. The visibility of range lights is not charted.

RANGE NAMES

The names of ranges given in the Light List should be added to all large-scale charts when convenient.

VI

Landmarks and Stations

LANDMARKS (Fig. 18) (D, I, J)

Only those objects which have been recommended as landmarks shall be charted.

If determined by triangulation, the positions of landmarks must be carefully plotted by their geographic coordinates, directly from the lithographed sheets if available. See special file of triangulation diagrams which are overprintings on a selected set of nautical charts covering the entire charted coastal areas. Diagrams are also available for all the states.

If determined by stereo bridging, the positions of landmarks shall be plotted by using their geographic coordinates, directly from Form C&GS-567, "Nonfloating Aids or Landmarks for Charts."

When determined by some other method, (sextant fix, Kelsh Instrument, planetable, photo plot), the landmark position shall be carefully transferred to the Drawing from the survey or topographic sheet. Since landmark reports are generally received in advance of final survey data, the initial application of new landmark information in maintenance revision will usually be directly from the Form 567. Such action should be clearly stated by the compiler on the form.

The Photogrammetry Division should be requested to locate accurately any landmark, the position of which is questionable. All deletions and additions of *important* landmarks should be published in the Notice to Mariners.

Objects reported by the Aeronautical Chart Division and other sources are not to be considered of sufficient accuracy for nautical charting, unless clearly stated otherwise. A file of these objects and recommended landmarks not accurately located will be maintained in the Standards Section. Accurate positions will be requested when a field party is being scheduled for the area.

Positions of navigationally important objects should be requested immediately. Emergency orders will be prepared when justified.

An opening on a bridge symbol should not be obscured by the landmark symbol.

Names of landmarks should not be abbreviated unless they fall in a very congested area, but if abbreviated, they must conform to Chart No. 1, "Nautical Chart Symbols and Abbreviations," which has an alphabetical list of abbreviations, terms and references.

Descriptive terms in general are not charted. Colors describing painted objects are particularly undesirable because of their temporary nature. The name of the material of which an object is built should not be charted, since the mariner cannot identify an object by its material even at a short distance.

The company's name on a tank, stack, etc., is omitted from the chart unless this name, or the abbreviation of it, is visible on the landmark in letters large enough to serve as an identifying feature to the mariner. Names of well-known buildings may sometimes be shown in parentheses following the name of the landmark, as, DOME (STATE HOUSE).

The large circle (2.5 mm) with dot in center (I-35, I-In) shall be used for recommended landmarks that have been accurately located. The landmark style lettering, all capitals, shall be used for both description and the name of the landmark, such as, STACK (TALLEST OF THREE), HOUSE (WEST GABLE). A small circle (1.0 mm) without dot (I-35, I-Io) shall be used for landmarks not accurately located. Label the circle with capital and lower case lettering, such as, Mon, Cup, Dome. The abbreviation "PA" should be added when necessary as a safety feature.

When two similar objects are adjacent, and shown by two separate landmark symbols, the word TWIN is omitted, but when they are indicated by one landmark symbol, the word TWIN is used.

When only one object of a group is to be charted, its name is followed by a descriptive legend in parentheses, including the number of objects in the group, for example (TALLEST OF FOUR) or (NORTHEAST OF THREE).

LANDMARK CLASSIFICATIONS

The following classifications are defined for the purpose of standardization (letters and figures refer to those on Chart No. 1, Symbols and Abbreviations):

MONUMENT MON. (I-35)



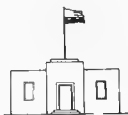
Do not use *obelisk*, or other terms.

FLAGPOLE FP. (J-19)



A single staff flagpole rising from the ground and not attached to a building.

FLAGSTAFF FS. (J-19)



Because of its non-permanence, a flagpole rising from a building is not desirable as a landmark. Although it is desirable in locating a building to observe upon the most definite part (such as the flagstaff), it is not necessarily the most important part for charting purposes.

FLAG TOWER F. TR. (J-Jc)



Any scaffold-like tower on which flags are hoisted, such as a Coast Guard skeleton steel flagpole. Do not use *signal tower*.

LOOKOUT TOWER LOOK. TR. (J-4)



Any tower surmounted by a small house in which a watch is habitually kept, such as a Coast Guard Lookout Tower or a Fire Lookout Tower. The term must not be substituted for OBSERVATION TOWER, or part of a building in which no watch is kept.

TOWER TR. (I-41)



That part of a structure higher than the rest, but having vertical sides for the greater part of its height. Any structure, whether or not its sides are vertical, with base on the ground and high in proportion to its base.

RADIO TOWER R. TR. (M-9)



A tall pole or structure for elevating antennas. For more than one tower use RADIO TOWERS.

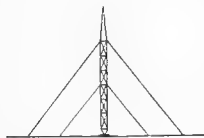
Chart FM stations thus: ○ RADIO TOWER 415 FT

Do not chart call letters. Omit height above Mean High Water if relatively low.

Chart AM stations thus: ○ ^{R TR}_(KAGT)
1340 KC

If it is a commercial broadcasting station the call letter and frequency should be added. As AM radio towers are usually lower than FM or TV, the elevation may usually be omitted.

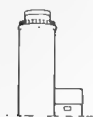
TELEVISION TOWER TV TR. (M-Mb) ○ TV TOWER 415 FT



A tall, slender structure for elevating antennas. Do not chart call letters. Height above Mean High Water should be charted if exceptionally high.

Obstruction lights on radio or television towers are omitted unless especially requested and their characteristics are known.

WATER TOWER (I-45)



(Infrequent)

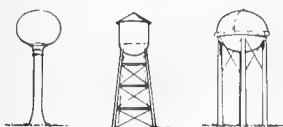
A decorative structure enclosing a tower or standpipe. Its appearance may prevent its being recognized as a water tower or standpipe.

STANDPIPE S' PIPE (I-45)



A tall cylindrical structure, in a waterworks system, the height of which is several times greater than the diameter.

TANK (I-53)



A water tank elevated high above the ground by a tall skeleton framework. The word *Elevated* may be omitted since a tank would not be a landmark unless elevated.

GAS TANK or OIL TANK (I-46,-71)



Since a gas or oil tank differs in shape and size from a water tank, the compound name is used. Gas or oil tanks, in general, are not charted unless recommended as landmarks, or requested by the Army or Navy.

DOME



A large, hemispherical cupola, or a roof that is actually rounded or many sided.

CUPOLA CUP. (I-36)



A turrett or small dome-shaped tower which rises from a building and is small compared to the building.

SPIRE (I-8b)



A slender pointed structure surmounting a building. It is rarely broken by stages or other features. Do not use *steeple*. The term SPIRE is not applicable to a short pyramid-shaped structure rising from a tower or belfry.

HOUSE or BUILDING HO. BLDG. (I-3a,-5)



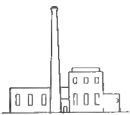
When the building itself is the landmark, it is not desirable to chart a specific point, such as *west gable*. Chart HOUSE or BUILDING, followed by the description of the point located, if recommended by the field party.

CHIMNEY CHY. (I-44)



A relatively small, upright structure projecting above a building for the conveyance of smoke.

STACK (I-44)



This term is to be applied to any tall smokestack or chimney, regardless of color, shape or material, when the stack is more prominent as a landmark than any building in connection with it. Do not use *chimney*.

WINDMILL (I-42)



A self-explanatory term.

TREE (C-5)

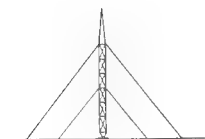


Do not use *lone trees* or *conspicuous trees*, since the adjective is assumed. Otherwise the trees would not serve as a landmark.

LORAN STATIONS (L-63,-Lg)

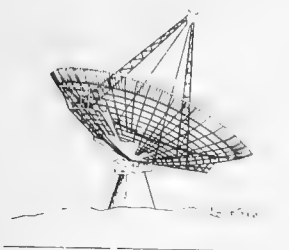


Loran stations with antennas 90 feet or less in height shall be charted with the position approximate symbol (L-Lg) and designated "Loran Station". They shall be shown only on those charts that include loran lines of position.



Loran stations with antennas higher than 90 feet shall be charted with the landmark symbol (L-63) and designated "LORAN TOWER". They shall be shown on all charts of the area, unless determined to be infeasible.

TELEMETRY ANTENNA (M-Ma)



The telemetry antenna of a missile satellite tracking station shall be charted with the landmark symbol and designated "TELEM ANT."

COAST GUARD STATIONS (J-3,-3a)

The names and numbers of Coast Guard Stations shall be added to charts of 1:80,000 scale and larger. When the Coast Guard Station is not a prominent landmark, the symbol is used and placed normal to the shore. On charts at scales smaller than 1:80,000, the symbol and abbreviation C.G. shall be used.

BROADCASTING STATIONS (See R. TR., pg. 26)

The Flight Hazard Section, Aeronautical Chart Division, maintains and supplies data from an up-to-date list of call letters, geographical location, frequency, power, and other information pertinent to commercial broadcasting stations. The "*List of Broadcasting Stations*", published by the Bureau of the International Telecommunication Union, Berne, Switzerland, becomes obsolete between printings. Requests for up-to-date commercial broadcasting station information shall be made through the Chief, Nautical Data Branch.

It is the policy of the Bureau to chart broadcasting stations in accordance with the following procedure:

1. Stations specifically recommended for charting will be charted regardless of other radio aids in the locality. Chart elevation above Mean High Water if exceptionally high.
2. Stations shall be charted in areas not adequately covered by other radio aids if accurate positions are available.
3. Whenever the towers of commercial AM broadcasting stations are charted as landmarks add their call letters and frequency. Omit call letters at TV and FM towers.

Towers shall be shown thus:



○ R. TR.
(KAGT)
1340 KC

○ TV TR

4. Obstruction lights on all towers shall be omitted unless specifically requested.
5. On charts of exclusively inland river areas, broadcasting stations shall not be charted unless the tower is recommended as a visual landmark.

AERONAUTICAL RADIOBEACONS, RADIO RANGE STATIONS (Fig. 23) (M-Mb,-Mc)

These facilities usually are shown on small-scale charts only when specifically requested and after approval by the Chief, Nautical Chart Division. Where considered to be of particular value in surface navigation, they have been shown on a few large-scale charts. Surface navigators should use aeronautical radio range stations only as radiobeacons. Bearings of radio range courses are not given because: courses cover a fan-shaped area that increases rapidly in width when going away from the radio station; courses over water cannot be flight-checked, so exact locations cannot be given; courses may stray with changes in atmospheric conditions; courses are realigned frequently and seldom can be hand corrected.

For aeronautical radiobeacons and radio range stations, the standard marine radiobeacon symbol (M-3) a magenta ring of 7.1mm. diameter centered over a black dot of 0.76mm. diameter or over the standard landmark symbol, will be used, together with the letters AERO R.BN., or AERO R.Rge. and the identifying frequency and signal, thus: AERO R.BN. 302 , or AERO R. Rge. 342 . It is not necessary to add operating minutes because they are all continuous.

The attention of the Aids Section shall be called to any aeronautical radiobeacon added to the charts so that appropriate information can be published in the Notice to Mariners and subsequent issue of N.O.O. Publication 117.

The fact that all aeronautical radiobeacons near the coasts will not be shown does not preclude their use by shipmasters. N.O.O. Publication 117 contains a list of most of those beacons which are near the coast, with positions and pertinent data sufficiently accurate for use on small-scale charts.

When the best available position is of doubtful accuracy, an accurate position should be requested through the Chief, Nautical Chart Division.

In evaluating graphic positions the following standards are to be followed:

- a. Positions originating with C&GS topographic or hydrographic surveys or Obstruction Charts are acceptable for charting at scales equal to or smaller than the source.
- b. Positions on modern 1:24,000-scale G.S. Quads are acceptable for charting at 1:40,000 scale and smaller.

When an aid has been approved for charting, and an accurate position requested, the aid shall carry the notation PA pending receipt of such position.

TRIANGULATION STATIONS (D-1)

Triangulation stations, rather than landmarks, should be shown on the charts when needed to control surveys of the Corps of Engineers or when they may be of value to the U.S. Navy in its operations. Only recoverable stations are charted; they are represented by small triangular symbols. When determined by the Corps of Engineers, the abbreviation C. of E. is appended. The Corps of Engineers' name of the station is also added.

VII

Titles and Notes

TITLE INFORMATION

An explanation of abbreviations used on nautical charts need not be shown in the title of charts with scales smaller than 1:50,000. However, when this information is omitted, reference shall be made to the Symbol Sheet, thus:

For Symbols and Abbreviations see C. & G. S. Chart No. 1

AUTHORITY NOTE

An authority note similar to the following must be used on all charts, listing only those Bureaus that have contributed to the information used in compiling the chart:

AUTHORITIES

Hydrography and topography by the Coast and Geodetic Survey with additions and revisions from the Geological Survey, Naval Oceanographic Office and Corps of Engineers.

When most of the information is from sources other than the Coast and Geodetic Survey, a note similar to the following is used:

AUTHORITIES

Surveys by the Coast and Geodetic Survey and Corps of Engineers

STORM SIGNALS (Fig. 13)

Storm signals are displayed by the Weather Bureau at numerous places along the coasts of the United States. These signals are to warn the mariner of the approach of violent storms. The stations where storm signals are displayed should be listed on the conventional charts affected, thus:

STORM WARNINGS

The U. S. Weather Bureau displays storm warnings at the following approximate locations

Custom House, Boston (42°21.5'-71°03.2')

Boston C. G. Station (42°22.1'-71°03.1')

Boston Lightship (42°20.4'-70°45.5')

Names of yacht clubs, marinas, boat yards, etc., shall not be included in the list. Use only the geographic feature named in the Weather Bureau report, e.g., Seattle, West River, Hatteras C.G. Station, etc.

On charts at scales smaller than 1:200,000 there shall be listed individually, by geographic position, only the most prominent and conspicuous offshore warning stations. The following note shall be used on these charts:

STORM WARNINGS

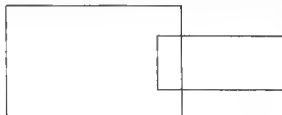
For a complete list of storm warning stations, see large scale charts

JUNCTION NOTES

References to adjoining charts and to insets, panels and sections shall be treated as follows:

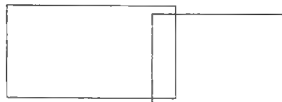
When two charts of different scales join—

(CONTINUED ON CHART 1220)



When two charts of the same scale join—

(JOINS CHART 865-5C)

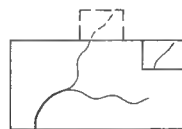


When a chart is printed front and back, add the following note in margin at junction:

(JOINS SIDE B)

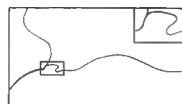
Inset: When an area outside the chart is included within the chart borders, an inset is used—

(JOINS INSET)



Inset: Representation of a small area on a larger scale—

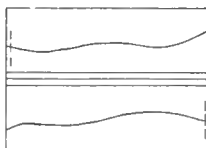
(SEE INSET)



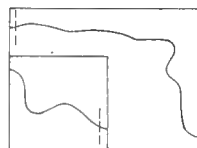
Panels or sections: When panels or sections on the same scale join—

(JOINS PANEL BELOW)

(JOINS SECTION BELOW)



PANEL



SECTION

REFERENCE TO CHARTS

The reference (use chart —) shall be used on small-scale charts where hydrography and/or aids to navigation have been omitted because of available large-scale chart coverage.

(use chart 400) Black plate

The reference (chart —) shall be used on all charts where considered desirable to call attention to additional large-scale coverage.

(chart 400) Magenta plate

BRIDGE CLEARANCES (H-18a,-18b)

Bridge clearances, both horizontal and vertical, shall be shown on all Small-craft, Intra-coastal Waterway and large-scale Conventional Charts. On small-scale charts, clearances shall be shown at fixed bridges spanning waterways that are expected to be navigated at the scale of the particular chart.

Bridge clearances and classifications shall not be shown on waterways which are not represented by depth curves, soundings, or depth legend. The charting of such clearances, omitted or removed from existing charts, shall be reconsidered when larger scale charts of the area are published.

The Corps of Engineers shall be the authority for showing bridge clearances on nautical charts.

However, for those bridges which the Engineers have not furnished or published clearances, clearances from another reliable source may be charted pending receipt of data from the Corps of Engineers. Bridge clearances from sources other than the Corps of Engineers shall be labeled "REPORTED."

It shall be the responsibility of the Chief, Nautical Data Branch, to originate written requests for the Bureau's field units at their first opportunity to verify "reported" clearances of bridges considered important to the mariner.

Verified clearances by our field units shall be turned over to the Corps of Engineers. If that organization accepts and publishes them, the "reported" label shall be removed from the charts affected. If the Corps of Engineers does not accept C&GS values, the label "reported" shall be retained.

A card file (Form C&GS-961) of bridge clearances, compiled from available information, is maintained by the Nautical Data Branch as follows:

1. Atlantic Coast and West Coast of Florida to longitude 84°00'. In this file, the forms will be filed first by latitude and second by longitude.
2. Gulf Coast from longitude 84°00' to Mexico. In this file, the forms will be filed first by longitude and second by latitude.
3. Pacific Coast, including Alaska and Hawaii. In this file, the forms will be filed first by latitude and second by longitude.

Information for this file is obtained from:

1. Corps of Engineers publication "Bridges Over the Navigable Rivers of the United States" (four parts) issued in 1961.
2. Additional information (footnotes) in preliminary 1960 Corps of Engineers bridge lists used to supplement item 1.
3. Corps of Engineers construction permits and final completion reports subsequent to 1961 bridge listings.

Disposition of bridge clearance data:

1. Bridge card completed in accordance with listings thereon by Nautical Data Branch personnel.
2. Data transferred to Aid Proofs of affected charts.
3. Bridge card given to Chief, Aids to Navigation Section for publication in Notice to Mariners.
 - (a) If no Notice is required and correction is to be made only at next printing, a copy of the bridge card is forwarded to the Coast Pilot Branch and so noted on the card.
4. Clearance data transferred from Aid Proof to revision drawing by cartographer.
 - (a) Location of structure added to revision drawing by cartographer from original source material.

The three charting phases of bridge structures are as follows:

1. Commencement
 - (a) Add dashed-line symbol.
 - (b) Designation "Bridge under construction."
 - (c) Magenta screening on important waterways supplemented by caution note calling attention to probable hazards to navigation in area (see Figure 12).
2. Completion prior to Corps of Engineer inspection.
 - (a) Add authorized permit clearances.

Example:

FIXED BRIDGE	}	AUTHORIZED
HOR. CL. 100 FT.		
VERT. CL. 25 FT.		
 - (b) Delete magenta screening.
3. Corps of Engineer inspection "as built" clearances.
 - (a) Revise clearances as necessary.
 - (b) Delete AUTHORIZED.

All fractions of a foot shall be disregarded in determining the final charted clearance.

For symbols representing various types of bridges, see Symbol Sheet (Chart No. 1) items H-14 through H-18b.

The terms Left and Right, when referring to bridge spans and river banks, mean Left and Right proceeding downwardly toward mouth of stream, and in the Intracoastal Waterway, proceeding south on the Atlantic Coast and west on the Gulf Coast.

The tabulations in the Bridge Book list vertical clearances referred to low water and high water. However, the vertical clearance notes at the front of each part of the book give the following information:

Tidal Waters—The clearance shown refers to Mean High Water and Mean Low Water, except in regions of diurnal inequality where the Mean Lower Low Water clearance may be given.

Nontidal waters—The clearance shown at high water refers to the stage at which navigation generally ceases.

The latter category shall be treated individually, such as the Columbia River where charted clearances are referred to Columbia River Datum (MLLW during lowest river stages). Chart 6151 clearances are referred to MLLW.

Clearances above dams are referred to the datum of soundings which is ordinarily the Normal Pool Elevation.

Normal Water Surface elevation on certain rivers is, for all practical purposes, to be considered MHW.

Notes regarding clearances at bridges, etc., must conform to the following standards: (6 pt. No. 3 L.C.G.C. Caps)

MORROW LIFT BRIDGE		OVERHEAD POWER CABLE
HOR. CL. 220 FT.		AUTHORIZED CL. 75 FT
VERT. CL. 15. FT. DOWN		
VERT. CL. 145 FT. UP		HOLDEN BEACH CABLE FERRY
		HOR. CL. 75 FT
REMOVABLE SPAN)		
BASCULE)		LOCK
FIXED BRIDGE)	HOR. CL. 50 FT.	WIDTH 75 FT
SWING BRIDGE)	VERT. CL. 15 FT.	LENGTH 640 FT
PONTOON BRIDGE)		
RETRACTILE BRIDGE)		

OVERHEAD CABLE CROSSINGS (Fig. 1) (H-4)

Overhead cables shall be indicated by a dashed line with clearance referred to MHW*. The clearance authorized by the Corps of Engineers shall be used for charting rather than the actual or "as-built" clearance. Cables known to carry high voltages are to be labeled, thus:

OVERHEAD POWER CABLE
AUTHORIZED CLEARANCE 40 FEET

*Clearances on Columbia River Charts are referred to Columbia River Datum (MLLW during lowest river stages). Chart 6151 clearances are referred to MLLW.

For reference to datum other than MHW, see above Bridge Clearance notes.

A card file (Form C&GS-961) of cable clearances is maintained in the same manner as for bridge clearances. The files are compiled from information furnished by the Corps of Engineers in the form of construction permits.

The application of overhead cable data is the same as that previously described for bridge clearances.

Clearances, other than those furnished by the Corps of Engineers, shall not be charted.

Overhead cable crossings located from other sources such as C&GS surveys, aerial photography, etc., shall be charted and labeled OVERHEAD POWER CABLE or OVERHEAD CABLE, as the case may be. The Nautical Data Branch should be requested to obtain the authorized permit clearance of such cables.

Clearances shall not be shown on waterways which are not represented by depth curves, soundings or depth legend. Symbol and designation shall be charted.

Exception: Such clearances may be included on *small-craft charts*.

VIII

Records

DESCRIPTIVE REPORT NOTE

When an original topographic or hydrographic survey is applied to a chart, a notation shall be entered in the Review Section of the Descriptive Report of the survey on Form C&GS-8352, "Record of Application to Charts." If Form 8352 is not in the Descriptive Report, the cartographer shall insert one next to the back cover.

HISTORY OF CARTOGRAPHIC WORK

A record, commonly known as a "History" (Form C&GS-8322) must be submitted for every chart compilation, whether it results in a new chart, a reconstructed chart or a correction. The "History" must represent a complete and detailed record of all available information used or consulted in the compilation. The information used for the compilation may come from various types of surveys and records, such as hydrographic sheets and accompanying descriptive reports, topographic sheets and descriptive reports, blueprints, letters, field examinations and reports, U.S. Engineers reports, Coast Pilot publications, congressional documents, charts of foreign countries, Name Standards of this Bureau, triangulation records, and many other sources too numerous to mention. It is the compiler's duty to obtain, whenever possible, any available information, in addition to that on record in the Division, which is pertinent to the job in hand. A sample of this record is shown on the following page.

C & GS 925 Rev 2/762		HISTORY OF CARTOGRAPHIC WORK - NAUTICAL CHART DIVISION FILES				REMARKS (over)			
CHART 566		TO REPRODUCTION		LITH Rec'd		Changed to NE-95 hand corr. - 12-12-62			
DRAWING #18		NC	NP	RP	LITH Ver				
SHEET PROJECT 50150		DATE	DATE	DATE	PRINT DATE				
OCT 2 1962		OCT 3 1962		DEC 20 1962					
SOURCE OF INFORMATION		LOCALITY		INFORMATION APPLIED					
APPLIED	File No	Date	Authority	Type of Information					
Part Full									
✓ 1	H-8522	1961	C&GS	Hydro	W. of Kent I.	Applied entire base survey			
✓ 2	H-8523WD	1961	C&GS	Hydro	W. of Kent I.	50 and 124 soundgs carried forward			
✓ 3	L-964	1962	C of E	Topo	Cedar Pt.	Added pier			
✓ 4	L-362	1962	C of E	Clearance	Ches. Bay Bridge	Lowered vert clear. (for construction gondola)			
✓ 5	L-89	1962	C&GS	Landmark	Entire chart	No corr.			
✓ 6	L-340	1962	C&GS	Landmark	Entire chart	Added "O Standpipe" at Round Bay and deleted "O Crock" at Crystal Beach			
✓ 7	L-1285	1961	C&GS	Misc.	Entire chart	3 ft. sounding added at Chan. into Lake Ogleton			
✓ 8	L-1217 } BP-60369 } 4-61	1961	USN	Hydro	Annapolis	Added shoaling note on Chan. into Spa Creek			
✓ 9	BP-61203-05 } 12-61 } 4-62 } C of E	1961	C of E	Hydro	Craighill Chan.	Deleted upole at Annapolis			
✓ 10	Aid Proof #23					Added foot bridge at Annapolis			
✓ 11	New print ch.t. 566					Revised soundings and depth curves (thru ch.t 385)			
						Revised soundings (2) along edge of channel			
						Corrections made thru 10-1-62			
						Applied to drawing			
Items	Completed by	Started	Completed	Time (hrs)	Items	Reviewed by	Started	Completed	Time (hrs)
1-2	John Jones	9-24-62	9-26-62	11	1-2	John Doe	10-1-62	10-1-62	2
3-11	W. Smith	9-27-62	9-28-62	16	3-11	John Doe	10-2-62	10-2-62	4 1/2

In the "History" heading, the compiler shall add only the chart, sheet, and project numbers. All other items in the heading shall be completed by the Chief, Conventional Chart Branch, and the Chief, Nautical Data Branch.

Items entered on the "History" should be numbered consecutively, and the information called for under the various headings must be supplied by the compiler.

Under the heading "Applied," a check mark should be made in the appropriate column to indicate whether the item has been fully or partially applied. As it is important that no item of source material be cleared from the Standard until it is fully applied to the chart, it is required that all partial applications be underscored on the "History" in red. Under no circumstances shall any item be considered as fully applied unless it results in a complete application, either directly or indirectly, of a completed survey record. Information applied partially is also indicated on the Standard.

Under the main heading "Source of Information," there is a sub-heading "File No." The file number usually carries a designation, in addition to the number, which identifies the source material as a hydrographic survey *H* or topographic survey *T* of this Bureau, or as a blueprint *Bp* or letter *L* showing information from other sources. In addition to the above items of source material, many publications of other organizations are used to furnish chart information. These publications are entered under "File No." with their original designations, such as "A.M.S. Quad Central Park," "G.S. Quad Winter Haven," "Canadian Chart 803," etc. The important thing to remember is that the reference under File No. should identify the item without question.

Under sub-heading "Date," the actual date of the survey or determination should be given whenever it can be ascertained. Otherwise, the date of publication is to be used.

Under sub-heading "Authority," the name of the person, agency, or organization making the survey, determination or report should be entered.

Under heading "Type of Information," it should be recorded whether the source material involved hydrography, topography, triangulation, aids to navigation, landmarks, cable areas, bridge clearances, names, etc.

Under heading "Locality," to expedite location of reference area, the compiler shall list a prominent name, approximate geographic position, or general note such as "north quarter of chart," "east portion of chart," etc.

The entry under the heading "Information Applied," should consist of a short, definite statement, describing the condition of the source material, how it was used and what information resulted on the chart. For example, it should be made clear just what information has been charted in every partial application of source material. If the source material is applied before verification and review, or if information is applied indirectly through another chart, it should be so stated. If contours only, or shoreline only, or drainage or cultivation, or a combination of any of these were used, mention should be made of this. If no correction to the chart is required from the source material, this fact should be stated. This column may also be used for any pertinent and useful remarks.

Reference to triangulation sources must be as complete as possible. For example: "Geographic positions, Calif. III, page 38."

A copy of the Chart Specifications form should accompany all "Histories" of new and reconstructed charts.

Histories of canceled charts and histories prior to reconstruction of a chart are stored in the Federal Records Center, Alexandria, Va. Requests for these histories should be referred to the Standards Section.

FUTURE HISTORY RECORD

Form C&GS-8325 entitled "Information of Value in Future Corrections to Charts" should be filled out and filed in front of the History for the chart concerned.

This form was designed to record information which the cartographer discovers while compiling a chart and which he wishes to pass on as a help at the time of future corrections to the chart. Some of the items which should be recorded are noted on the form as a guide. The cartographer should also add any information regarding a particular chart which, in his opinion, should be preserved for future reference. For example, notes regarding the need for future surveys, the location of certain fixed aids, or the mention of discrepancies in source material which cannot be reconciled, would be very useful. Areas in which information is needed should also be indicated on a set of standards in the Standards Section.

The form should be consulted for possible assistance to the Cartographer when experiencing difficulty in applying source material.

TOPOGRAPHY

GENERAL STATEMENT

Topographic detail is shown on nautical charts to help the mariner determine his position at sea in relation to fixed visible objects. It is compiled primarily from photogrammetric surveys made by this Bureau and supplemented by other sources when necessary.

Topographic maps made from the surveys are used for planning, compiling, and correcting topography shown on the charts. The map manuscripts are available during different stages of their compilation as follows:

Preliminary Manuscript

Compilations from meager or unverified control. Preliminary manuscripts are not diagrammed on the Standards and should never be used for nautical chart compilation.

Incomplete Manuscript

Controlled plots with incomplete detailing; prepared for the use of field parties. Incomplete manuscripts are diagrammed on the Standards with the pencil notation "History," but shall not be used for compiling or correcting the charts.

Advance Copy, Advance Print, Advance Manuscript

These synonymous terms indicate a controlled plot with detailing complete except for revisions made during review and may be used for compiling or correcting the charts. Normally, any revisions made as the result of the review are minor and rarely affect the chart. The numbers assigned the manuscripts in this advanced form are indexed on the Standards in pencil, indicating these maps must be marked partially applied on the chart History until the reviewed manuscripts are applied to the charts.

Reviewed Manuscript

These are the final basic surveys which may be completely applied to the charts. All applications shall be indicated on Form C&GS-8352 "Record of Application To Charts" in the Descriptive Report. Cartographers taking charts in hand for correction should obtain authorization to apply these surveys completely, if time permits.

Revision Sheets

Revision Sheets, sometimes called "RS Sheets" are copies of either advanced or reviewed manuscripts to which are made corrections from aerial photographs, taken after the date of the Advanced Print. They are assigned an R.S. number which is different from the original manuscript number. Revision Sheets may be applied to the charts in the same manner as the advanced or reviewed manuscripts.

Some New Charts and corrections to existing charts are compiled directly from the photographs. When this is done, it is the responsibility of the nautical cartographer to see that the topographic delineation is clear and appropriate. Notes in blue ink shall be added to the Drawings to clarify questionable detail for the engraver. To indicate tint colors on the Drawings, the letters "Ma" shall be used for green (marsh tint), "W" for blue (lakes and ponds), and "B" for buff (land tint). While it is sometimes necessary to clarify corrections by showing the tints in color on the Drawings, it is not desirable because the colors photograph on the reproduction negatives and obscure the line detail. This method of indicating tints should be avoided where possible; but, if used, the colors should be lightly shaded.

It shall be the duty of the engineer to indicate in the Specifications the detail to be charted and the symbolization to use. Consideration must be given to the chart scale and the purpose for which the chart is being constructed. In general, on large-scale charts complete topographic detail should be shown along the coast for several miles inshore, while on small-scale charts most of the detail inside the high-water line should be omitted.

On compilations and on final charts the outer coastline and important rivers are shown by the maximum weight line (.011"), but streams and unimportant indentations are shown by thinner lines. In a dense drainage system, minor streams are omitted.

Physical features, such as gravel, brush, trees, etc., generally are not shown by symbols, but are indicated by name.

Symbols used on the charts of this Bureau are shown on Chart No. 1, "Symbols and Abbreviations," and Figure 1 in the Appendix of this manual. A few of those symbols which need emphasis are discussed on the following pages.

I

Natural Features and Relief

HIGH WATER LINE (Fig. 1) (A-9)

The shoreline shown on the charts is the mean high-water line except in marsh or mangrove areas where the outer edge of vegetation (berm line) is used. It shall be represented by a .011" line which shall gradually decrease up streams and rivers. Unsurveyed shoreline, or shoreline connecting two surveys which do not join satisfactorily, shall be represented by a dashed line. The outer limits of marsh shall be indicated by a .006" continuous line.

LOW WATER LINE (A-10) (R)

On new chart and reconstruction Compilations and on correction Drawings the low-water line shall be shown as a single row of dots. It shall be delineated whenever possible from hydrographic surveys. However, when the hydrographic surveys do not adequately portray the low water line, it shall be compiled from the photogrammetric surveys.

When a foul limit line is shown along shore, the low-water line, if inshore of the foul line, may be omitted.

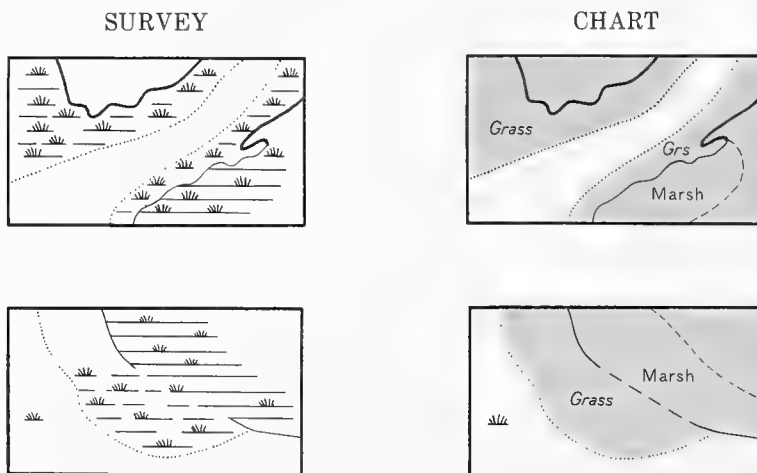
The area between the high and low-water line shall be tinted green and, when known, the character of this area such as "Sand," "Mud," "Gravel" shall be labeled.

MARSH (Fig. 1) (C-17)

The mean high-water line in marsh, mangrove, cypress, or similar swamp areas is generally obscured by vegetation and will not ordinarily be located on topographic surveys. In such areas, the outer edge of vegetation visible above Mean High Water, usually represented by a fine line on the topographic survey, presents a fairly definite shoreline to the navigator and should be charted by a .006" solid line.

On photogrammetric surveys, the line of change between the solid marsh and an area usually flooded is indicated by a difference in symbols; on the chart, it shall be shown by a fine dashed line .006" in width.

An area shown on the photogrammetric survey by the open marsh symbol outside the high-water line shall be indicated on the charts by the word "Grass" or "Grs". If the low-water line is not indicated on the survey sheets, the area shall be defined by a single row of dots and shall be tinted green. Areas too small to be tinted may be indicated by tufts of grass. A marsh area inside of the mean high-water line shall be represented by a green tint and black legend. A black broken line .004" in width shall be used to denote the inshore limits of marsh when no other symbol furnishes such a limit. Symbols for roads, railroads, levees, and bluffs are examples of symbols that may replace the black dashed line.

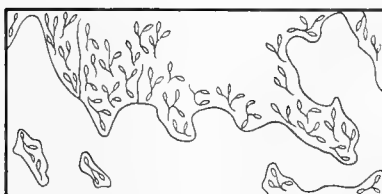


In all cases, to clarify to the lithographer the limits of the area to be shown tinted on the printed chart, the cartographer shall indicate the marsh area by a blue pencil tint on the Drawing. Water areas of lakes and ponds shall be similarly tinted and the abbreviation "W" for water shall be placed in such lakes and ponds in non-photographic blue ink.

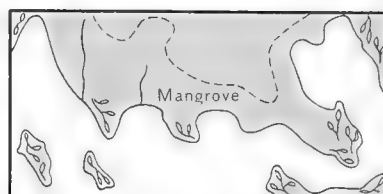
MANGROVE (A-7)

The mangrove symbol is used only when the mangrove area is of small extent or when the growth is a prominent feature. For large areas, the word Mangrove is used and repeated if necessary. When the word is used, the inner limits are indicated by a thin black dashed line.

SURVEY



CHART



CYPRESS (WOODED SWAMP)

Cypress is treated in the same way as mangrove except that trees growing outside the high water line are indicated by the word Trees.

SURVEY



CHART



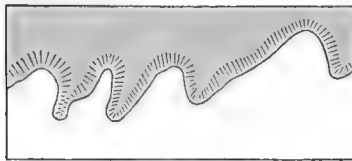
TREES (C-5, -5a to -5f)

When trees are recommended as a characteristic feature, or where they would appear to be useful to the navigator (as for instance, on a sand spit where a tangent may be observed), the tree symbols shall be shown on the charts.

BLUFFS AND CLIFFS (A-2, -3)

The terms "bluff" and "cliff" are variously defined. On nautical charts, bluffs are usually considered to be not rocky and cliffs are considered to be rocky. As bluffs and cliffs are of particular value for radar navigation, it is desirable that they be symbolized in some form on the charts. However, since several symbols are available for depicting relief a study shall be made for each chart and the proper symbol to use will be noted in the Specifications.

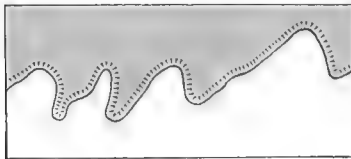
BLUFFS AND CLIFFS



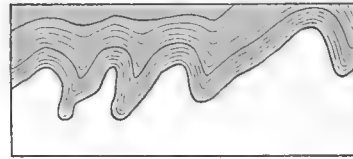
HIGH, NOT ROCKY
(BLUFFS)



ROCKY
(CLIFFS)



LOW, NOT ROCKY
(BLUFFS)



CONTOURS

CONTOURS (Fig. 1) (C-1, -1a)

On charts where contours are to be shown, the contour interval shall be noted in the Specifications. The interval shall be uniform on any one chart, but to bring out a summit or an important feature, an intermediate interval may be shown by a dashed line.

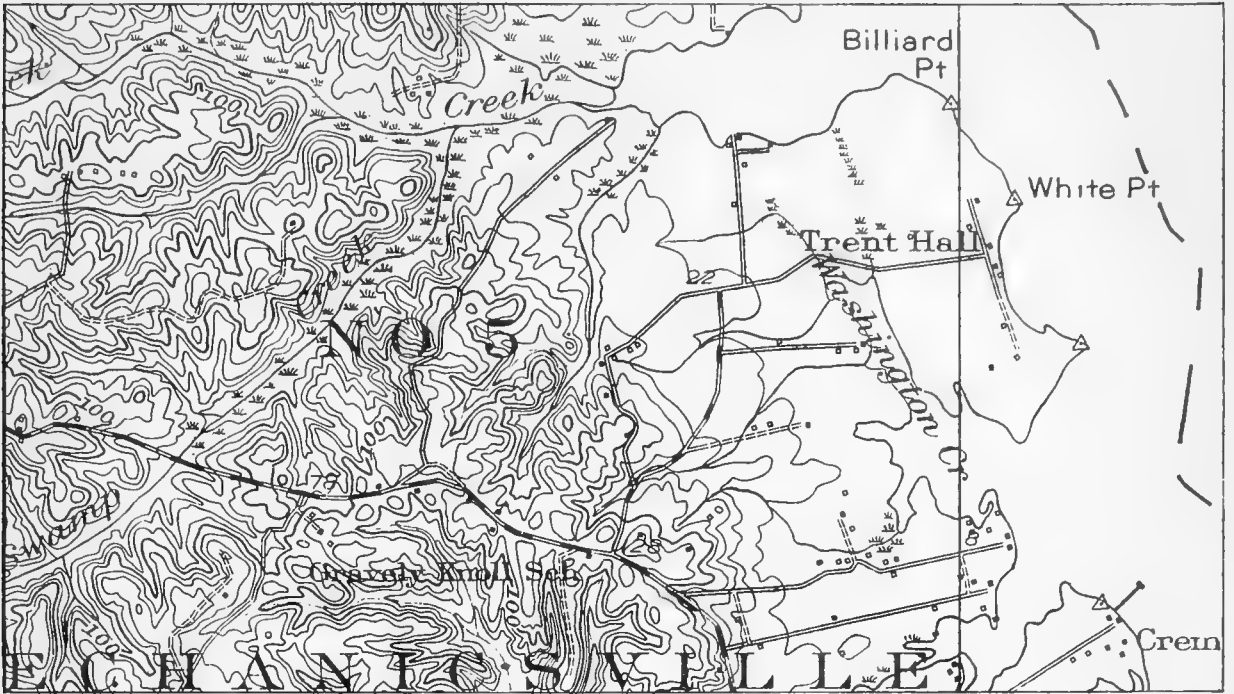
For charts to which gradient tints will be added, the interval selected shall be wide enough to show clearly the gradations of the color tints. See charts 5111, 5112, 5114, 5115, and 6102.

Contours shall be delineated by a .004'' line with every 4th or 5th contour (index contour) accentuated by an .008'' line.

To give the navigator a general and easily interpreted picture of the relief, contours shall be generalized. The degree of generalization depends on the nature of the terrain and the scale of the chart. (See pg. 45.)

The contour values shall be in slanting figures placed at suitable intervals parallel with, and centered on, the accentuated lines. (C-1) In flat areas where no lines are accentuated, contour values should generally be shown on every line. (See pg. 45)

On small-scale charts without contours, mountain or hill summits shall be represented by a dot surrounded by hachures. (D-Db)



Section from Geological Survey quadrangle map.



Nautical chart compilation showing generalization of contours taken from Geological Survey quadrangle map shown above.

ELEVATIONS (D-3, -Da, -Db, -Dc, Db; O-1)

When the information is available, elevations shown on nautical charts shall be referred to Mean High Water and the note "Heights in feet above Mean High Water" shall be used. (See fig. 2.)

When contour and spot elevations based on the plane of Mean Sea Level are charted, the following note shall be charted:

HEIGHTS

Elevations of rocks, bridges, landmarks and lights are in feet and refer to Mean High Water. Contour and summit elevation values are in feet and refer to Mean Sea Level.

When elevations are referred to datum planes other than Mean High Water or Mean Sea Level, an appropriate note shall be added to the chart. (See Bridge Clearances, pg. 35.)

Elevations of summits must be checked with those shown on aeronautical charts, U.S. Geological Survey and Corps of Engineers quadrangles, and those determined by the Division of Geodesy, and every effort must be made to reconcile discrepancies found.

Elevations of points on slopes shall be omitted. Elevations of tops of trees shall be indicated by the overlined slanting figures as shown on Chart No. 1, Item C-11. When used, this symbol shall be added to the General Notes of that chart. Treetop elevations, if available, should be charted on peaks in Southeast Alaska.

Slanting figures shall be used for all elevations and, wherever possible, summit elevations shall be so placed that the top of the first figure bears 135° from the position symbolized by the dot.

When there is insufficient space to show elevation figures on islets or rocks, they should be indicated by slanting figures in parentheses placed nearby in the water area.

SAND BEACHES AND DUNES (A-4, -6)

When called for in the Specifications, sand beaches behind the high-water line shall be indicated on the charts. Three rows of dots are sufficient representation in small areas, but for large areas limit lines in blue ink may be shown and the area labeled "Sand" in blue.

When not too extensive, sand dunes may be shown along the beach. When the symbol is not used, the area shall be labeled with the words "Sand dunes."

II

Culture: Shore and Offshore Structures**PIERS (G-9)**

Piers should be numbered in accordance with the Port Series publication unless it is superseded by later information. Piers should be shown with a double line where space and/or scale permit; in general, on charts at 1:40,000 scale and larger.

JETTIES AND BREAKWATERS (G-6, -8, -8a, -Ga)

On charts 1:40,000 scale and larger, it is desirable that jetties and breakwaters be shown with a double line. However, where space and/or scale do not permit, they may be shown by a single line. Submerged portions shall be shown by dashed lines and the limits of the submerged base, when known, shall be shown by a dashed line.

PILES, DOLPHINS, ETC. (G-21, H-9, L-59, O-30)

Piles, dolphins, stakes, and pipes shall be represented by a small circle with a description. When they show above the plane of Mean High Water, use upright lower-case letters with the first letter capitalized, thus: "Pile," "Stake," "Pipe." When the object is submerged, labels in italics are to be used, thus: "*Subm pile*," "*Subm stake*," "*Subm pipe*."

Where several pile symbols are charted, the preferred label is "Piling." Where space is limited, the label "Piles" may be used and the abbreviation "Dol" may be used for dolphin.

Extensive areas of piling shall be shown by a dashed line and labeled "Piling." If the pilings are arranged in rows, representative rows of dashed lines shall be charted. If no pattern is apparent, the outer limit of the area shall be charted with the label "Piling" in the center.

For objects used as channel markers, refer to "Private Aids," page 85.

SEWERS (H-11)

A sewer extending out from the high water line is shown in magenta by a dashed line and labeled "*Sewer*."

FENCES

A fence extending into the water is shown by a dashed line and is labeled "Fence," if room for the word is available.

PLATFORMS (O-Ob, -Oc)

An offshore platform shall be represented by a solid square symbol and labeled "Platform." The square shall measure 1.25 mm. on a side except in narrow rivers or congested areas where it may be made smaller.

Offshore oil well structures are described in detail under hydrographic dangers, page 66.

DUCK BLINDS

A duck blind is not charted unless it is of a permanent nature and a danger to navigation.

FERRIES (H-19)

Ferry terminals shall be labeled with the word "Ferry." Ferry routes should not be charted for great distances but may be shown for short distances out from the slip by a magenta dashed line.

The black dashed-line symbol should only be used when charting a cable ferry.

III

Other Culture

CITIES AND ROADS (Fig. 1) (H-1; I-1, -1a)

On existing charts, cities, towns, and roads have been represented by road patterns and symbolized by single or double lines depending on the scale of the chart. For instance, on charts larger than 1:40,000 scale, roads in open country, cities, and towns are shown by double lines. On charts 1:40,000 to 1:99,000 scale, streets in cities and towns are shown by single heavy lines while the roads in open country are shown by double lines. On charts 1:100,000 and smaller scale, only single heavy lines are used.

On all New Charts and Reconstructions, both large and small scale, consideration shall be given to charting the areas of cities and towns by a screening and showing only the major highways leading to or through the cities by single heavy lines. However, this new treatment should not replace the older road pattern symbolization on all charts. Both methods have their merits and on some charts even a combination of the two methods may be used effectively.

Highways in general shall not be shown on charts of smaller scale than 1:250,000. Only through or connecting public highways, and roads leading from such highways and terminating at the shore, shall be shown. Private roads leading from public highways to a building shall be omitted. In cities, only streets which are actually constructed and in use are to be charted. Omit some streets, as necessary, to avoid crowding. Numbers and names of important U.S. highways shall be charted when the information is available.

When double-line streets and roads are to be charted, they shall be shown on the Drawing by a single line with a note to the engraver to engrave standard double lines. When so designated, the line should represent the center of the road. Care must be taken to see that it is possible to engrave a double line where a single line is drawn and that too many streets are not shown. Highway interchanges and odd road intersections will be shown with double lines to aid the engraver. When single-line roads are shown on a Drawing and there is a possibility of their becoming confused with contours, streams, or other detail, they shall be labeled on the Drawing with the letters "Rd" in blue ink.

Roads shown by dashed lines on the survey sheets are not to be charted unless they are considered of some importance, in which case they must be charted by solid lines.

Trails shall not be shown on the charts.

STREET NAMES (Fig. 20) (I-26, -26a, -Ie)

Street names shall be charted along the waterfront of important harbors on charts 1:12,000 scale or larger when recommended in the Specifications.

RAILROADS, RAILWAYS (Fig. 1) (H-3, -3b, -3c, -14)

A single .008" line is used for both single and double-track railroads. In the case of railroad yards, either enough of the tracks are represented to indicate the area covered, or the limiting tracks and an appropriate legend are shown. City electric railways are generally not charted.

BUILDINGS (I-3a, -5)

Prominent buildings along the waterfront and large individual buildings back from the waterfront that are of navigational assistance to mariners are shown on charts 1:40,000 scale or larger. No other buildings are shown. Buildings represented by a symbol smaller than one-eighth of an inch shall be charted in solid black. Larger buildings shall be outlined in black and cross-hatched.

A prominent feature on a building may be shown by a landmark symbol and labeled when specifically recommended for charting as a landmark.

CHURCHES (I-8)

Church buildings considered to be prominent features, but which have not been recommended as landmarks, may be charted by their symbols, thus: †

AIRPORTS (Fig. 20) (I-23, -24, -Ic, -Id)

On large-scale charts, the limits of runways of commercial airports shall be shown.

When a commercial airport is to be shown on a small-scale chart, the symbol shown on Chart No. 1 (item I-Id) is to be used.

All reference to military airports is omitted at present.

MILITARY FEATURES

No name or symbol relating to presently used fortifications or military installations shall be shown on any chart. Roads or buildings in military reservations shall not be shown unless requested by the Army or Navy. Prominent natural features and official aids to navigation must be charted.

Objects of present military importance considered to be essential navigational features shall be charted only with the consent of the proper military authorities.

HYDROGRAPHY

GENERAL STATEMENT

Hydrographic features are charted only after a thorough study of the configuration of the bottom as revealed by the original surveys. The variety of submarine relief must be presented in a clear and practical manner. Important objects must not be obscured by other data. A dangerous rock, an islet, or the least depth on a shoal must be shown clearly and prominently. Small islets and rocks should be exaggerated if necessary, to make them easily discernible.

Specific instructions to field parties call for basic hydrographic surveys to supersede all previous surveys made by this Bureau in the areas covered. When applying reviewed basic surveys to the charts, all prior soundings should be removed. However, critical soundings not specifically disposed of by the reviews of the surveys should not be removed arbitrarily because such soundings may have been charted subsequently to the date of the review.

Hydrography should be applied progressively from the largest to the smallest scale charts. Detail is eliminated and generalized in proportion to the scale reduction.

A conflict between the delineation of the low-water line or the amount that rocks awash uncover on contemporary hydrographic and topographic surveys should be adjusted by giving greater weight to the information shown on the hydrographic survey.

To aid in navigating by echo-sounding apparatus, depth curves have been given special prominence on nautical charts in areas where modern hydrographic surveys have been made. Deep-water submarine relief has thus become more important to the navigator, and the more faithfully the chart depicts this relief, the closer the navigator can relate his depth readings to the chart and the more certain he will be of his position. Significant submerged features shall not be unnecessarily generalized.

I

Surveys

UNVERIFIED HYDROGRAPHIC SURVEYS

Unverified surveys should be applied to charts going to press when the chartered bottom configuration of the areas covered by the surveys is inadequately delineated. Otherwise, only the critical information should be applied.

UNREVIEWED SURVEYS

When an unreviewed hydrographic survey is used for charting, a statement to that effect must be added to the special page provided in the Descriptive Report of the survey.

WIRE-DRAG SURVEYS (O-6a; Q-9,-9a)

Areas in Alaska which have been swept to a safe depth by wire drag, but which have not been covered by adequate hydrographic surveys, are indicated on the charts by a green overprint. When time permits, the green tint may be added to other charts of important areas covered by wire drag.

Soundings on shoals or rocks discovered with the wire drag and not yet transferred to a contemporary hydrographic sheet must not be overlooked when correcting or compiling a chart.

The maximum cleared depth over a rock, wreck, obstruction, or shoal shall be charted on other than a Wreck Chart only when it is within 3 feet of the depths found by other means in general depths of 18 feet, and within 6 feet in greater depths. Descriptive terms (*Rk*, *Wk*, *Obstr*) are to be charted only when existence of the object is indicated by a field examination such as by a hang or sounding, thus:

$$\frac{21}{Rk} \qquad \frac{21}{Wreck} \qquad \frac{21}{Obstruction}$$

The maximum clearance over small, shoal areas, such as along the Maine coast, is to be shown by the bracket symbol and bottom characteristic (if available) thus:

$$\frac{21}{hrd}$$

If no bottom characteristic is available, the descriptive term "*Shoal*" is to be used, i.e.,

$$\frac{21}{Shoal}$$

The charted abbreviation note shall read:

$\frac{21}{}$ Wreck, rock, obstruction, or shoal swept clear to the depth indicated.

II

Soundings

PLANE OF REFERENCE FOR SOUNDINGS

The plane of reference for soundings along the Atlantic and Gulf coasts of the United States and Puerto Rico is the mean of all low waters (Mean Low Water); except that where tides on the Gulf Coast and south coast of Puerto Rico are chiefly diurnal, Mean Low Water is based on a mean of the lower of the daily low waters. Along the Pacific coast of the United States, Alaska, and the Hawaiian Islands, it is the mean of all lower low waters (Mean Lower Low Water). Care must be exercised to see that foreign charts used in compilation are on these planes.

TIDE NOTE

Upon request by the Nautical Chart Division, tidal information is furnished on Form C&GS-832, "Tidal Information" from the Tides and Currents Branch, Marine Data Division.

Values given in the tide note of a chart are referred to the plane of reference of the soundings on that chart. Thus, the amount stated under Mean High Water is the mean of all high waters observed at the station named. The amount stated under Extreme Low Water is actually the lowest tide observed during the period in which tidal observations were made. This period may be a few days or many years. The date of the tide note is that on which the latest information was applied. This note should be checked for new values approximately every three years. The date checked shall be given in the lower left corner, thus:

(363)=month and last two digits of the year.

Where applicable, the standard form of tide note shown below shall be used on all charts of scale larger than 1:200,000.

TIDAL INFORMATION				
Place	Height referred to datum of soundings (MLW)			
	Mean High Water	Mean Tide Level	Mean Low Water	Extreme Low Water
Hooper Strait	feet 1.7	feet 0.9	feet 0.0	feet -3.5
Monie Bay	2.3	1.2	0.0	-3.5
Port Allen	2.5	1.3	0.0	-3.5

(363)

The approximate geographic position should be shown at each tidal place not easily located on the chart.

DEPTH UNIT

All soundings on any one chart must be expressed in the same depth unit, either feet, fathoms, or the combined form fathoms and feet (to 11 fathoms). This applies to large-scale plans on a chart and also to all of a group of plans forming a chart. However, channel legends and controlling depth tabulations may be expressed in feet on a chart showing soundings in fathoms.

SIZE OF FIGURES FOR SOUNDINGS (Fig. 21)

Unless figures of uniform size are used on a Compilation or Drawing, a proper selection of soundings cannot be made. Large figures usually result in a selection of soundings that are too widely spaced. The figures used should not be larger than 2 mm., nor smaller than 1.5 mm.

FRACTIONS

Fractions without a whole number should have a bar between the numerator and the denominator, e.g., $\frac{1}{2}$. In fractions accompanying a whole number, the bar is omitted, e.g., $1\frac{1}{2}$.

SOUNDINGS CHARTED IN FEET

Ordinarily fractions of feet are not charted but, where necessary to obtain a proper distribution of soundings and to show the depth curves in their proper position, a $\frac{1}{2}$ -foot fraction may be used on the deeper side of the curve. One-half foot fractions may also be used to keep depth curves open and to define more clearly the natural channels.

The following table is to be used when converting tenths of feet on a survey to whole or half feet:

Survey	$\frac{1}{2}$ feet	Whole feet
0.1 } 0.2 } 0.3 } 0.4 }	0.0 ft.	
0.5 } 0.6 } 0.7 }	$\frac{1}{2}$ ft.	0
0.8 } 0.9 }	1 ft.	1

SOUNDINGS CHARTED IN FATHOMS (Fathoms and Feet to Eleven Fathoms)

On all new and reconstructed charts using fathoms as depth unit, soundings shall be charted in fathoms and feet for depths less than 11 fathoms, thus: 8₂.

On charts constructed prior to 1948, soundings were expressed in fathoms and quarters to 7 fathoms, then in fathoms and halves to 8 fathoms. Fractions were not used for depths greater than 8 fathoms except adjacent to the 10-fathom curves, where, in flat bottom, 10 $\frac{1}{2}$ -fathom soundings were used to avoid displacement of the curve. When extensive hydrographic revisions are made to these charts, consideration should be given to changing the sounding units to fathoms and feet in depths less than 11 fathoms as outlined above. Often it is more practical to retain the fathoms and quarters units, carrying quarters to 11 fathoms in the revised area.

When soundings in whole feet or fathoms and feet on an original survey by this Bureau or in feet and tenths on a Corps of Engineers survey, are to be charted in fathoms and fractions of fathoms, the feet remaining after converting into whole fathoms (6 feet equals one fathom) shall be converted to fractions of fathoms in accordance with the following tables:

Feet and tenths	$\frac{1}{4}$ fathoms
0.0 to 0.9	0
1.0 to 2.4	$\frac{1}{4}$
2.5 to 4.0	$\frac{1}{2}$
4.1 to 5.1	$\frac{3}{4}$
5.5 to 5.9	1
Feet and tenths	$\frac{1}{2}$ fathoms
0.0 to 1.9	0
2.0 to 4.9	$\frac{1}{2}$
5.0 to 5.9	1
Feet and tenths	Integral fathoms
0.0 to 4.9	0
5.0 to 5.9	1

When both the original surveys (feet and tenths) and the charts to which they have been applied show soundings in feet, it is advisable to use the original surveys to correct another chart on which soundings are shown in fathoms.

Where the soundings are plotted on an original survey in fathoms and tenths, the decimals of fathoms are to be converted for charting in accordance with the following table:

Fathom	Integral		Integral		
	feet	$\frac{1}{4}$ fm.	$\frac{1}{2}$ fm.	fms.	fms.
0.1	0	0	0	0	0
0.2	1	$\frac{1}{4}$	0	0	0
0.3	2	$\frac{1}{4}$	0	0	0
0.4	2	$\frac{1}{4}$	$\frac{1}{2}$	0	0
0.5	3	$\frac{1}{2}$	$\frac{1}{2}$	0	0
0.6	3	$\frac{1}{2}$	$\frac{1}{2}$	0	0
0.7	4	$\frac{1}{2}$	$\frac{1}{2}$	0	0
0.8	5	$\frac{3}{4}$	$\frac{1}{2}$	1	1
0.9	5	$\frac{3}{4}$	1	1	1

SELECTION OF SOUNDINGS

The most important features of a chart are the soundings and depth curves by which the main characteristics of the configuration of the bottom are represented.

The least depths on shoals and the practicable channel depths must be selected before spacing the surrounding depths. In narrow passages and critical areas of uneven bottom, care must be taken to select enough soundings to indicate clearly the dangers and the channels between them. Subject to the foregoing, the soundings in areas completely developed by the hydrographic survey should be shown with uniformity and without crowding. Crowding a chart with unnecessary soundings detracts from its clearness and reflects on the cartographer's skill. Depth curves can be used effectively to eliminate many soundings and yet reveal the bottom configuration.

After the shoals are shown and the channels developed, the selection for the rest of the chart depends on the physical characteristics of the bottom, and no hard and fast rules can be given. If the slopes are gentle, the selection is simply a matter of spacing the soundings as uniformly as the survey will permit. If the bottom is rocky and broken, a uniformly spaced selection will not reveal the true nature of the ocean floor. Care must be taken not to obscure a shoal sounding by placing a deep sounding too close to it. However, the deepest soundings must not be neglected as they are valuable for echo-sounding navigation and for defining the depth curves more clearly. Soundings of the same depth as a curve, and placed close to or on the curve, serve no useful purpose on the chart and should be omitted. *A curve around a shoal sounding must never touch the figure.*

When there are channel ranges, a line of soundings on the range should be selected. This does not apply to areas in dredged channels where depths are indicated by a note.

If the application of a recent survey to a chart reveals conditions so changed that satisfactory junctions cannot be made with the hydrography of former surveys, a blank space is left beyond the limits of the more recent survey and a note is added: "Hydrography to (eastward) from surveys of 1934."

On small-scale charts, soundings within a group of rocks or coral heads through which there is no well defined channel should be omitted.

Soundings should be shown in slips and around piers if space permits. Care must be taken to select soundings far enough off the faces of piers to indicate depths at the bilge and and keel lines of vessels which will probably use such piers. In new docks or slips where maintenance of depths is questionable, legends with dates should be used if space permits.

A shoal sounding on an isolated rock should have the abbreviation "*Rk*" placed near it. (See O-5a.)

SELECTION OF SOUNDINGS WITHIN COMPASS ROSES

In an area covered by a compass rose, care must be exercised to avoid selecting soundings or bottom characteristics which may fall on the numerals marking the graduations. Where a shoal sounding falls on one of the numerals, it usually will be necessary to move the rose. The selection of soundings or bottom characteristics which fall on a limb of the compass should be avoided. The foregoing applies to all charts, whether the rose is currently printed in magenta, red, or black.

UNDERLINED SOUNDINGS (Q-2)

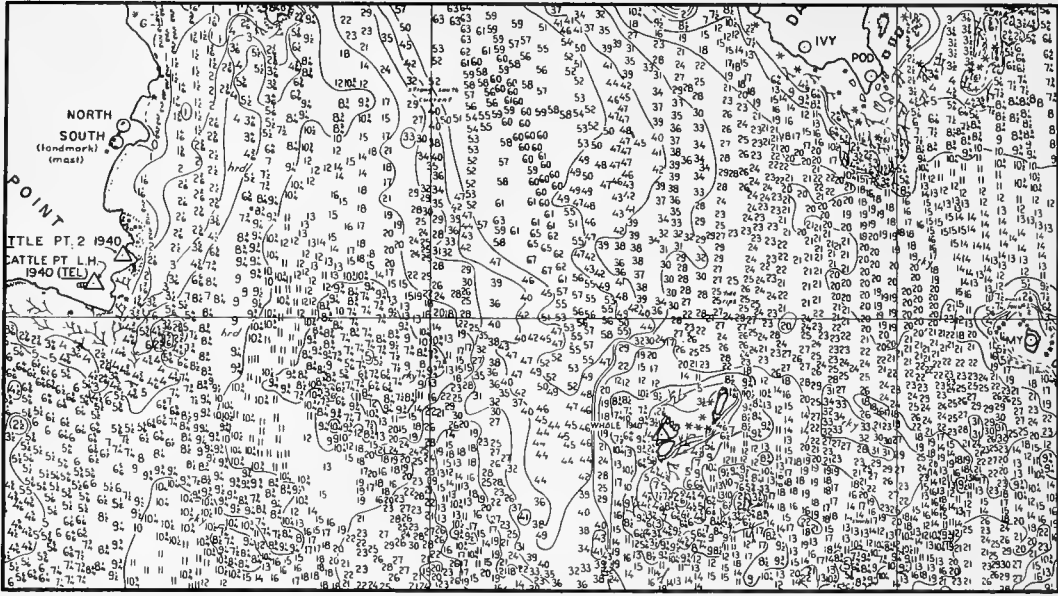
Soundings selected from blueprints should be underlined on the prints as an aid to the reviewer.

NO-BOTTOM SOUNDINGS (Q-2)

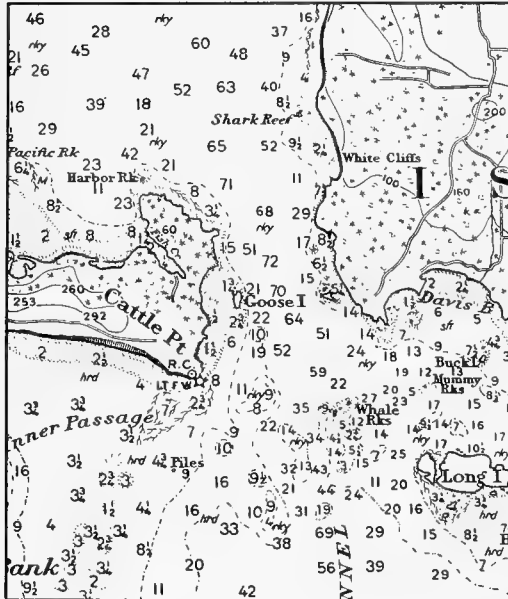
No-bottom soundings are shown under a bar and small dot, thus: $\overline{121}$, but their use should be avoided whenever possible.

STREAM DEPTHS (Q-Qa)

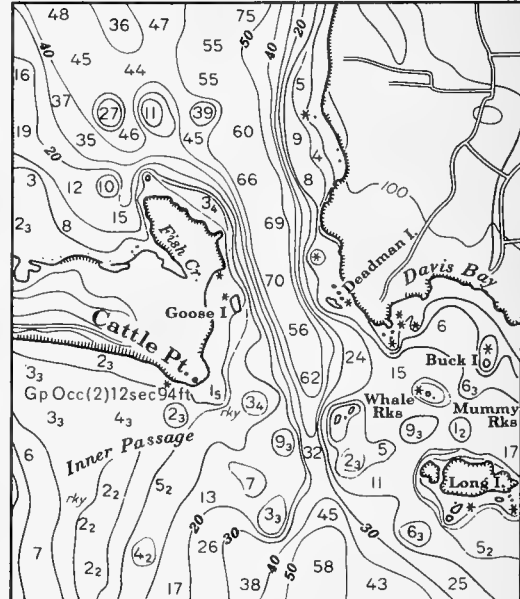
The shoreline of narrow streams may be broken to show soundings when necessary. Along narrow streams the controlling depths from Engineers' reports should be shown at the places indicated in the report. Leaders should not be used to show the location of soundings.



Section of a 1943 basic hydrographic survey which was applied to the lower half of the section of chart shown on right below.

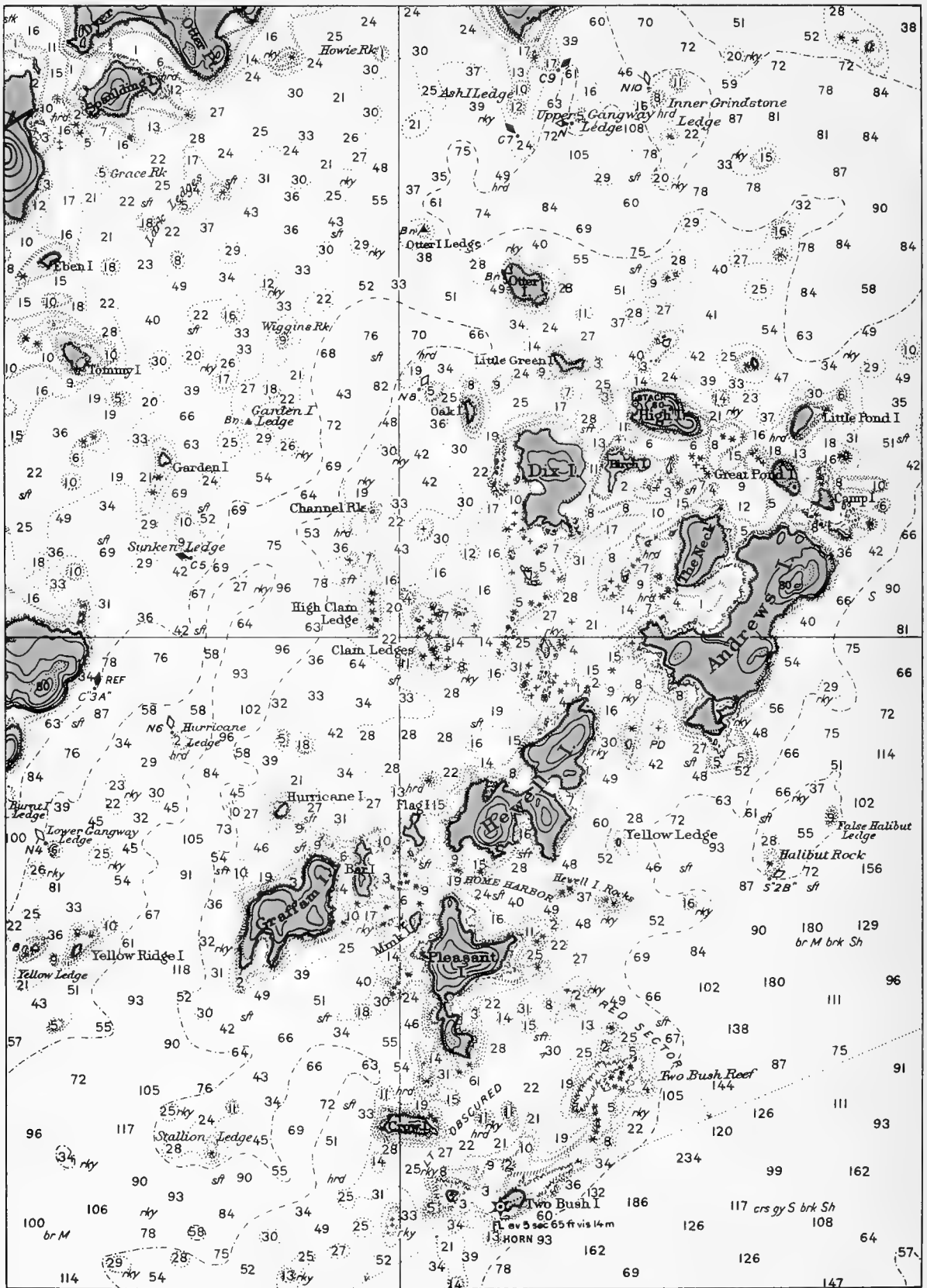


Compilation made in 1907 showing selection of soundings in fathoms from an early hydrographic survey.

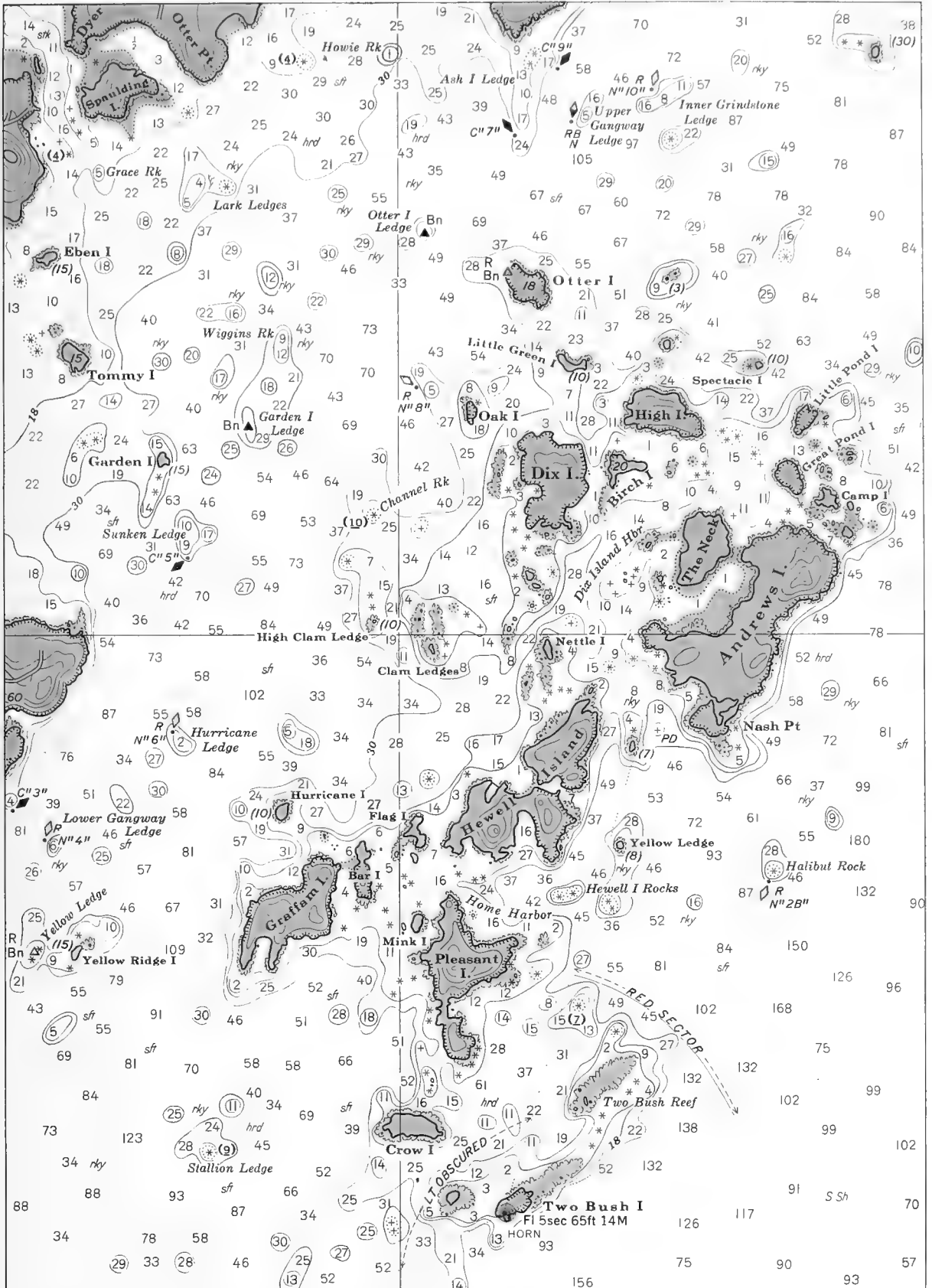


Selection of soundings principally from basic survey shown above. Depth curves have been added for echo sounding navigation.

Note small number of charted soundings required to bring out the essential features.



Section of chart 225, early edition.



Section of chart 322, of recent construction, showing continuous depth curves. Same area as section of chart 225.

III

Depth Curves and Tints

DEPTH CURVES (Fig. 1) (R)

The configuration of the ocean floor can be adequately revealed only by the proper use of depth curves. The character and form of the ocean bottom, completeness of the surveys, the draft of vessels using the charts, and the now frequent use of the echo sounder in navigation, all have an important bearing on the selection of the depth curves to be charted.

Wherever necessary, additional depth curves should be added to existing charts at the time extensive hydrographic corrections are made, but the Chief of Branch will determine which curves are to be added. The depth curves to be used on new or reconstructed charts will be given in the Specifications.

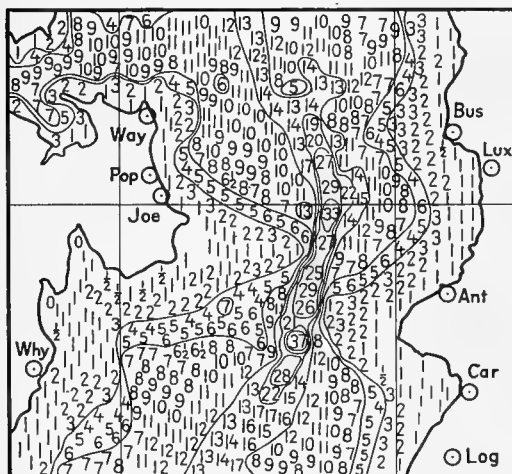
Continuous, solid depth curves in black shall be used on all new or reconstructed charts. All depth curves shall be labeled clearly in the same unit as the soundings.

The cartographer must be constantly on the alert to add or omit curves, other than standard, which will bring out more clearly the features of value to navigation. By the proper use of depth curves, dangers and dangerous areas can be made to stand out clearly. On the smaller scale charts, it will be necessary to generalize curves to some extent. However, care must be taken not to close or seriously reduce the width of a navigable channel.

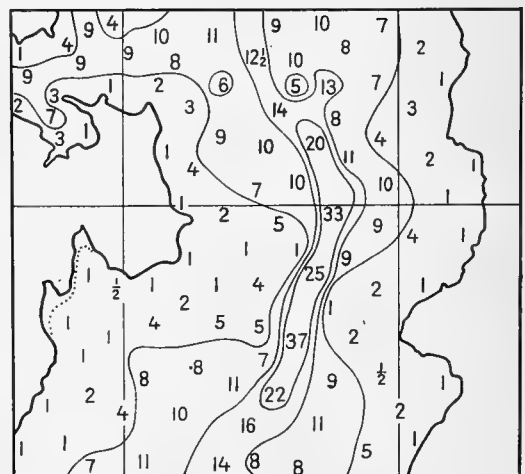
Depth curves applied from surveys by this Bureau are to be charted as close as possible to the positions shown thereon, except where sufficient curves for fathometer navigation have not been drawn on the older surveys. In such cases, additional depth curves should be drawn as necessary. In converting detached soundings to fathoms and fractions, additional curves or revisions to curves may also be required. Before depth curves are applied to a chart from surveys plotted in feet and tenths, they should be redrawn on the survey sheet to include within their limits the appropriate soundings with fractions of 0.2 foot.

Depth curves shall include within their limits all soundings of the same depth as the curve. They should not touch the sounding figures.

When curves on existing charts are revised, they shall be made continuous solid lines, in black, as illustrated below.



HYDROGRAPHIC SURVEY

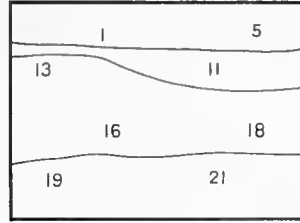


CHART

As illustrated below, short sections of broken curves on the survey sheets should be connected if the configuration of the bottom revealed by other curves in the area being charted indicates that it would be logical.

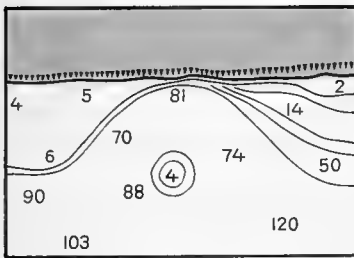
4	1	1	6	5
13	14	14	11	10
14	15	15	13	15
15	16	16	14	18
19	21	21	21	20
21	24	24	24	21

HYDROGRAPHIC SURVEY

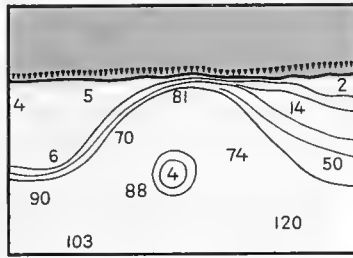


CHART

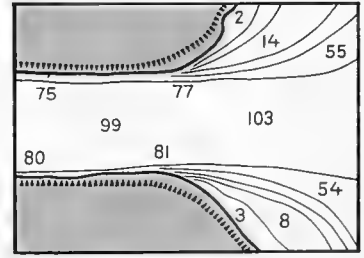
When necessary to omit some depth curves on steep slopes, the deepest curve (and the shoalest if space permits) should be retained and the less important *intermediate* ones omitted. Curves must never run abruptly into each other or into the shore, but must be curved to make them parallel as is the case in nature. The curve to which the blue tint on the printed chart is to be shown shall be given preference over all other curves and shall be as complete as possible.



Deepest and Shoalest Curves
No tint involved

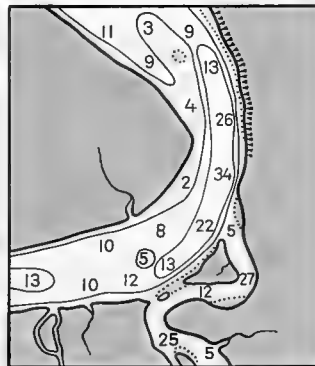


Tint Curve Unbroken
18 ft. curve



Deepest Curve
Maximum width channel

Depth curves around depressions are of little value and, in general, should be omitted, but they shall be shown when they reveal features which may have some value in navigation, or when they indicate on which side of a river the deepest water may be found.



CHART

TINTS IN WATER AREAS (R)

On an increasing number of printed charts, a blue tint is shown in water areas to the curve which is considered the danger curve for that particular chart. In general, the 6-foot curve shall be considered the danger curve for small-craft and Intracoastal Waterway charts, the 12- or 18-foot curve for harbor charts, and the 30-foot curve for coast and general charts. The blue tint should be omitted within the dashed lines used to indicate the side limits of dredged channels when they connect with the untinted deeper water areas, regardless of depth of dredged channel.

As a blue tint enhances the value of a chart for navigation, it should be added to all charts not now tinted which have curves complete enough to define the limits of the tinted areas.

IV

Improved Channels

CORPS OF ENGINEERS (D-De)

The Corps of Engineers is the administrator of the Federal laws enacted for the protection and preservation of navigable waters of the United States. They are authorized to establish regulations for navigation therein, approve plans for structures of any kind, establish anchorage grounds and harbor lines, remove sunken vessels obstructing or endangering navigation and grant permits for the installation of cables and pipelines. They are also charged with the improvement of rivers and harbors and the Intracoastal Waterways. Copies of surveys made by the Corps of Engineers are furnished this Bureau for application to the charts.

IMPROVED CHANNELS (Figs. 1, 21) (Q-5, -6)

The side limits of the improved channels are shown on the charts by dashed lines. Except when tabulated, the controlling depth with width and date ascertained are given within or adjacent to the channel. Surveys, Monthly Reports, Annual Reports, and letters of the Corps of Engineers are the principal sources of information for charting available depths.

In addition to the surveys, detailed information regarding depths in the important dredged channels is furnished, usually monthly, by the Corps of Engineers, on tabular forms. These give the project dimensions, controlling depth in each quarter, and date of survey for channels 400 feet wide and greater, and the same information is given for channels from 100 feet to 400 feet wide except that the controlling depth is given for the middle half and for each outside quarter. This information is disseminated by placing a similar tabulation on the charts, usually in the form of a sticker and by publication in the weekly Notice to Mariners.

In general, tabular forms are not submitted by the Corps of Engineers for channels less than 100 feet in width, or for channels having a project depth less than 10 feet, except coastal inlets and harbors of refuge. Controlling depths reported for these channels are based on at least 80 percent of the project width.

Tabulated values should not be published in the Notice to Mariners unless a similar tabulation is shown on the charts.

Controlling depths shall be given in feet only, and shall not be greater than project depth. However, tabulated depths should agree with those disseminated by the Corps of Engineers.

The procedure for charting and publishing controlling depth information is as follows:

1. Nautical Charts

a. Full tabulations for the four quarters

To be used when adequate information is available and conditions of the improvement warrant. The surveys received with the tabulated depths from the Corps of Engineers shall always be used to ascertain the best method of presenting the controlling depth information to the public. Shoals along the edges of the channels should be described by a footnote.

Controlling depths in the tabulated form, based on actual surveys, shall not be superseded by examinations consisting of a few lines only. Such reports shall be taken care of by a footnote.

b. 27 FEET FOR MIDDLE WIDTH OF 150 FEET JAN 1963

This form shall be used for channels 100 feet wide and greater when the tabulated form is not considered justified, and when there are shoals in the outer quarters near the edges of the channels.

The controlling depth shall be given as near the project depth as possible, and shall be for the greatest available width. Consideration shall be given to the draft of the vessels expected to use such channels when selecting the depth and width to be charted.

When the available width closely approximates the project width, the word *MIDDLE* may be omitted.

c. 27 FEET FOR WIDTH OF 50 FEET JAN 1963 (see note)

This form shall be used when the controlling depth is given for the middle 80 percent. In this case, when the information is available, the depths in the outside quarters shall be stated in the Notice to Mariners.

d. 5 FEET

This form shall be used when no information is available as to the date the controlling depth was determined or the width to which it applies.

e. When no recent information is available relative to an improved channel charted by dashed lines, consideration should be given to removing the channel lines and adding soundings and depth curves. Channels classified by the Corps of Engineers as inactive fall in this category.

Soundings and curves should also be used for those channels for which infrequent surveys are received provided the scale of the chart is such that soundings and curves would better depict the bottom configuration.

f. Center line depths shall be given as a footnote on the tabulated form when found justified.

g. On charts where dredged channel legends and tabulations are adequately covered by larger scale charts, omit the legend and tabulation, place a "(see note)" in the channel, and add (preferably on land) a project note similar to the following:

BEAUFORT INLET
The project depth is 30 feet to Morehead
City. For controlling depths see chart 423.

h. Unless supported by controlled, properly developed surveys, Coast Pilot inspection reports shall not be used to show greater controlling depths in channel legends or to update the legends.

i. Where the depth reported is less than the charted depth, use a notation such as "Reported shoaling in channel 1961". Abbreviate if necessary to "Rep shoaling 1961" or "Shoal rep". In Federal project channels the charted depth legend shall be retained if there is room.

j. When permit drawings for public or private developments indicate that dredging has been accomplished but no afterdredging survey has been furnished, a legend such as "Reported dredged 6 ft 1960" may be used.

2. Notice to Mariners:

a. The same tabulated depth information shown on the charts shall be published in the Notice to Mariners.

b. Revisions made on the charts shall be published in the Notice to Mariners in the same format, to permit mounting over the charted tabulations.

c. When space on the chart does not permit stating the controlling depths for the full project width, and the information is available, the depths in the outside quarters shall be given in the Notice to Mariners.

d. All controlling depth notes published in the Notice to Mariners will call attention to the fact that the Corps of Engineers should be consulted for subsequent information, thus:

The Corps of Engineers should be consulted for changing conditions
subsequent to the above.

V

Dangers

CORAL AND ROCK REEFS AND LEDGES (A-11d,-11g)

Coral and rocky reefs and ledges are indicated on the charts by the same symbol. The area between the mean high-water line and the outer edge of the ledge symbol should be tinted green on the printed chart. The type of reef (rock or coral) is named when known.

Reef or ledge symbols should be distinctly drawn so that they will reproduce satisfactorily on the printed chart. The symbols for reef areas less than $\frac{1}{8}$ " in diameter, at the scale of the chart, should be changed to a rock awash symbol. A reef or ledge symbol is used only when the reef or ledge uncovers at low water.

There is no distinctive symbol for a submerged reef or ledge, and where the limits have been determined they should be indicated by a dashed line which encloses the sunken rock symbols or the appropriate legend (See O-10). Italic letters should be used for the legend.

A rocky reef is considered to be detached from shore, whereas a ledge is a rocky formation connected with and fringing the shore. Italic lettering should always be used when ledges are named.

OYSTER REEFS (Pg. 69)

Oyster reefs which uncover at the plane of soundings should be indicated by a low-water curve and labeled, thus: "*Oys*". Submerged reefs, not adequately defined by soundings, should be delineated by a short-dashed line properly labeled at frequent intervals.

NAMING REEFS

The style of type to be used in the naming of reefs surrounding an island is a cartographic problem. In general, it is best to use italic lettering when the reef predominates, and roman lettering when the island predominates.

RIPRAP MOUNDS (K-Ka)


At many light structures on the East coast, riprap mounds are maintained to protect the structures against ice damage or scouring action.

As a warning to small craft, all known riprap mounds shall be clearly charted, using the scallop-like symbol for rock (Symbol Sheet, A-11d). In most instances this will require exaggerating the outer limits of the riprap so as to extend them beyond the light symbol's 3-mm. magenta disc.

On charts of the 1:80,000-scale series where these riprapped lights are not charted, a rock awash symbol shall be shown in the position of the light structure.

When the riprap symbol is charted, the following caution note shall be added to the notes of that chart:

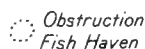
CAUTION

Mariners are warned to stay clear of the protective riprap surrounding navigational light structures shown thus: 

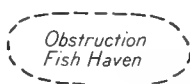
FISH HAVEN (Fig. 1)

Fish havens are artificial barrier reefs and obstructions, established to enhance fish propagation in coastal waters (See Chart Letter 921/59).

Small areas shall be shown by a dotted circle, blue tint, and labeled as follows:



Large areas shall be shown by short-dashed lines, generally without blue tint, and labeled thus:



OIL WELL STRUCTURES (O-Oa,-Ob)

Structures established in offshore water areas for the drilling of oil wells shall be charted as a solid 1.25-mm. square symbol with proper description as follows:

1. Unnamed structure: Platform (lighted)
HORN
2. Named structure: Hazel (lighted)
HORN

(Names on the latter type structure are visible from seaward and the air, making them extremely useful as privately maintained aids to navigation and for AIR-SEA rescue operations.)

Structures shown on the 1200-series charts shall be omitted from the 1100-series. In the areas so affected, the 1200-series chart limits shall be shown in magenta on the 1100-series with the following explanatory note:

CAUTION

Oil well structures are charted only where offshore of the indicated limits of the 1200-series charts.

When oil well structures are reported to exist in confined, constricted or landlocked water areas, the area shall be labeled: "*Obstructions Wells and Pipelines.*"

ROCKS

In a general way, rocks are classified as bare rocks, rocks awash, and sunken rocks. Bare rocks are those extending above the plane of Mean High Water; rocks awash are those exposed at any stage of the tide between Mean High Water and the chart datum; sunken rocks are those covered at the chart datum.

For cartographic purposes, a more specific classification has been adopted. This classification is different, as between the Atlantic and Gulf Coasts on one hand, and the Pacific and Alaska Coasts on the other. For a graphic representation see Page 68.

Atlantic Coast

Bare rocks (O-1)—extending more than 1 foot above Mean High Water.

Rocks awash (O-2, 3)—having their peaks between 1 foot above Mean Low Water and 1 foot above Mean High Water.

Rocks awash at chart datum only (O-3)—having their peaks between 1 foot below and less than 1 foot above Mean Low Water.

Sunken rocks (O-5a, 26)—covered more than 1 foot at Mean Low Water.

Pacific Coast

Bare rocks—extending more than 2 feet above Mean High Water.

Rocks awash—having their peaks between 2 feet above Mean Lower Low Water and 2 feet above Mean High Water.

Rocks awash at chart datum only—having their peaks between 2 feet below and less than 2 feet above Mean Lower Low Water.

Sunken rocks—covered more than 2 feet at Mean Lower Low Water.

Page 69 shows rocks as they are shown on survey sheets and the equivalent symbols and notes to be used on charts.

In using the rock symbols, the cartographer should consider the character of the area, whether exposed or protected; the proximity to shore; the range of tide; and the probable visibility of the rock at some stage of the tide.

Special care should be used in charting dangerous rocks. Isolated and dangerous rocks, whether bare, awash, or sunken, are emphasized on the charts by a black dotted line encircling the symbol. It should be noted that, on some hydrographic survey sheets of this Bureau, a rock symbol encircled by a dotted line indicates any rock that has been accurately located, whether it is dangerous or not.

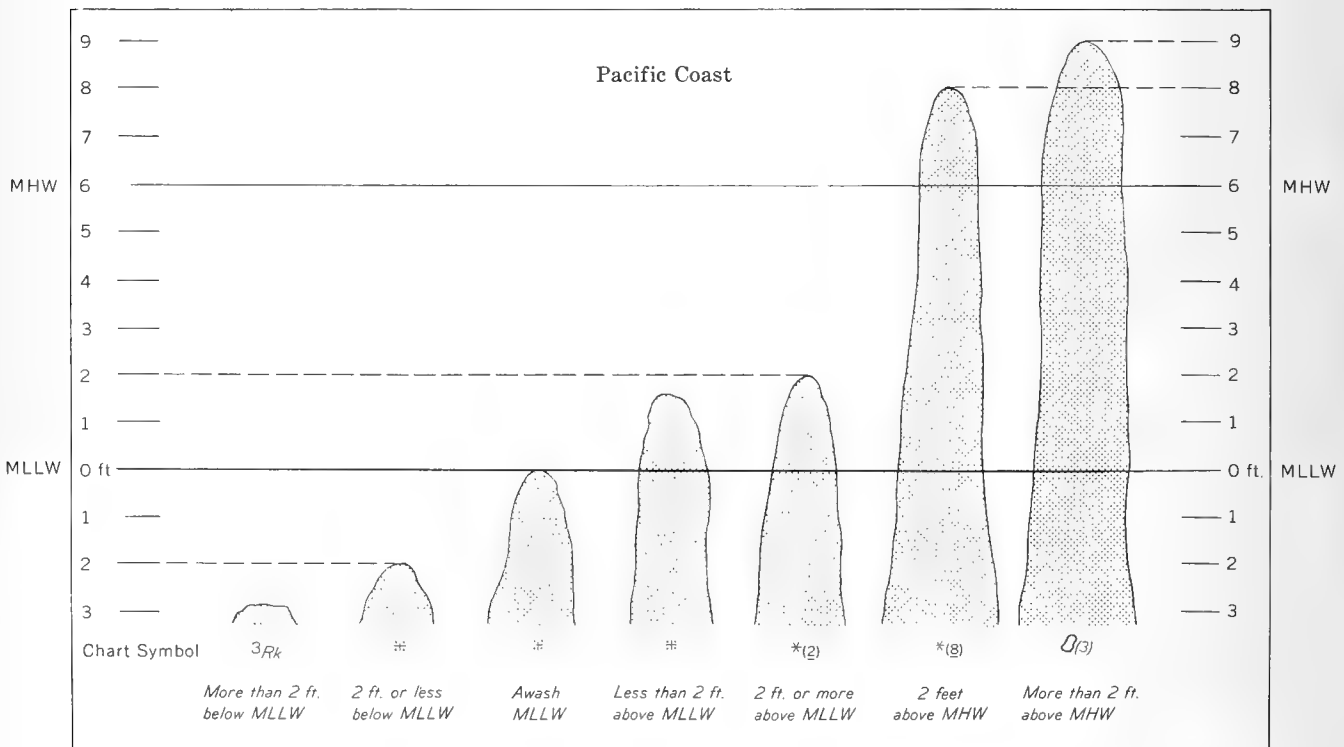
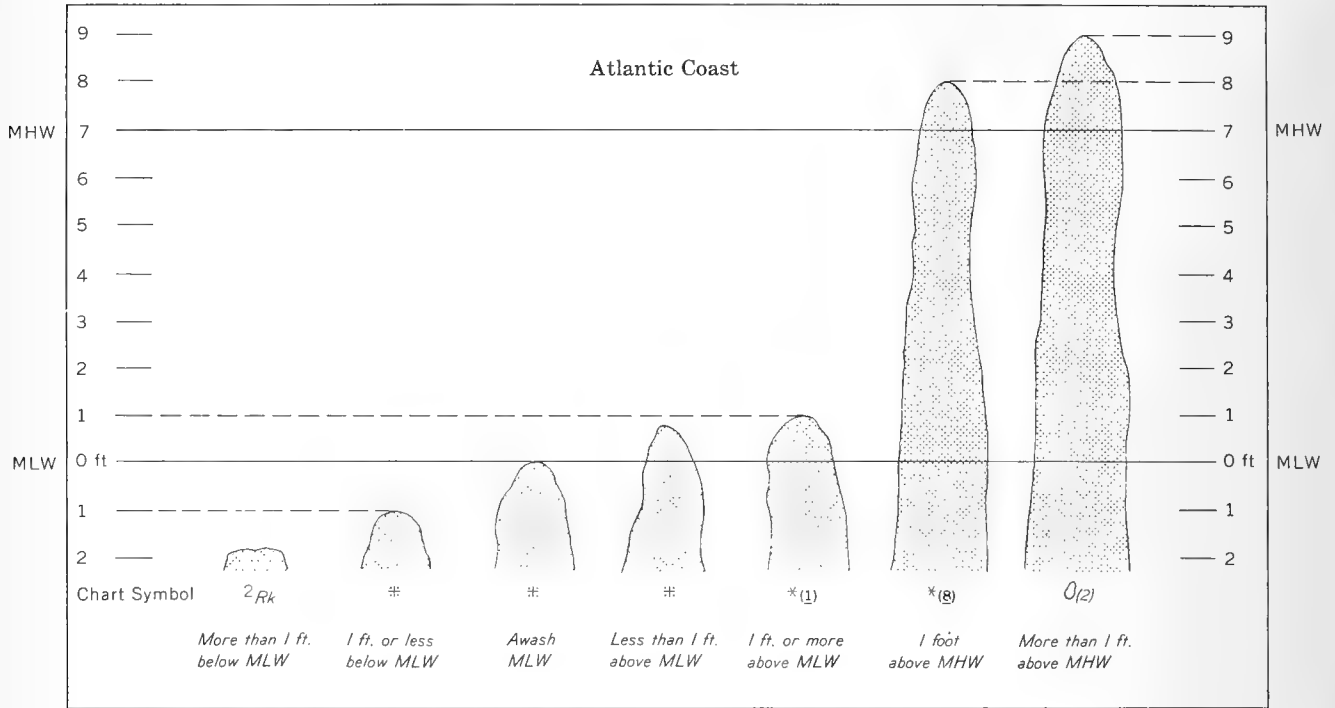
SUNKEN ROCKS AND ROCKS AWASH (O)

In areas that are generally foul, and where it is impracticable to get actual depths, the symbols for sunken rocks and rocks awash may be used in such a manner as to give a general picture of conditions prevailing in the area. The sunken-rock symbol must not be used when the depth on the rock is known, except on small-scale charts where there is no room for the depth figure.

To give prominence to dangerous offshore rocks, the complete note relating to them shall be charted, thus: Uncovers 3 ft MLW (Mean Low Water). Survey notes of awash MHW should be converted to sounding datum.

The abbreviations MLW, MLLW, MHW, or MHHW shall be used.

ROCKS



Relationship of Rock Symbols to Tidal Datum Planes.

SURVEY SYMBOL		CHART SYMBOL
1	*	* (lines intersect at 60°)
2	*	⊛ (offshore or dangerous)
3	(individually located) * or ⊛	* or ⊛ (if offshore or dangerous)
4	+	+
5	+	⊕ (if offshore or dangerous)
6	(individually located) + or ⊕	+ or ⊕ (if offshore or dangerous)
7	(3) *	x (3) (uncovers 3 ft at sounding datum)
8	bare 6 ft MLW (MLLW) *	* (6) or ⊛ uncovers 6 ft MLW (MLLW)
9	uncovers 6 ft MLW (MLLW) *	* (6) or ⊛ uncovers 6 ft MLW (MLLW)
10	awash MLW (MLLW) *	⊞ or ⊛ (awash MLW or MLLW)
11	(0) *	⊞ or ⊛ (awash MLW or MLLW)
12	awash MHW *	* (8) (difference between MHW and plane of soundings)
13	* (1)	* (1) or ⊛ uncovers 1 ft MLW
14	(Atlantic Coast 1 ft below MLW) 1 Rk	⊞ or ⊛ awash MLW
15	(Atlantic Coast 2 ft below MLW) 2 Rk	2 Rk
16	(Pacific Coast 2 ft below MLLW) 2 Rk	⊞ or ⊛ awash MLLW
17	(Pacific Coast 3 ft below MLLW) 3 Rk	3 Rk
18	(Atlantic Coast 1 ft above MHW) o (1)	* (8) or ⊛ uncovers 8 ft MLW (see next page)
19	(Atlantic Coast 2 ft above MHW) o (2)	o (2) or ⊙ (2) (if dangerous)
20	(Pacific Coast 2 ft above MHW) o (2)	* (8) or ⊛ uncovers 8 ft MLLW (see next page)
21	(Pacific Coast 3 ft above MHW) o (3)	o (3) or ⊙ (3) (if dangerous)
22	uncovers 1/2 tide *	* (5) or ⊛ uncovers 5 ft MLW or MLLW (1/2 tide plane)
23	(3) * * (5) (2) * * (5)	* * (5) (value at offshore rock only)
24	(reef, large scale survey)	* (small scale chart)
25		* (small scale chart)
26	(large scale survey)	(small scale chart)
27		
28	(limiting edge of submerged rocky ledge)	
29	(large scale survey)	(small scale chart)
30	(coral or rocky ledge)	(small scale chart)
31	(large scale survey)	(small scale chart)
32	(oyster bar uncovers at MLW)	(tinted)
33	(oyster bar submerged)	(tinted)
34	(oyster bar submerged and uncovers at MLW)	(tinted)

WRECKS (O)

Chartered wrecks are generally of two kinds, stranded or sunken, the former term applying where any portion of the hull is above the sounding datum, and the latter applying to those dangerous or nondangerous wrecks which are below the chart datum or where the masts only are visible. A sunken wreck with less than 11 fathoms of water over it is considered one which may be dangerous to surface navigation (see pg. 71).

Wrecks cleared by wire drag should be indicated on the charts by the special symbol provided.

The symbol for a dangerous wreck differs from that for a nondangerous wreck in that the symbol for the former consists of the sunken wreck symbol surrounded by a dotted curve. For emphasis, a blue tint should be added within the danger curve around wrecks.

All nondangerous (as well as dangerous) wrecks are to be charted on Alaskan charts, regardless of depth. In other areas except on "Wreck Charts," nondangerous wrecks shall not be charted outside of the 20-fathom curve; however, those now charted shall be retained.

On the "Wreck Charts," (for benefit of fishing industry) twenty-two to date (71, 1106-1117 incl., 1207, 1215, 1219, 1222, 3075, 3076, 5020, 5021, and 5022) all known dangerous or nondangerous wrecks are to be shown out to the 300-fathom curve. Nondangerous wrecks shown on Wreck Charts 1207, 1215, and 1219 shall be omitted from the 1100 series. The seaward limits of these 1200-series charts and an explanatory note shall be shown in magenta on the 1100 series.

When wrecks or obstructions are searched for with the wire drag and the reported position is cleared, with no hang obtained, the maximum clearance is to be shown on the Wreck Charts only. The "basket" symbol will be retained, but the descriptive term (i.e. "Wreck or Obstr") should be omitted. Nothing will be shown on the other charts except when shoals or rocks are also cleared as specified under WIRE-DRAG SURVEYS.














The symbol and all references of a wreck or obstruction are to be *removed* from all charts when the word "raised" is used in the Wreck List or other sources such as Notice to Mariners.

When the words "destroyed" or "demolished" are used, the symbol shall be *retained* on the Wreck Charts only.

According to the regulations given above, some wrecks will be treated differently on the Wreck Charts than on other charts, while others will appear only on the Wreck Charts. A comparison of the overlap between a Wreck Chart and a non-wreck chart shall accordingly be guided by these instructions.

Information relative to wrecks shall be published in the Notice to Mariners.

WRECKS

<p>Visible wreck</p>	  Qk FI R	<p>Stranded wreck, showing any portion of the hull or superstructure above datum of soundings (not masts, and funnels only).</p> <p>Note that the bottom line of the symbol, which represents the water surface, must always be parallel to the bottom of the chart.</p> <p>Do not apply this symbol in crowded areas, especially when it interferes with Topography. (Use dangerous sunken wreck symbol instead.)</p> <p>When marked by a light (on charts with magenta overprint)</p>
<p>Sunken wreck which may be dangerous to surface navigation.</p>	  Wreck Qk FI R  Wreck RB "WR" I Qk FI R  Wreck	<p>Wreck over which the exact depth is unknown but is considered dangerous to surface navigation and might have less than 11 fathoms over it.</p> <p>When marked by a light (magenta disc overprint).</p> <p>When marked by a lighted buoy (magenta disc overprint).</p> <p>When marked by an unlighted buoy.</p>
<p>Nondangerous sunken wreck</p>		<p>Wreck over which the depth is unknown but not considered dangerous to surface navigation or has more than 11 fathoms over it.</p>
<p>Sunken wreck with only masts visible</p>	 Masts	<p>All of hull or superstructure submerged. Masts showing above datum of soundings.</p>
<p>Wreck, depth known</p>	 5 Wreck	<p>Least depth found over wreck.</p>
<p>Wreck, cleared by wire drag</p>	 21 Wreck or Wk	<p>Wreck cleared by wire drag to 21 feet. (See instructions listed under wire drag.)</p>
<p>Wreckage</p>	 Wreckage	<p>Outline of the area of a number of wrecks.</p>
<p>Wreck, large-scale chart</p>	 Wreck	<p>On large-scale charts, wrecks should be delineated in outline when all or most of the hull or superstructure shows above the sounding datum.</p>
<p>Wreck, submerged, large-scale chart</p>	 Wreck	<p>On large-scale charts, submerged wrecks should be outlined by a dashed line.</p>

KELP (O-20)

Kelp generally grows in areas of rocky bottom, and in exposed waters it is found in depths as great as 10 fathoms. The presence of kelp is an indication that submerged pinnacle rocks may exist in the area.

In general, the word "*Kelp*" is used in place of the kelp symbol, which is used only in small areas.

TIDE RIPS (O-18)

The words "*Tide Rips*" shall be used in place of the symbol.

MARINE ACCIDENT FILE

In 1954 a special file of nautical charts was established for use in connection with marine accident cases or wreck investigations. Upon receipt of information of an accident, three copies of the appropriate charts at the time of accident are placed in this file and retained for five years.

DANGER TO NAVIGATION REPORT

The Coast and Geodetic Survey policy for the disposition of a report of a grounding or other danger to navigation is best explained by reference to the flow diagram, page 73. In general, the routing of a report is as follows:

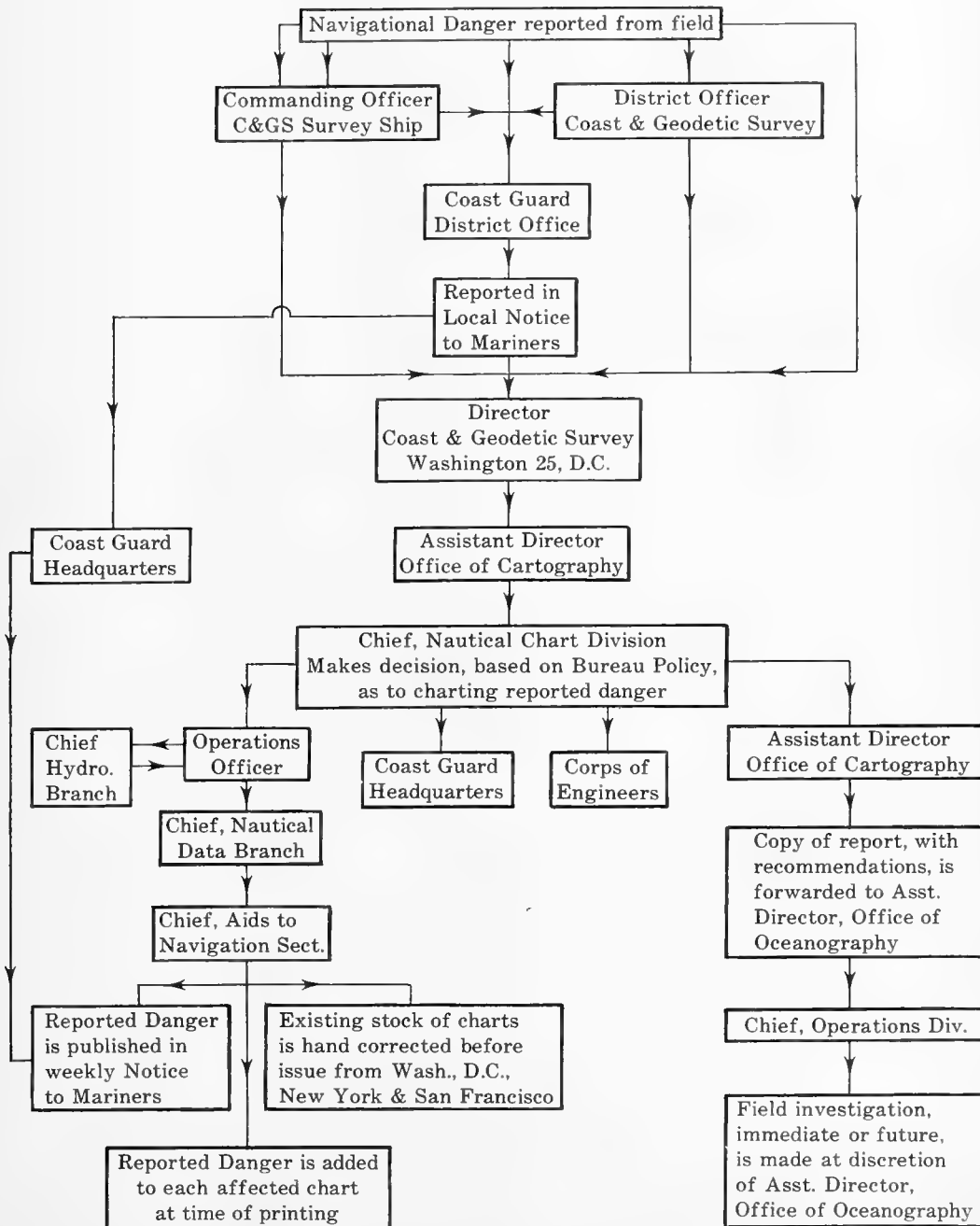
1. A danger to navigation report received by, or originating with, the Coast and Geodetic Survey in the field is immediately forwarded (generally by radio) to the affected Coast Guard District Office for publication in the local Notice to Mariners and for broadcasting over radio to the boating public. Our commanding officer in the field also notifies (generally by telegram) Bureau Headquarters in Washington, D.C.

2. Immediately upon receipt of a danger to navigation report in our Headquarters, the report is routed through the Office of the Director and the Assistant Director for Cartography, to the Office of the Chief, Nautical Chart Division. This Division Chief then requests an evaluation by the Operations Officer; Chief, Hydrographic Branch; and Chief, Nautical Data Branch. Upon receipt of the results of this evaluation with recommendations, the Division Chief makes the decision as to how the reported danger would be charted. In accordance with this decision, the Chief, Aids to Navigation Section writes an article for insertion in the Notice to Mariners. A copy of the danger report, with a notation as to how it will be charted, is forwarded with recommendations from the Chief, Nautical Chart Division, through the Assistant Director for Cartography to the Assistant Director, Office of Oceanography, for consideration of a field investigation of the reported danger. A copy of the report is also sent to the Coast Guard for consideration of aids to navigation. Another copy is furnished the Corps of Engineers for consideration of removal of the danger.

U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

POLICY FOR DISPOSITION OF
REPORTS OF DANGERS TO NAVIGATION
(Rocks, Wrecks, Obstructions, Shoaling)

MARCH 1963



VI

Bottom Characteristics**BOTTOM CHARACTERISTICS (S)**

Bottom characteristics shall be spaced at reasonable intervals over the chart and shall be placed a little below and to one side of the sounding. Within practical limits the representation should show the type of bottom on the different bottom features. Rocky areas unsuitable for anchoring as well as areas well suited for anchoring are of special interest to the navigator. Fishermen have a special interest in the characteristics on shoals and those revealing areas in which nets might be damaged.

In general, two words or their abbreviations will suffice in describing bottom characteristics. The abbreviations used must conform with those printed in the standard note on the chart. Only in special cases will it be necessary to use any others.

In harbors, inland waters, and along the coast, where the navigator may be interested in the holding quality of the bottom, characteristics should consist of the type or character, such as *rky, hrd, M, sft, S, stk*. Avoid *hrd M* and *sft S*.

In deep water, characteristics should consist of the type of bottom, and color, if pertinent, such as *bk M, yl Cl, Sh, S*.

VII

Verification of Wire-Drag Surveys

The area and depth diagram, which is also known as the "A and D sheet", shows the final results of drag operations in a simplified and clear manner. It shows the maximum effective wire-drag depths in every portion of the area covered by the wire-drag survey. It also shows the soundings as well as the groundings on shoals. A summary of groundings and clearances is given in the Descriptive Report.

The soundings and groundings are shown by black numerals; the groundings are encircled in green ink. Notes at groundings give the maximum effective wire-drag depth at which the groundings were cleared. If the grounding was not cleared by a subsequent wire-drag strip, these notes will so state.

A grounding not cleared by a wire-drag strip may be charted only as a sounding. Areas shown on the A and D sheet as "splits" or insufficient overlaps of adjoining wire-drag strips are considered not to be covered by the wire-drag. (For further information concerning wire-drag surveys, see Coast and Geodetic Survey "Wire Drag Manual," publication No. 20-1.)

VIII

Review of Hydrographic Surveys

The written review appended to the Descriptive Report of a hydrographic survey is a record of the discussions, evaluations, and recommendations derived from a comprehensive study of the latest and prior surveys by this Bureau and charted information from other sources.

The compiler shall read the review before applying the survey to a chart. The review serves as an important aid to the compiler in the construction or revision of a nautical chart.

A review's main purpose is to make the new survey complete with reference to all information on prior hydrographic or wire-drag surveys so that it is unnecessary for the chart compiler to consult any prior surveys of the area covered, except as specifically mentioned in the written review. The latest reviewed basic survey supersedes all prior surveys in the common area. In order to do this, it is frequently necessary to carry forward from the prior surveys to the present survey, data which have not been confirmed or disproved by the present survey.

Compilers will find specific comments and conclusions in the review relative to the character of the area, shoreline, and development of the bottom features including the least depths on shoals or obstructions. The adequacy of the junctions with contemporary surveys or other currently charted detail is considered and evaluated.

Discussions by the reviewer, under "Comparison with prior surveys", consider changes in shoreline or bottom configuration and state whether these changes are due to natural or artificial causes or to less detailed and accurate methods employed in the prior surveys.

Under the heading "Comparison with chart" the origin of the charted data is listed, and all differences between the charted and current survey data are enumerated. The majority of the charted information will have been considered in the comparison with prior surveys. Therefore, attention need be given only to the charted data from Chart Letters, advance copies of Boat Sheets, Coast Guard and Naval Oceanographic Office Notices to Mariners, Corps of Engineers surveys, or other sources. Where charted data from sources other than the Bureau surveys have not been disproved by the present survey and should be retained on the chart, a specific recommendation to that effect is made. Finally the discussion is concluded with a statement as to the adequacy of the present survey to supersede the charted hydrography.

In cases where improved channels fall within the area of the hydrographic survey, the controlling depth notes are usually furnished by the Corps of Engineers. Controlling depth notes dated subsequent to the present survey information are recommended for retention on the chart.

Where shoals and channels have shifted in position and are not adequately marked by the charted buoys, or a new unmarked danger is noted, the review will so state. Differences between the charted and present survey position of the fixed aids to navigation are noted.

The compiler should note whether or not the survey and review has been finally inspected and approved for application to the charts or if it has been previously partially applied. Guidance as to the proper procedure should be sought from the Chiefs of the Conventional or Small-craft Chart Branches.

Finally the compiler should give reasons in the "History of Cartographic Work" for deviations, if any, from the recommendations made under "Comparison with charts" in the review.

IX

Registration of Surveys

The registration of hydrographic surveys (H-Series) is completed upon receipt of the Smooth Sheet, Descriptive Report and field records in the Washington Office. Besides the regular basic hydrographic surveys there are wire-drag surveys (which are filed as the H-Series with a suffix W.D.), field examinations (which are designated as F.E. and filed progressively by the year of the registration), and the deep-sea tracklines (which are filed under specific H-Series: H-7100 to 7119). All permanent survey records such as supplementary special reports, sounding volumes, fathograms and other such records are forwarded to the Bureau library.

The registration of photogrammetric surveys (T-Series) is not completed until after the survey has been reviewed and approved. Although copies of many photogrammetric compilations can be obtained from the vault they may represent only the incomplete, preliminary or advance photogrammetric information. These copies are maintained as a temporary reference file and are destroyed upon receipt of the final approved copy.

The various types of photogrammetric surveys filed in the vault are Planimetric, Shoreline and Topographic surveys. Planetable surveys generally made prior to the advent of photogrammetric surveys are also filed in the vault. These may also be planimetric, shoreline or topographic in the details shown. The registry numbering of the planetable surveys are from 0 to 4999, those mounted on aluminum are from 6000 to 7999; photogrammetric surveys are numbered from 5000 to 5999 and 8000 to 12000.

Geographical indices are maintained for all registered surveys on medium-scale nautical charts of the Bureau. The actual coverage is diagrammed on these charts, some of which are programmed on two or more copies to avoid congestion.

X

Survey Repository

The original surveys of the Coast and Geodetic Survey are filed in the fire-proof repository, located in room 1117. This vault contains over 9700 topographic and 8700 hydrographic surveys which have been made since 1834.

The vault is also a storage depot for assorted documents associated with the Bureau surveying activities and for some classified materials. It is needless to say that this material is irreplaceable and should be handled with extreme care.

All persons removing documents or surveys from the vault shall complete either the blue (hydrographic) or the pink (topographic) request forms C&GS-8255, "Topographic/Hydrographic Sheet Request" and assume complete responsibility for the prompt return of all items borrowed.

AIDS TO NAVIGATION

GENERAL STATEMENT

Lights, lightships, fog signals, buoys, daybeacons, radiobeacons, and loran (see section on electronic aids to navigation) are the principal aids to navigation shown on the charts. Complete information regarding these aids will be found in the Light List. The correct charting of these aids is illustrated on Figures 1 and 24 in the Appendix, and on Chart No. 1.

Aids with their characteristics must be so charted that they are identified readily by the chart user and are not obscured by less important information. Care must be taken that the legends which describe the light characteristics fall outside both the magenta disc, used to overprint the dots representing the positions of lights, and the encircling magenta rings, used to symbolize radiobeacons.

It is the responsibility of the cartographer and verifier to see that all aids and lettering concerning aids are in their correct positions on compilations and in the areas corrected on Drawings, before being submitted to the Aids Section for checking.

There is a definite pattern to the placement of aids to navigation marking our harbors and inland waterways known as the Lateral System. The coloring and numbering of lights, buoys and daybeacons is determined by their position with respect to the navigable channels proceeding from seaward toward the head of navigation. Even-numbered, red or white lighted buoys and lights, mark the right-hand side of the channel entering from seaward. Odd-numbered, green or white lighted buoys and lights, mark the left-hand side of the channel entering from seaward. In coloring and numbering of offshore buoys and lights along the coasts and along traffic routes not leading distinctly from seaward, or toward headwaters, the above system applies when proceeding in a southerly direction along the Atlantic Coast, in a northerly and westerly direction along the Gulf Coast and in a northerly direction along the Pacific Coast. The Intracoastal Waterway is similarly marked proceeding from the north Atlantic States to the lower coast of Texas regardless of the compass headings of individual sections.

When determined by triangulation, the position of all fixed aids must be plotted carefully by their geographic coordinates. When determined by stereo bridging, they should be plotted by their geographic coordinates, directly from Form 567. When not determined by triangulation or stereo bridging, their positions should be transferred carefully to the Drawings from the survey sheets. The symbols for buoys, daybeacons, and lights, together with their accompanying lettering, should be so placed as to keep channels clear.

All aids to navigation along dredged channels shall be charted in their true positions when being plotted or revised on Drawings or Aid Proofs, unless such aids on opposite sides of a channel plot less than 1.5 mm. apart. In this case the aids may be separated to 1.5 mm. if the approval of the Chief of Branch is obtained. At this separation, daymarks will barely overlap. However, aids shall not be moved off ranges or natural objects. The overlap of magenta discs is not considered detrimental to the clarity of the chart. Any lettering or sounding within the disc should be moved to clear it except a critical sounding which shall not be moved.

It will not be necessary for cartographers to investigate the charted positions of channel aids in those areas not being revised from new source material unless the Aid Proof indicates that this should be done.

Fixed aids are often built on rocks and isolated features, and care must be taken to restore these features when the aids are removed from the charts.

Before being sent to the Reproduction Division, all new or corrected charts must be submitted to the Aids Section for checking of aids. After all the necessary work has been accomplished in the Reproduction Division and the chart is ready for printing, a final check of aids is made, at which time a check must be made of the printing date. This printing date should be a Monday following the date of the last Notice to Mariners applied. The Coast Guard Headquarters, Aids to Navigation Division, is contacted at this time for knowledge of proposed navigational aid projects with approximate dates of completion within the chart limits in order to coordinate the printing supply and completion of major revisions.

Temporary defects in aids to navigation are not indicated on the charts except where a buoy replaces a fixed aid. A standard note covering this practice is added to all charts. (See Fig. 9.) When a buoy replaces a fixed aid, the following abbreviations are added at the fixed aid by a hand correction in red:

- TRLB Temporarily replaced by lighted buoy showing the same characteristic
- TRUB Temporarily replaced by unlighted buoy
- TLB Temporary lighted buoy
- TUB Temporary unlighted buoy.

LIGHTS (Figs. 1, 19, 20, 24) (K)

The positions of all fixed lights shall be shown on Drawings by the intersection of two red lines parallel to the neatlines, and on Compilations by similar intersecting blue lines. On charts, a lighted beacon or lighthouse is represented by a black dot, 0.76 mm. in diameter, and overprinted by a magenta disc, 3.0 mm. in diameter.

On all Drawings and Compilations, the cartographer shall indicate the size of the magenta discs for lighted aids to navigation by drawing a non-photographic blue-ink circle on the Compilations and a green-ink circle on Drawings, using the standard diameter at each position.

The characteristics and numbers of all lights must be shown on the Compilation in blue, and on the Drawings in red, and must be in the exact positions they will occupy on the finished chart. The lower case "l" is used in the abbreviation for flashing, Fl. Two lights on the same structure should be so indicated by their characteristics even though these are the same, e.g. $\left. \begin{matrix} \text{Fl} \\ \text{Fl} \end{matrix} \right\} \text{R}$. Amber lights are indicated by the abbreviation "Am." The words and abbreviations for visibility and every, *vis.*, and *ev.*, are to be omitted from the charts. The visibility distance of range lights shall not be charted.

On large-scale charts, the characteristics of lights shall be shown in the following order:

- | | | |
|---------------|--------------|-------------------------|
| 1. Character | as Gp Fl | group flashing |
| 2. Color | as R | red |
| 3. Period | as (3) 10sec | three every ten seconds |
| 4. Height | as 85ft | eighty-five feet |
| 5. Visibility | as 10M | visible ten miles |
| 6. Number | as "2" | light number "2" |

The legend will appear on the charts thus:

Gp Fl R(3) 10sec 85ft 10M"2"

Omissions shall be made on the smaller scale charts in the following order:

- | | |
|-----|---------------------------------|
| 1st | <i>height, 85ft</i> |
| | Gp Fl R(3) 10sec 10M"2" |
| 2nd | <i>period, every 10 seconds</i> |
| | Gp Fl R(3) 10M"2" |
| 3rd | <i>number in group, (3)</i> |
| | Gp Fl R 10M"2" |
| 4th | <i>number, "2"</i> |
| | Gp Fl R 10M |
| 5th | <i>visibility, 10M</i> |
| | Gp Fl R |

On small-scale sailing charts, complete information regarding characteristics should be given for those lights which it is anticipated will be used in coastwise navigation.

Names of lights which are not numbered should be charted when space permits.



OFFICIAL U. S. COAST GUARD PHOTOGRAPH

MILE ROCKS LIGHT

Mile Rocks Light Station, located one-half mile off Lands End in the Golden Gate area of San Francisco, was completed in 1906. The superstructure, which is 78 feet above the water, houses the fog signal apparatus and a 11,000 candlepower light visible at 14 miles. The rocks upon which the light station is situated are constantly washed by swirling currents.

BUOYS (Figs. 1, 21) (L)

In general, the positions of floating aids should be taken from the latest Aid Proof of the largest scale chart available. However, survey positions should be given careful consideration. Any floating aid taken from sources other than the Aid Proof should be left in pencil for checking by the Aids Section. The Aids Section shall ink all such aids accepted and call for deletion of the corresponding presently charted aid.

The position of a navigational buoy or mooring buoy is indicated by the dot or small circle at the base of the symbol.

In congested areas and on smaller scale charts, omissions of characteristics at buoys shall be made in the following order:

	Lighted Buoys	Unlighted Buoys	Daybeacons
1st	R''22'' Fl R 4sec BELL	R N''2A''	R Bn''12''
2nd	R''22'' Fl R BELL	N''2A''	R ''12''
3rd	Fl R BELL''22''	N	''12''
4th	Fl R BELL		
5th	BELL		

All buoys, except mooring buoys, black buoys (and red buoys which are colored red instead of magenta on Small-craft and folded Intracoastal Waterway Charts), should carry the abbreviation indicating their color.

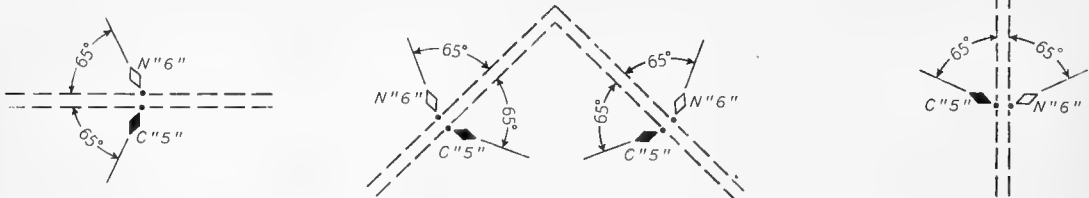
Periods (cycles) of the lights on buoys must be indicated on the charts, but the visibility need not be shown.

Lighted buoys are indicated on the printed chart by a magenta disc, 2.5 mm. in diameter, and centered on the dot at the base of the buoy symbol. (See L-2.)

For the present, buoys carrying radar reflectors are indicated on the charts, thus: Ra Ref
The symbol for radar reflector is:  (See M-13.)

Buoys, with their numbers and characteristics, should be shown on the Compilations in black, and on Drawings in red, clear of rock symbols and the least depth on shoals.

To simplify correction work along channels, buoy symbols should be placed at an angle of about 65 degrees from the channel lines, and with the symbol pointing toward the top of the chart wherever possible. The lettering pertaining to channel buoys should be placed far enough away from the channel lines to permit slight changes in the positions of the buoy symbols without disturbing the lettering.



The orientation of the buoy symbols, other than those along dredged channels, should be about 25° from the vertical.

Unlighted buoys along dredged channels shall be charted in their true position on large-scale charts. On small-scale charts, when the widths of channels are exaggerated, the buoys are charted in their correct relation to the edge of the channel.

Buoy symbols marking the limits of fish trap areas should be oriented so as to fall inside the area and, in general, at an angle of 65° from the limiting lines.

Mooring buoys, whether lighted or unlighted cans, nuns, or spars, should be shown by the mooring buoy symbol. (L-22)

The purpose for which a buoy is to be used determines the symbol for charting. Buoys having a ring to which a boat is to be tied, shall be represented by the mooring buoy symbol. A white can, nun or spar, lighted or unlighted buoy marking a position for dropping anchor or marking anchorage area limits shall be represented by the standard open buoy symbol.

Racing buoys shall not be charted. In areas where racing buoys are established, the following note shall be charted:

RACING BUOYS

Racing buoys within the limits of this chart are not shown hereon. For location and description see the Coast Guard Local Notices to Mariners and Light List.

DAYBEACONS (Fig. 20) (L-52)

Daybeacons on large-scale charts shall be shown in black on Compilations, and red on Drawings, in their true position by the standard symbol. Black beacons shall be shown in solid color and all other beacons shall be shown open. Red beacons shall be overprinted in magenta. The abbreviation "Bn" should be shown only at beacons which do not have identifying numbers or letters. The abbreviations on both land and water should be in vertical lettering. The abbreviation for black shall be omitted, but the abbreviation for color shall be shown and placed above the number, or above or after "Bn," thus: Δ_{2}^R Δ_{Bn}^R Δ_{BnR} . The center of the symbol is the geographic position.

LIGHTSHIPS (Fig. 24) (K-6)

Characteristics of lights on lightships shall include the height of the light and its visibility. The position of a lightship is indicated on the chart by the small circle at the base of the symbol. This circle is to be overprinted on the final chart by a magenta disc 3.0 mm. in diameter. Names of lightships should be in Draftsman's Italic. Correct charting of a lightship is illustrated on Figure 24 in the Appendix.

STATION BUOYS

A station buoy is anchored close to a lightship, or to an important buoy, to mark the position in case the regular aid is carried away. The station buoy has the same color as the regular aid. Lightship station buoys bear the letters *L.S.* above the initials of the station. Station buoys are not to be shown on the charts.

LIGHTFLOATS (L-12)

Floats which display lights should be indicated on the chart by the lighted open buoy symbol and labeled "*FLOAT.*"

LIGHT SECTOR (Fig. 1) (K-12; P-4)

A *Light Sector* is an arc of a circle bounded by two radii in which a light is visible. The length of the dotted line used to indicate the limits of a *Light Sector* should generally correspond to the visibility given in the Light List. Thus, if a light's visibility is 20 miles, the length of the ray lines should be 20 miles at the scale of the chart.

Limits of sectors and arcs of visibility are given in the Light List in degrees in a clockwise direction from seaward toward the light.

Colors of sectors are labeled in the form of an arc of a circle about one inch away from the light. For red sectors, a magenta line should be shown under the words "*RED SECTOR.*"

HORN

A horn, bell, gong, or siren, not accompanying a regular aid, should be indicated on the chart by a small circle symbol. The name should be in caps, using 6 pt. No. 3 Lightline Gothic style of type: ○ HORN

RADIOBEACONS (Figs. 1, 24) (M-3, 4, 5)

Radiobeacons are operated continuously with a series of six radiobeacons sequenced on a single frequency. In the system of time sharing, the six beacons are sequenced to transmit for a period of one minute in consecutive rotation with the exception of marker radiobeacons which operate continuously transmitting a series of ½-second dashes for 13½ seconds, silent 1½ seconds. Details relative to radiobeacons will be found in the Light List and U.S. Naval Oceanographic Office Publication No. 117, Radio Navigational Aids. For policy governing charting of aeronautical radiobeacons, see Page 30.

Radiobeacons are indicated on the charts by a magenta circle 7.1 mm. in diameter. The magenta circle need not be shown adjacent to the standard abbreviation note shown on the charts.

For charts on the Atlantic Coast with scales from 1:40,000 to 1:1,000,000, and on the Pacific Coast with scales from 1:40,000 up to the smallest scale charts, excluding Charts 9340, 9400, 4000, 9000, the frequency, code signal and operating schedule shall be indicated adjacent to the radiobeacon symbol, thus:

R Bn 302 ---- & ———
Continuously (1m on-5m silent)

In Canada, with the exception of those beacons revised to the above standards, the characteristic signal is usually repeated three times and is followed by one or more dash signals. In this case the legend should be charted as follows:

R Bn 300 ···— 3 times & — —
60m-10m & 30m-40m

On charts with scales other than those mentioned above, only the radiobeacon symbol (magenta circle 7.1 mm. in diameter) and the legend R Bn shall be charted.

Only marine radiobeacons have been calibrated for surface use. Limitations on the use of other radio signals as an aid to marine navigation can be found in the "List of Lights and other Marine Aids," published by the Coast Guard and "Radio Navigational Aids," Naval Oceanographic Office Publication No. 117.

DISTANCE FINDING STATIONS (Fig. 24) (M-15)

Sound signals synchronized with radiobeacons shall be indicated on the charts by the abbreviation "DFS."

AERONAUTICAL LIGHTS (Figs. 1, 24) (K-4)

As the effective range of aeronautical lights is in most cases greater than that of the lights established for ship navigation, those listed in the Light List should be shown on the charts. The position is indicated on the chart by a dot with a magenta disc 3 mm. in diameter. The light symbol should be accompanied by its characteristics and the abbreviation "AERO." (See Aeronautical Radiobeacons, Radio Range Stations, pg. 30.)

All true aeronautical lights are rotating in character and are shown on the charts as "Rot." The color is indicated by the standard abbreviations used for nautical lights. The period, height, visibility and number are not charted.

Obstruction lights, sometimes referred to as aeronautical lights, are not to be charted unless specifically requested and approval is obtained from the Branch Chief to chart same. When the structure is shown with the landmark symbol and the obstruction light has been approved for charting, the following symbolization shall be used: \odot $\begin{matrix} \text{TANK} \\ \text{FR Lt} \end{matrix}$ Since the landmark symbol is used, the magenta disc is omitted.

A file with a card for each rotating aeronautical light is maintained in the Aids Section. This file gives the location and color of the lights. The Radio Facility Chart Branch of the Aeronautical Chart Division furnishes all information which it receives that can be used in the correction of the card file. The compiler should consult this file before making any changes to charted aeronautical lights. If changes are made, the card should be corrected accordingly and, if necessary, the change should be published in the Notice to Mariners.

PRIVATE AIDS (K-17; L-29, -Lf)

Only those private aids listed in the C.G. Light List shall be charted. If aids established and maintained by private interests are charted, they shall be marked, "Priv maintd" (in vertical type if fixed, in italic type if floating). On small-scale charts, or when space is limited, this information may be omitted if charted on one or more large-scale charts covering the area.

Any fixed unlighted aid not established or maintained by the Coast Guard, and not listed in the C.G. Light List, should be charted thus: \odot MARKER when approximate, thus: \circ Marker

Lighted aids should be shown with the light symbol, proper characteristics and the abbreviation "Priv maintd". If the aid is not included in the Light List it should be charted thus: \circ Marker (lighted) when approximate, thus: \odot MARKER (lighted)

A private light (charting approved by Branch Chief) on a radio tower, or other structure shown with the landmark symbol, should be charted in a manner similar to the following:

$$\odot \begin{matrix} \text{R TR} \\ \text{FR Lt} \end{matrix}$$

Since in this case the landmark symbol is used, the magenta disc should be omitted. "FR Lt" is the abbreviation for fixed red light.

I

Electronic Navigational Systems

Included within this category are those electronic navigational systems which require the cartographer to prepare the necessary lines of position for overprinting on selected charts. Currently this category includes Loran "A", Loran "C" and Consol.

Loran "A" provides accurate fixes at sea to ranges of 700 nautical miles by day and about 1400 nautical miles by night, regardless of weather. Loran depends upon measuring in microseconds (millionths of seconds) the time interval between the reception of short pulses transmitted from pairs of radio stations on shore. One transmitter of a loran pair, the "master station", emits a number of uniformly spaced pulses each second. Several hundred miles away a second transmitter, the "slave station", emits a corresponding series of pulses which are kept accurately synchronized with those from the master station.

The time difference between the reception of a master pulse and the corresponding slave pulse establishes one point. If a constant value of time difference is observed at a series of points, and if these points are plotted on a chart and connected, the resulting smoothed curve will be a spheroidal hyperbola, and a loran line of position. A minimum of two "families" or "rates" of these loran lines of position are overprinted on a given chart to provide intersections for fixes.

Loran "C" provides very accurate fixes at sea to ranges of 1400 nautical miles day and night by using ground wave signals. Fixes up to 2500 nautical miles may be obtained day and night using sky wave signals; however, the accuracy is then of the order of ± 5 nautical miles. The method of observation is basically similar to Loran "A" except that all stations in a chain operate on the same pulse repetition rate.

At the present Loran "C" is being used as a special purpose highly accurate navigation system for the Department of Defense. In order to obtain the ultimate accuracy out of the system, especially programed shipboard computers are used. Due to receiver costs, few sets other than by the military, are in use.

In preparing for this overprinting, the cartographer is concerned with these steps:

1. Determining which rates will provide the best coverage on the given chart.
2. Determining which lines of position for a given rate will result in the most satisfactory and usable spacing.
3. Plotting the tabular intercepts on a copy of the chart printed on a stable medium, and connecting like points with smooth curves.
4. Preparing overlays as necessary to indicate color separations.

The determination and establishment of the most satisfactory rates is normally the result of coordination with the U.S. Coast Guard, and the decision of the Chief of Division. These factors are important for consideration:

1. The geographic distance of the stations of a given rate from the neatline limits of the chart.
2. The relationship of rates to one another. The most satisfactory fixes are obtained where the intersections of the lines of position are normal to one another; the least satisfactory are at or near baseline extensions.
3. The existence of extensive shoal areas on a chart would preclude the overprinting of loran lines within these areas.

On a printed copy of the chart the cartographer shall sketch in the desired lines of position, preferably in the colors in which they are to be printed. Normally, a given rate is printed in the same color on all charts; any deviation from this shall be authorized only by the Chief of Division. The lines of position shall be spaced approximately three-fourths of an inch apart where convergence is greatest; as the lines of position diverge, intermediate lines shall be added. Excepting near base-line extensions, no space shall be greater than the largest spacing of the linear interpolator. Normally, every line of position is labeled; the 100-microsecond lines shall carry the complete designation, as 2L4-1500, while intermediate lines may be designated only as 1420, 1440, etc. The designation shall be kept aligned as far as possible, and are spaced along each line at 15- to 18-inch intervals.

A blueline made from the black negatives of the chart shall be procured. The blueline should be printed near the center of a large sheet of polyester plastic, on the grained side; the plastic shall *not* be trimmed from the edges.

Three principal forms of plotting data for loran lines of position are available:

1. The bound copies of "Loran Tables", N.O.O. Publication No. 221 with specific sub-numbers in parentheses.
2. "Tab Runs", which are preliminary tables also obtained under limited distribution from the Oceanographic Office.
3. Supplemental "tab runs" obtained from our own Computing Division to augment either of the above.

A quick examination of the tables and tab runs above will show that intercept values are provided for every 15' of arc at and near both stations where the hyperbolas change direction most rapidly. Further out from the two stations, intercepts are provided for every 30', while at the greatest distances they are at every minute of arc. Rule in the necessary additional projection lines in a non-photographic blue ink. The projection lines should be ruled outside the neat lines as necessary to insure at least one plotted point for every line of position either on or outside the next lines.

Plot the intercepts from the tables (or tab runs), labeling each point with a small circle in colored pencil, preferably that color in which the rate is to be printed. Frequently it will be necessary to interpolate to obtain points for intermediate lines of position. Both tables and N.O.O. tab runs provide "delta values" (the column headed by " Δ "), which are actually tenths of a minute of arc expressed as whole numbers. The algebraic sign preceding the delta value indicates whether it is to be added to or subtracted from the intercept next preceding, to obtain a new intercept midway between the full values.

After all rates are plotted on the single sheet of stable-base plastic, like points are connected by fine black lines. All necessary type is added as determined by the study above, as well as a linear interpolator that best fits the more usable intervals of lines of position.

Colored overlays shall be prepared one for each color in which loran information is to be printed, and each overlay shall show clearly what information is to be printed in each color.

All notes pertaining to loran in general, as well as the linear interpolator, shall be added to the black Drawing, to be printed in black.

When one of the loran rates is printed in magenta, all compass roses shall be printed in black.

All loran lines of position, including base-line extensions, shall be engraved 0.004" wide.

Loran lines of position shall be broken only for type of the same color, for *all* sky wave corrections, and for ocean station vessels. Black information shall not be broken for loran information; neither shall loran information be broken for black information. Avoid placing loran type where it will be obscured by the black.

After verification, the loran Drawings with type and the overlays are ready for reproduction.

A consol radio station is a directional radio beacon. The bearing lines radiating from the station are great circle lines of position identifiable to the mariner by a separate count of dots and dashes. The navigator determines his bearing from a station by a count; the intersection of bearings from two stations provides a fix. Consol may be used in conjunction with one or more of the established methods of navigation.

Control points for consol bearing lines are computed as geographic positions either by the cartographer, or submitted as tab runs from the electronic computer. On a reverse blue-line of the black negatives, plot first the geographic position of the consol station, then plot the remaining geographic positions of the bearing lines. Connect like points with smooth curves in pencil only.

Using the consol station as a center, ink in arcs of concentric circles to include all of the pencilled bearings and space the several arcs uniformly five or six inches apart. The intersections of the pencilled bearing lines and the arcs shall be shown by short ticks inked on the inside of each arc; intermediate points for bearings may be computed as necessary, or they may be added by graphically subdividing the circular distance.

SMALL-CRAFT CHARTS

In the Spring of 1958 The Director of the Coast and Geodetic Survey appointed a committee to make a study of a special chart to meet the requirements of the small-craft navigator. A compact chart was designed for use in the inland and coastal waterways of the United States for recreational boaters. These compact charts, the latest addition to the Bureau's list of nautical charts published, are the Small-craft Charts. They provide the small-craft navigator with a convenient instrument for navigation and are constructed with the same high standard of accuracy established for the Conventional Nautical Charts. To promote safe navigation, selected basic educational aids are charted for the small-craft operator. Small-craft Charts are issued in three different types (see page 90) and are identified by the following assigned group numbers:

- I. 100-SC to 199-SC: Small-craft Chart Folio, consist of three or four folded sheets printed front and back and bound in a suitable cover—(Chart 101-SC).

- II. 600-SC to 699-SC: Small-craft Route Charts (rivers and narrow waterways), consist of a folded single sheet printed front and back and issued in a suitable jacket—(Chart 690-SC) (Conventional Charts printed front and back may be assigned to this number series by deleting the letters "SC").

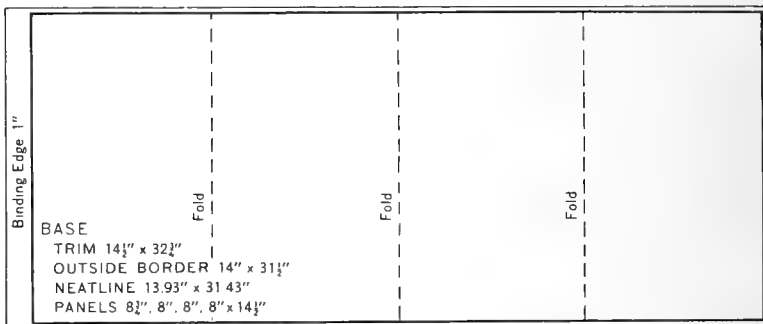
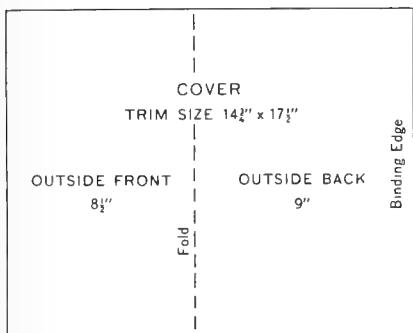
800-SC to 899-SC: Small-craft Route Charts (Intracoastal Waterway) consist of a folded single sheet printed front and back, and issued in a suitable jacket—(Chart 829-SC).

- III. 70-SC to 9500-SC: Small-craft Area Charts. The "SC" designation following the chart numbers will in all cases, except those listed above, designate a Conventional Chart published with additional Small-craft information. These charts are folded on a horizontal axis folding into panels—(Chart 246-SC).

The diagrams below show the cover, base, neatline and panel dimensions of the three basic types of Small-craft Chart formats in current use.

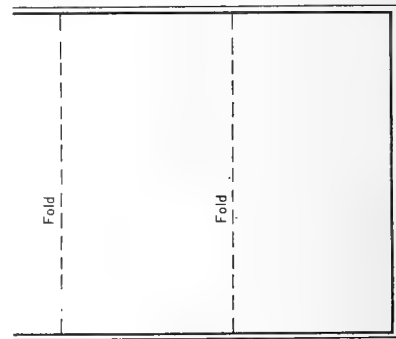
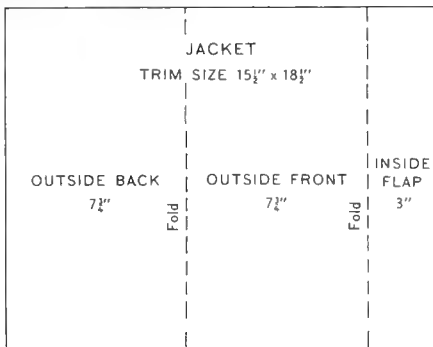
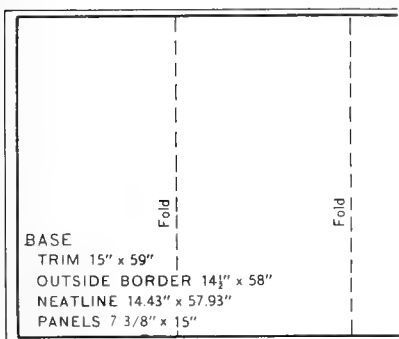
100-SC FOLIO CHART TYPE

Small-craft Chart: Multiple pages printed back-to-back; each page accordion-folded and issued in a side (ring) binding with protective cover.



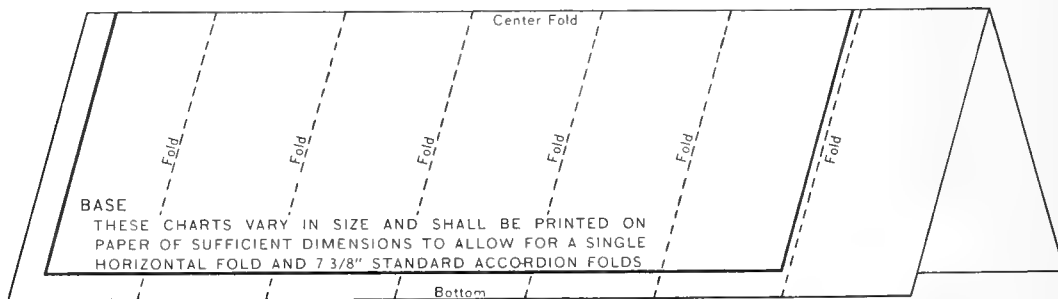
600-SC AND 800-SC ROUTE CHART TYPE

Charts of rivers, narrow bodies of water; Intracoastal Waterway Charts. 1 page printed back-to-back; 7 folds; 8 panels; accordion-folded and issued in a jacket.



AREA CHART TYPE

Conventional Chart: 1 page printed one side; folded on a horizontal axis; accordion folded and issued in a jacket.



Small-craft Charts

GENERAL SPECIFICATIONS

FORMAT DIMENSIONS: See page 90.

A PLANNING LAYOUT shall be made on a pre-determined format, showing the limits, title, and scale of the base chart and the insets. Space permitting, selected photographs of pertinent features within the charted area will be employed.

MERCATOR PROJECTIONS, based on the middle latitude of the chart, shall be computed and ruled for the base chart and insets. Projection and subdivision intervals are determined by the chart scale.

LINE WEIGHTS: See page 96.

SOURCES shall include all the latest information as to:

1. Hydrography
 2. Topography
 3. Photography
 4. Aid Proofs
 5. Coast Pilot
 6. Geographic Names Standards
 7. Notice to Mariners
 8. Facilities (Services and Supplies)
- } Standards

When source material has been evaluated, a graphic index shall be made of all the data to be used in the chart. For compilation, this source material is then reduced or enlarged photographically for fidelity of detail and scale. All data used during compilation and review must be recorded on the History Sheets. Marine Weather information, Tides, Currents, and all other notes concerning the chart and insets should be selected and revised, if necessary. Modernized wording should be used whenever possible.

FACILITY information is obtained by a facility inspection survey. The facility positions are plotted on the largest scale charts, T-sheets, or quads covering the Small-craft Chart area and described as Facility Standards. Information for individual facilities shall be assembled and transferred to the facility index forms. Field numbers designate the individual facilities until all facilities have been plotted on the base charts and insets. A number is then assigned and applied to the red or magenta compilation in bold type with a leader to its exact position. The facilities are listed consecutively within the Facility Index and placed on the cover whenever possible. Facility tabulations are revised in each new edition of the chart.

CHART DETAIL to include:

1. Landmarks and other navigational aids shall be precisely plotted.
2. Urban area limits are selected from latest sources, outlined on an urban compilation and show the actual urban limits and not the city or town boundaries. The urban pattern will be screened by the Reproduction Division.
3. Main roads and railroads shall be single line, identified, labeled and show through the urban pattern. All roads leading to facilities must be shown.
4. Drainage patterns, lakes, streams, canals, and reservoirs are charted when significant.
5. Selected critical spot elevations and bluffs should be charted if prominent.
6. Latest bridge and cable data shall be applied.

HYDROGRAPHY is to be compiled from latest sources. Hydrographic information on the base charts within the limits of the insets is omitted except for that used for through traffic. Soundings shall be carefully selected and charted in feet, or fathoms and feet, as required. The 6-foot, low-water, and/or other critical depth curves are selected. A blue tint shall be shown to the 6-foot or critical depth curve.

Low water areas are tinted green and outlined by a dotted curve.

Reefs, rocks, shoals, wrecks, piles and other water obstructions shall be carefully plotted.

Bottom characteristics shall be carefully selected and spaced.

All channel limits and notes are placed on the black Compilation.

Restricted, prohibited, cable and pipeline areas shall be verified and applied to the red or magenta Compilation. Restricted areas are shown by the "TTT" symbol.

MAJOR COURSE HEADINGS are shown on the red or magenta Compilation, and appropriately labeled.

MAJOR DISTANCES are international nautical miles and given between primary course changes and/or at marked five mile intervals on the red or magenta Compilation.

TYPE for entire chart and insets shall be ordered using Small-craft Chart No. 117-SC as a standard. Futura Type is the basic style type to be used on all Small-craft Charts. This open-face style provides, under adverse conditions, ease of identification and increased legibility. (See page 96 for type styles and sizes.)

All type must be placed carefully and interfere as little as possible with the cartographic detail.

Marginal information and standard notes shall be applied using Small-craft Chart No. 117-SC as a standard.

INSETS: The placement of insets is determined on the planning layout and so far as practicable, insets are placed on the reverse side of the base charts. Projection intervals are determined by the scale. The insets are numbered and cross-referenced as to their location on the base charts. The limits of insets, on the base charts, are outlined accurately and numbered in sequence on the magenta or red Compilation. Compass roses should be placed on all insets, however, where space is limited a north arrow shall be charted.

CHART INDEX of the area shall be compiled at the best possible scale to diagram the charted area and the adjoining chart coverage. This index is placed on the outside back cover whenever possible.

TIDE TABLES are photographic reductions of the published Tide Tables.

TINT GUIDES are sent to Reproduction to guide them in the application of the blue and green tints.

The date of the latest Notice to Mariners must be used for the cut-off date when the proof of Base No. 1 is ready for final verification of aids. This cut-off date also applies to the remaining sections of the Small-craft Chart.

A certain degree of flexibility should be allowed in Small-craft Chart compilations due to the special problems encountered in difficult areas.

All other procedures in the construction of Small-craft Charts, in general, follow the Nautical Chart Manual standards.

On the planning chart, compilation, and final drawing, attention is directed to the cartographic balance of the complete Small-craft Chart with its ultimate use always in mind. This chart is designed for recreational craft use and emphasis must be placed on completeness, accuracy, legibility of type and detail, and final usage.

New editions of the Small-craft Charts are issued annually and are not hand corrected between printings. Notices to Mariners warn navigators of critical changes between editions.

CONSTRUCTION OF SMALL-CRAFT CHARTS

- I. Prepare a layout, to scale, of the selected area on pre-determined format (see pg. 90).
 - A. Assemble layout in cover showing continuity of coverage and positions of scales, compass roses, insets, notes, photographs, etc.
- II. Present to Chief of Division, the layout, detailed specifications and proposed method of compilation to be employed.
 - A. Secure his approval and scheduled date of completion.
 - B. One of the three following methods for compilation construction is presently used for "Folio" charts and "Route" charts:

Method No. 1

A new Mercator projection is computed and ruled on a stable plastic. The areas not covered by conventional large-scale charts are compiled by rough drafting from evaluated scaled source data on the new projection. The Compilation is then forwarded to the Reproduction Division for engraving. From the resulting scribed copy a blackline print is furnished. This print is then the base Compilation, and requires a complete application of geographic names, notes, soundings and other miscellaneous type on a registered transparent stable plastic overlay.

Method No. 2

Mosaic to new Mercator projection, if required, positive scaled sources photographically reproduced on stable base film. The scaled sources are made from the existing large-scale conventional chart negatives. The resulting mosaic is the base Compilation. Compile and smooth draft, on this mosaic base, all required hydrographic and topographic revisions. Retain all geographic names, notes, projection values, etc. as per existing conventional chart. Supplemental type stripper-film from existing charts is applied direct to the mosaicked base Compilation.

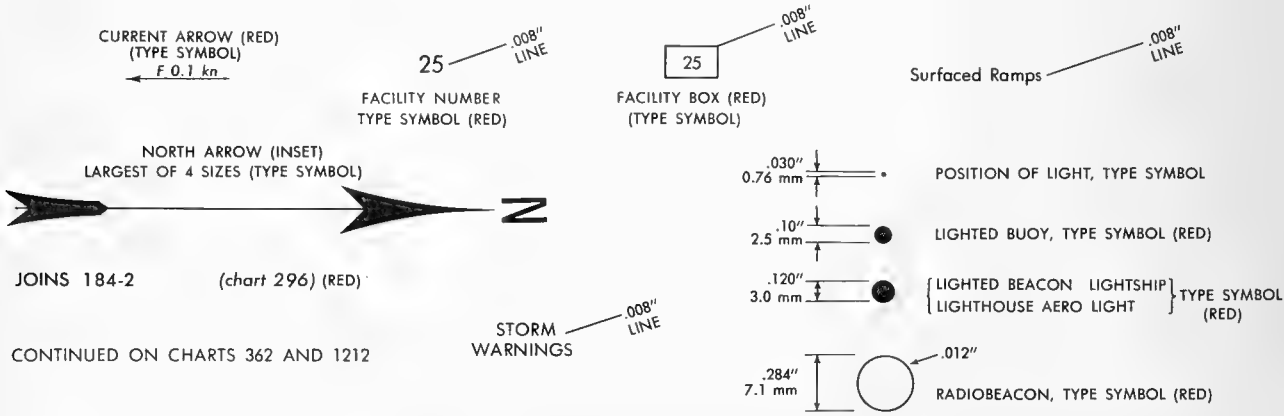
Method No. 3

Same as Method No. 2 except for limited modernization of hydrographic and topographic symbolization. Duplicate negatives, of existing large-scale conventional charts, are made by the Reproduction Division and the required modernization applied to these negatives as per furnished marked copy. Stable-base film positives, made from the corrected negatives, are mosaicked and used as the base Compilation. This method requires a complete application of new small-craft style type for geographic names, notes, soundings and miscellaneous type on a registered transparent stable plastic overlay.

SMALL-CRAFT CHART TYPE GUIDE

TOPOGRAPHIC NAMES.....	Futura Book
STREET NAMES, RR AND ROUTE NO's..	6 Pt. Futura Book
STATE AND COUNTY NAMES.....	10 Pt. Futura Book
SPOT ELEVATIONS.....	6 Pt. Futura Medium Oblique
HYDROGRAPHIC NAMES.....	Futura Medium Oblique
ALL AIDS.....	8 Pt. Futura Medium and 8 Pt. Futura Medium Oblique (in congested areas 6 pt. may be used)
SOUNDINGS.....	6 Pt. No. 4 Lining Gothic
SOUNDING FRACTIONS.....	Stock Film (N-329, N-405, N-452)
BOTTOM CHARACTERISTICS.....	6 Pt. Futura Medium Oblique
COURSE BEARINGS.....	8 Pt. Futura Medium Oblique
MILEAGE DESIGNATIONS.....	10 Pt. Futura Medium Oblique
CURRENTS.....	6 Pt. Futura Medium Oblique
HEIGHTS OF ROCKS ABOVE SOUND- ING DATUM.	6 Pt. Futura Book
ALL NOTES (2'' AND 3½'' WIDE).....	8 Pt. Futura Book
BRIDGE AND OVERHEAD CABLES.....	5 Pt. Futura Book
LANDMARKS.....	6 Pt. Futura Book
PROJECTION FIGURES (BASE).....	10 Pt. Futura Book
PROJECTION FIGURES (INSETS).....	8 Pt. Futura Book
PROJECTION SUBDIVISION FIGURES (BASES AND INSETS).	6 Pt. Futura Book
STATE GRID VALUES.....	6 Pt. Futura Medium
SCALE DESIGNATIONS.....	10 Pt. Futura Book
BAR SCALE TYPE.....	8 Pt. Futura Book
INSET AND PHOTO LABELS.....	10 Pt. Futura Book
BASE (PAGE) NUMBERS.....	12 Pt. Futura Medium
JOINS NOTES (WHEN JOINING AN- OTHER SMALL-CRAFT CHART).	8 Pt. Futura Medium
CONTINUED NOTES.....	8 Pt. Futura Book
FACILITY NUMBERS.....	10 Pt. Futura Book
FACILITY INDEX TYPE.....	8 Pt. Futura Book
STORM WARNING LABELS.....	8 Pt. Futura Book (in congested areas 6 pt. may be used)
NM CORRECTION DATE (BASE).....	10 Pt. Futura Book

SMALL-CRAFT (HEAVY BORDER LINE)		.035"				
SMALL-CRAFT (INSET BORDER LINE)	INSET OUTLINE ON BASE (RED)	MILEAGE MARKER LINE (RED)	.020"			
INTERNATIONAL-STATE BOUNDARY		.015"				
ROADS		.012"				
ANCHORAGE (RED)	.010"	COUNTY BOUNDARY	.012"			
DANGER AREA (RED)	5.0 mm	RESTRICTED DUMPING GROUND (RED)	.010"			
SUBMARINE OPERATING AREA (RED)		PROHIBITED ANCHORAGE AREA (RED)	.010"			
DEFENSIVE SEA AREA (RED)	5.0 mm	PROHIBITED AREA (RED)	.010"			
RESTRICTED AREA (TYPE SYMBOL-RED)						
SHORELINE (HEAVY)		.011"				
6.0 mm	RAILROADS		.010"			
LOW WATER CURVE (DOTS)		.010"				
STATE PARK-RESERVATION BOUNDARY		.008"				
CHANNEL (WIDE)	5.0 mm	CHANNEL (MEDIUM)	3.7 mm	CHANNEL (NARROW)	2.5 mm	.008"
SPOIL AREA	FISH HAVEN	2.0 mm	DISPOSAL AREA	DUMPING GROUND	.008"	
SHORELINE (LIGHT)	CANALS	DITCHES	STREAMS	PIERS	.007"	
RULES OF THE ROAD (RED)	3.7 mm	COURSE LINE (RED)	SUBMARINE TRIAL AREA (RED)	6.5 mm	.007"	
FISH TRAP AREA		.007"				
RAY LINES (TYPE SYMBOL)						
CABLE AREA (RED)	2.5 mm	PIPELINE AREA (RED)	.006"			
RANGE LINE	SEWER (RED)	RAILROAD TIES	.006"			
OVERHEAD POWER CABLE	TRAILS	TRIAL COURSE	.006"			
PROJECTION	TRANSMISSION LINE	MARSH LIMITS	.005"			
DEPTH CURVES		.005"				



Small-craft line weights-symbols

PROJECTIONS AND GRIDS

THE MERCATOR PROJECTION

The parallels of latitude and the meridians of longitude constitute the framework for placing accurately all details which enter into the construction of the finished chart. They are essential to the navigator in plotting and scaling his position.

With few exceptions, nautical charts are constructed on the Mercator projection. On this projection, meridians of longitude and parallels of latitude are straight lines intersecting at right angles. The distances between meridians are equal throughout the chart, but distances between parallels increase progressively from the equator toward the poles, proportionately as the scales of the parallels increase, so that the scale at any point on the chart is the same in all directions.

This projection has a number of advantages, among which are conformality, simplicity of construction, convenience in plotting positions from the border divisions, and the fact that on it alone a course can be laid off from any meridian or compass rose within its borders. Its principal advantage, however, and the one responsible for its world-wide use for nautical charts is that any straight line drawn on it in any direction is a rhumb line (loxodromic curve). Thus the rhumb line, or the track of a ship on a constant course, is a straight line on the projection and will pass all features along that line exactly as they are charted. This is a great advantage in coastal navigation, since the straight line representing a constant course to be made good will indicate at once the distance at which dangers will be passed abeam.

Disadvantages of the Mercator projection are that it makes comparison of areas very misleading when large differences of latitude are involved; that great circle routes cannot be plotted conveniently on it without the use of an auxiliary gnomonic chart. Other disadvantages are that the scale is constantly changing with the latitude, with the result that a graphic scale cannot be used on smaller scale charts, making it necessary to measure distances along the border divisions for the latitudes in which the distance lies; and that for distances over 200 miles, bearings must be adjusted before plotting.

On all nautical charts, a minute of latitude is considered to be *approximately* 1 nautical mile.

CONSTRUCTION OF A MERCATOR PROJECTION

To construct a Mercator projection, draw a straight line for a central meridian and then draw a central parallel perpendicular to it. Each should be as central to the sheet as the selected intervals of latitude and longitude will permit. To insure greater accuracy on large sheets, the longer line of the two should be drawn first, and the shorter line erected perpendicular to it.

Example

Required a Mercator projection for a new chart of Corpus Christi Bay, Texas, extending from latitude $27^{\circ}38'$ to $27^{\circ}55'30''$; longitude $97^{\circ}00'$ to $97^{\circ}27'$; scale of middle parallel to be 1:40,000; projection interval 5 minutes, with construction line subdivisions 1 minute apart. For convenience all measurements are determined in millimeters.

THE MERIDIANS OF LONGITUDE

The middle parallel being $27^{\circ}47'$, the length of a minute of longitude is found, by reference to the Coast and Geodetic Survey Special Publication No. 5, page 64, to be 1642.65 meters (the value of $5' = 8213.3$ divided by $5 = 1642.65$). At the scale of the chart, one minute of longitude equals 1642.65 divided by $40,000 = 0.0410665$ meters or 41.067 millimeters. Lines representing 5-minute intervals of longitude ($5 \times 41.067 = 205.335$ millimeters), and 1-minute subdivisions for construction purposes (41.067 millimeters) may now be drawn.

THE PARALLELS OF LATITUDE

The distance between parallels of latitude is obtained from C&GS publication Mercator Projection Tables, Clarke Spheroid of 1866 (1955), page 7, by multiplying the differences between any two parallels of latitude by the value of 1 minute of longitude. For example, the value of a minute of latitude between $27^{\circ}38'$ and $27^{\circ}39'$ is 1.12283×41.067 or 46.111 millimeters. The spacings for all desired intervals may be obtained in the same way.

The latitude and longitude values thus obtained should be entered on Form C&GS-1016 "Mercator Projection Data on N.A. 1927 Datum." After the necessary data have been tabulated, the required projection lines are drawn parallel to the central meridian and central parallel as indicated in the illustration. When the Coordinate Plotter or Ruling Machine is used, the sum of the intermediate distances should be tabulated as shown on the sample of Form 1016.

PROJECTION LINES (Fig. 1)

Projection lines are full lines extending from neatline to neatline. They are broken for soundings, lettering, and other features which otherwise would be obscured by having the projection lines drawn through them. The projection line intervals in Figures 4 and 6 of the Appendix should be used in all cases, as they have been selected for a convenient span with dividers.

PROJECTIONS AND GRIDS

C & GS 1016
NC (4-9-62)

Mercator Projection Data on N.A. 1927 Datum

Chart No. 000

Location CORPUS CHRISTI BAY, TEXAS

Scale 1:40,000 Latitude 27°47'

Major Projection Interval 5' BLACK Minor Projection Interval 1' BLUE

Border 0.0 - 1.5 - 1.5 - 7.5 MM Material .010" VINYLITE

Dimensions in Millimeters 828.981 MM x 1129.809 MM

Limits 27°38' TO 27°55'30" LAT., 97°00' TO 97°27' LONG.

$\frac{8213.3}{5} = 1642.65$ METERS; AT MAP SCALE $\frac{1642.65}{40,000} = 0.0410665M = 41.067MM$

1' Long. at Middle Latitude 5 = 40,000

Remarks ALL INTERVALS COMPUTED IN MILLIMETERS

Computed by NAME, DATE Checked by NAME, DATE

Chart No. 000

West to East			South to North			
	<i>Intermediate Distance</i>	<i>Total Distance</i>		<i>Minute * Diff.</i>	<i>Inter. Dist.</i>	<i>Total Dist.</i>
BORDER	0.000	0.000	BORDER		0.000	0.000
BORDER	1.500	1.500	BORDER		1.500	1.500
BORDER	1.500	3.000	BORDER		1.500	3.000
NEATLINE 97°27'00"	7.500	10.500	NEATLINE 27°38'00"	-----	7.500	10.500
26'	41.067	51.567	39'	1.12283	** 46.111	56.611
25'	41.067	92.634	40'	1.12301	46.119	102.730
24'	41.067	133.701	41'	1.12318	46.126	148.856
23'	41.067	174.176	42'	1.12335	46.133	194.989
22'	41.067	215.835	43'	1.12353	46.140	241.129
<i>(In actual practice, complete interval listing)</i>						
01'	41.067	1078.242	55'	1.12562	46.226	795.364
NEATLINE 97°00'00"	41.067	1119.309	NEATLINE 27°55'30"	.56290	23.117	818.481
BORDER	7.500	1126.809	BORDER		7.500	825.981
BORDER	1.500	1128.309	BORDER		1.500	827.481
BORDER	1.500	1129.809	BORDER		1.500	828.981

* C & GS Mercator Projection Tables, 1955, Page 7 ** 1.12283 x 41.067

COMPLETED PROJECTIONS

On compilations cut apart in an east-west direction, the cartographer must indicate the distance (in millimeters) across the cut between parallels of latitude.

Projection intersections (ordinarily in blue) and other auxiliary information used by the compiler must be retained for use by the verifier.

PROJECTION RULING MACHINE

There is available in the Bureau a machine to rule accurately, and to a certain extent mechanically, polyconic and other projections of slight curvature, as well as Mercator projections and grids. This machine can rule on paper, plastic, and other mediums. The size of a projection that can be drawn on the ruling machine is limited by a rectangle 41 by 59 inches whose sides are parallel to the projection lines. The sheet itself, however, can extend somewhat beyond these limits, but ordinarily should not exceed 42 by 60 inches. In special cases a sheet 46 by 65 inches can be ruled.

It is a responsibility of the cartographer to check the projection before starting to compile a chart.

COORDINATE PLOTTER

The coordinate plotter can be used to rule Mercator projections and grids. It has a maximum working area of 43 by 45 inches. The length can be extended by supporting the outer end of the sheet. Dials read to 0.1 of a millimeter and can be estimated to 0.01 of a millimeter. Prepare computations to 0.001 of a millimeter.

CORPS OF ENGINEERS RECTANGULAR COORDINATES (LOCAL)

The local grid systems used by the Corps of Engineers are rectangular and have a progressive deviation from the meridians and parallels. The meridian through the origin of the system is ordinarily parallel to the north-south grid line. However, caution must be exercised in using local grids, because in some cases the north-south grid line is not parallel to the meridian at the zero point of the system. The point to be used as the origin for the following computations is the point at which the grid line and meridians are parallel.

Geographic positions of Corps of Engineers coordinate grid intersections have been computed for many harbors of the United States. From these positions, the coordinate grids have been drawn on copies of the harbor charts. When Corps of Engineers blueprints showing plane coordinate control are to be applied to a Drawing, the geographic position of the grid intersection should be scaled from the above-mentioned chart copies and transferred to the Drawings to furnish control for the blueprints.

When geographic coordinates have not been computed for the area of the blueprint to which they are to be applied, it will be necessary to compute the positions on Form C&GS-89 "Computation of Geographic Coordinates From Plane Coordinates" described below. When this is accomplished, the form is to be attached to the Chart History.

To find the geographic position of a point whose rectangular coordinates from a known geographic position are given:

Example No. 1

To compute the geographic position of a point whose local grid coordinates are 40,000 ft. S. and 160,000 ft. E.:

(1 foot=0.3048006096 meter)

Origin of coordinates: Cape Disappointment Lighthouse, Washington

Lat. 46°16' 1038 m.	Coordinate value of origin	} N. or S. 0.0 feet
Long. 124°03' 67 m.		

Name of station: **X**

Coordinates: N. or S. 40,000 feet=12,192 m.
E. or W. 160,000 feet=48,768 m.

Latitude N.-S. coordinates

N. or S. 40,000 feet = 12,192 m.
+ or - seconds in meters = 1,038 m.

N. or S. of 46°16' = 11,154 m.
*From table + or - 7' = 12,968 m.

Lat. (uncorrected) 46°09' 1,814 m.
**Curvature— = 194 m.

***Latitude 46°09' 1,620 m.

*From Special Publication No. 5, page 103.

**Correction from formula for curvature corrections,
page 104.

***Use in taking out longitude values from *Polyconic Projection Tables*, Special Publication No. 5, Coast and Geodetic Survey, page 102.

Longitude E.-W. coordinates

E. or W. 160,000 feet = 48,768 m.
+ or - seconds in meters = 67 m.

E. or W. of 124°03' = 48,701 m.
***From table + or - 38' = 48,914 m.

Longitude 123°25' 213 m.

Example No. 2

To compute the geographic position of a point whose local grid coordinates are 30,000 ft. N. and 155,000 ft. W.

(1 foot=0.3048006096 meter)

Origin of coordinates: Maryland

Lat. 38°20' 426 m.	Coordinate value of origin	} N. or S. 0.0 feet E. or W. 0.0 feet
Long. 75°10' 315 m.	referred to the Zero	

Name of station: Y

Coordinates: N. or S. 30,000 feet= 9,144 m.
E. or W. 155,000 feet=47,244 m.

Latitude N.-S. coordinates
N. or S. 30,000 feet =9,144 m.
+ or - seconds in meters= 426 m.

N. or S. of 38°20'=9,570 m.
*From table + or - 5'=9,250 m.

Lat. (uncorrected) 38°25' 320 m.
**Curvature— = 138 m.

***Latitude 38°25'= 182 m.

*From special publication No. 5, page 87.

**Correction from formula for curvature corrections,
page 104.

***Use in taking out longitude values from *Polyconic
Projection Tables*, Special Publication No. 5, Coast
and Geodetic Survey, page 86.

Longitude E.-W. coordinates
E. or W. 155,000 feet =47,244 m.
+ or - seconds in meters= 315 m.

E. or W. of 75°10'=47,559 m.
***From table + or - 32'=46,579 m.

Longitude 75°42' 980 m.

CURVATURE CORRECTIONS

$$\text{Curvature correction} = A \times \left[\frac{\text{long}}{10,000} \right]^2$$

(see note)

$$\text{Case No. 1} \quad 8.15 \times \left[\frac{48,768}{10,000} \right]^2 = 194 \text{ m.}$$

(page 102)

NOTE: In computing A, use uncorrected latitude of point whose geographic position is being computed.

TABLE OF CURVATURE FOR 10,000 METERS

Lat.	A. meters	Lat.	A. meters	Lat.	A. meters	Lat.	A. meters
25°	3.65	31°	4.71	37°	5.90	43°	7.30
26°	3.82	32°	4.90	38°	6.12	44°	7.56
27°	3.99	33°	5.09	39°	6.34	45°	7.83
28°	4.16	34°	5.28	40°	6.57	46°	8.10
29°	4.34	35°	5.48	41°	6.80	47°	8.39
30°	4.52	36°	5.69	42°	7.05	48°	8.69

STATE PLANE COORDINATES

The State Plane Coordinate Grid may be computed and plotted on charts when using U.S. Corps of Engineers blueprints with State Grid control, by one of two methods:

1. Computing the geographic positions of the State Grid coordinates found on the blueprints and plotting them on the chart. There are special publications of Plane Coordinate Projection Tables for all states. There is a detailed example of the necessary computations in each. If the number of computations warrant it, the computations may be obtained from the Electronic Computing Division within a few days. The computer is all programmed, so it is just a matter of punching cards for the desired grid intersections, and the time to run them through the computer.

2. By use of the special publication of Plane Coordinate Intersections Tables (2½ minute). These tables give the Plane Coordinates of every 2½ minute Geographic Intersection by states. The even 5- or 10,000-foot grid may be measured from the nearest 2½ minute intersection by setting, on a pair of dividers, the difference (at map scale) from the 2½ minute intersection value found in the table, and the even 5- or 10,000-foot grid value. Using this value and the 2½ minute intersection as a center, swing an arc. The grid line may be obtained by drawing a line tangent to two arcs of the same value.

GEOGRAPHIC NAMES

GENERAL STATEMENT

Nautical charts are published primarily for the use of the mariner, and are only one of the many aids on which he must depend. The Coast Pilot, the List of Lights, Channel Condition Reports, and Tide Tables, together with Notices to Mariners are an adjunct to the Nautical Chart; and in approaching the coast from the open ocean, to coastwise navigation, to navigating in bays and rivers, the numerous land and sea bottom features and aids assume varying degrees of importance to the mariner. These considerations serve as a guide to the cartographer in the selection of geographic names, names of navigational aids, channel names, and notes which should be on a particular nautical chart.

SOURCE OF GEOGRAPHIC NAMES

Field surveys are the main source of the names appearing on nautical charts. Hydrographic surveys supply names seaward of the shoreline, such as water features, submarine features, and small geographic features seaward of the shoreline. Topographic and air-photographic surveys are the source of shoreline names and names landward of the shoreline. Numerous kinds of published material and reports supplement the field surveys.

THE GEOGRAPHIC NAMES SECTION

This section provides standardization of geographic names in the publications of this Bureau, and maintains active representation in the U.S. Board on Geographic Names.

Reports on geographic names from the field parties are processed in the Geographic Names Section. Records are maintained which show the source of each name, together with its verification, history, and its use in the publications of this bureau, and on maps of other agencies. Names reported by field surveys which differ with names on other federal maps are submitted to the Board on Geographic Names for decision.

The section maintains a Geographic Names Standard for each nautical chart. Changes in names are noted thereon, and a notice of the change is sent to the Nautical Chart Division. In order for name revisions made on the charts to be reflected in other publications of the Bureau, the Name Standards must be ever current. Cartographers shall notify the Geographic Names Section when names are added to or deleted from a chart.

It remains the responsibility of the cartographer to determine which names shall or shall not be charted, depending upon their importance or usefulness on a particular nautical chart. The Geographic Names Section determines the correct spelling and the feature to which the name applies, or the area to which the name is applicable.

Name discrepancies encountered in applying new source material to a chart shall be referred to the Geographic Names Section for an opinion. New or reconstructed charts ready for reproduction shall be submitted to that section for approval of the charted names.

TERMINOLOGY OF SUBMARINE RELIEF

Definitions of names to be applied to submarine relief, for such features as bank, reef, shoal, etc., are included in this Manual (pages 118 to 128) and in the Hydrographic Manual.

NAMES ON COMPILATIONS AND DRAWINGS

The requirements for lettering names on the Drawings and Compilations are legibility, proper location, correct size and spacing, and the use of single-stroke letters. Names are lettered in red on Drawings, and on Compilations are lettered on an overlay. The names should be placed in the exact location in which they are to appear on the printed chart. On new charts and reconstructed charts, all type for names, title and notes should be in place on the type overlay before the charts are submitted for reproduction.

PLACEMENT OF NAMES (also see names of Dangers, pg. 65)

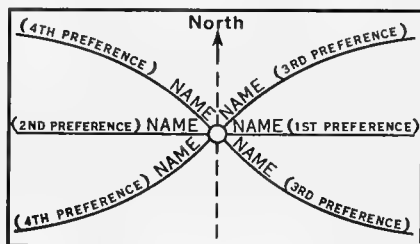
Vertical lettering is used to name land features or fixed objects which extend above high water. Slanting (italic) lettering is used for all names relating to water areas, underwater features, or floating aids. Insofar as practicable, names of land features should be placed in the land areas, and those of water features should be placed in the water areas. However, the names must not obscure anchorage areas in small bays nor detailed hydrography in critical areas. In such cases, the name of the water feature should be placed on an adjacent land area. A name must not be placed along the axis of the deepest water, nor across a channel, if it can be arranged otherwise. If possible, names should be so placed that they will appear on the printed chart either entirely on a tinted area or entirely on an untinted area. Names of cities should be located near the place named, but should interfere with other data on the chart as little as possible.

The name of a feature which covers a considerable area, such as an island or bay, should be placed in the approximate center of the area, if possible, and should be curved to follow the general configuration of the feature. Names of rivers and features of unusual length should not be spread out, but should be spaced for easy reading and repeated if necessary.

The preferred orientation of names is parallel to the bottom of the chart. When the axis of a channel is practically straight, the name should be lettered on a line parallel thereto. The name of a range should be parallel to the range line.

CURVED NAMES

In general, names not parallel with the bottom of the chart should be lettered on a curve so as to read from the direction of the bottom of the chart. Such names should be near, and point either to or from, the feature named. See diagram below.



A curved name is read more easily if its beginning is approximately parallel to the bottom of the chart, but when this is impossible, it is desirable to have the curved effect at the end of the name. Do not curve a name beyond the vertical. Sharp and reverse curves should be avoided.

LETTER SPACING

When two or more words constitute a single name, they must be separated by a space equal to that taken by the letter "I," capitalized.

Letters in a name shall not be spaced at distances greater than three times the height of the letters.

ABBREVIATIONS

It is standard practice to abbreviate names of railroads and the word "Point" when the latter is part of a geographical feature. Otherwise, abbreviations of names on charts should be avoided. When abbreviations are necessary, only those listed on standard Symbols and Abbreviations Chart No. 1 should be used. "Shl" for shoal, "Bk" for bank, "St" for stream, "Cr" for creek, or "R" for river shall not be used when space permits charting the full name. When abbreviations for landmarks are necessary, they should be charted in caps, e.g., "APT," "HOSP."

PERIODS

On charts, all periods after abbreviations are omitted in water and in land areas; but the lower case "i" and "j" are dotted. Periods are used only where needed for clarification, as for example, in certain notes.

CAPITALIZATION

The following rules shall be observed in regard to the capitalization of geographic names and terms:

1. Capitalize the first letter of single words thus:
Mud, Tank, Marsh, Uncovers, Wooded, etc.
2. Capitalize the first letter of the first word only, when two or more words are used, thus:
Oil tank, Densely wooded, Sand and mud.
3. Capitalize the first letters of all words identifying public buildings, parks, etc., thus:
Post Office, Municipal Stadium, Port Office.
4. Use lower case letters when word is enclosed in parentheses thus:
(snow-capped), (ruin), (marked by beacons).
5. Capitalize all letters of landmark names, thus:
TANK, TOWER, STACK.
6. Capitalize all letters of buildings, objects, etc. known to be conspicuous. Exceptions:
small-scale charts or where space is limited.
7. Capitalize the first letter of all words in the following type of terms:
See Plan, Plan A, See Caution.
8. Capitalize the first letter of all words referring to a charted area, thus:
Cable Area, Danger Area, Foul Ground, Tidal Flats, Prohibited Anchorage,
Harbor Limits, Dumping Ground, Spoil Area.
On large-scale charts, or when considered important, all letters will be capitalized.
9. Capitalized first letter of first word only, in terms referring to action areas:
Being filled, Proposed fill.

ORDERING TYPE

The style, size, and spacing of type used on charts published by this Bureau are illustrated in the Appendix of this Manual. The proper style, size and spacing for practically any name or descriptive term should be determined by referring to these illustrations.

In determining the size of type to be used, the cartographer should give the maximum size to the main line of the title. All other type should be smaller. Minor names of local importance only should be inconspicuous. The space available on the chart, and the relative importance of the feature to which the name or term applies, are to be considered in selecting the size and spacing of the type. The legibility of place names is usually improved by increasing the space between the letters; however, the amount of type-setting time doubles when space is requested, and should not be used unless necessary.

The following are requested on type orders:

1. Use Form C&GS-91, "C&GS Type Order" for ordering all type except the following:
 - (a) Use Form C&GS-8321, "Title and Notes for Nautical Charts"
 - (b) Use Form C&GS-8326, "Tidal Information"
2. Letter in ink or use typewriter. Do not use pencil.
3. Indicate type style by name or abbreviation, and list point size. Use red ink for this and other type-ordering instructions.
4. Furnish complete information as to spacing, centering, or other special treatment.
5. Arrange names, descriptive terms, notes and numerals according to style of type and then by point size.
6. Capitalize and punctuate exactly as desired.
7. State the number and kind of prints needed.

FORM 91 (8-2-54)		U.S.C. & G.S. TYPE ORDER				U.S. DEPARTMENT OF COMMERCE COAST AND GEODETIC SURVEY	
JOB IC 833,835			PROJECT 50144		DATE 6-5-63		
REQUISITION NO. 36136			REQUEST DELIVERY				
NO. OF PRINTS 10	STOCK Fotosetter; Tran. rev. pos. waxed stripper (do not strip)						
SENDER J. Smith		ROOM 300	PHONE 5246	DIVISION Nautical Chart	BRANCH Small-craft		
SIZE AND STYLE		SPACING	SIZE AND STYLE		SPACING		
12pt., 14pt., 18pt. Coast Survey Italic *		O *	10pt., 12pt., 14pt. Light Litho				
Murrells Inlet			Murrells Inlet				
Main Creek			Thompson				
THE BAY			Magnolia Beach				
The Bay			MURRELLS INLET				
Oaks Creek			THOMPSON				
LONG BAY							
			6pt. 8pt. Light Litho				
8pt. 10pt. Coast Survey Italic			Magnolia Beach				
Oaks Creek			Drunken Jack Island				
Main Creek			Goat Island				
THE BAY							
The Bay							
Woodland Creek			6pt. Century Expanded Italic				
Whale Creek			Allston Creek				
Parsonage Creek			Weston Flat				
Weston Flat			Parsonage Creek				
Allston Creek			Whale Creek				
			Woodland Creek				
8pt. Light Litho							
00' 02' 04' 06' } set 4 times *			6pt. No.4 Lining Gothic				
28' 30' 32' 34' }			2 FR 15ft Priv maintd				
6pt. Draftsman Italic			6pt. No.3 Lightline Gothic				
BW C BELL			U.S. Hy. No.17 U.S. 17				

* Type Style, size, spacing and instructions are shown in Red.

COMPILATION REVIEW

The compilation review, an exhaustive study and inspection of the compilation, is made for the following reasons:

1. To ascertain that all existing information pertinent to the chart has been considered.
2. To assure that only those sources which most clearly define existing conditions have been used.
3. To determine that the material used has been properly generalized.
4. To assure that all symbolization conforms to standard practice and that all prominent objects and aids to navigation have been accurately plotted.
5. To make an artistic appraisal and, if necessary, a recommendation for the rearrangement of such features as geographic names, notes, or compass roses.
6. To assure that the chart is so compiled as to be most useful to the mariner.

Upon assignment of a chart Compilation, the reviewer receives a Specification sheet and History sheet. The former defines the title, limits, sounding unit, depth curve and contour interval, while the latter contains a list of all source material applied to the chart by the cartographer. The reviewer evaluates and verifies the compiler's selection of the critical and essential information shown on the chart. At the same time, the History sheet is checked, so that upon completion of the review, it becomes a record of all data pertaining to the chart Compilation.

Three qualities of a good Compilation are accuracy, completeness, and clearness. *Accuracy* is of prime importance. The plotting of all fixed aids to navigation, landmarks, wrecks, and obstructions should be checked from their geographic coordinates. All soundings should be checked for value, and their location should be true within half the width of the figure.

Check all sectors, ranges, measured mile courses, and grid systems as well as dredged channels, anchorages, spoil areas, dumping grounds, cable, restricted and prohibited areas. Buoys shall agree in position and characteristic with the Notice to Mariners upon which they are based.

The chart Compilation should be *complete*. This implies that all source material pertinent to the job has been considered and that the selected material has been applied in full or in part. The History sheet should be so marked for partially applied material that such material may be fully applied at a later date. Boat sheets, however, or copies of them, should always be fully applied since they are advance information, soon superseded by the smooth sheet of the hydrographic survey.

Preliminary and *incomplete* manuscripts of topographic surveys are not to be used on a chart Compilation. *Advance* copies, prints, or manuscripts of topographic surveys may be used but should be underscored in red on the history sheet so that the final copy may be examined later. (See page 40.)

Examine all existing charts of the area and overlapping charts of the same series, for differences which should be reconciled.

In addition to the qualities of accuracy and completeness, the chart Compilation should be *clear and legible*. Clarity of expression is important, since the chart is an instrument which the navigator uses in order to follow a safe course. Vital information, such as the dangerous shoals and rocks, the ship channels, and the aids to navigation should not be charted in an obscure or ambiguous manner. Also check to see that there are no conflicts between the various colors to be used in the printed chart.

Any notes or recommendations to the compiler shall be made on transparent overlays. These overlays together with the entire Compilation should be returned to the compiler for correction.

RECENT DEVELOPMENTS

I

Bathymetric Compilations

SPECIFICATIONS ADOPTED FOR IHB PLOTTING SHEETS

U.S. Naval Oceanographic Office "3000 Series" Plotting sheets shall be used for compilation bases. Negatives of this series are obtained from the Naval Oceanographic Office on written request. From these negatives three blackline prints are made on matte finish plastic, to be used as follows: (1) *Primary Compilation*—for sounding data corrected to true depths—shown in upright type; (2) *Secondary Compilation*—for uncorrected or discrete sounding data—in italic type;* (3) *History Overlay*—to show source of all sounding data.

*NOTE: Corrected and uncorrected soundings shall not appear on the same compilation.

Soundings shall be in fathoms and shall be no larger than 2.00 mm. nor smaller than 1.50 mm. The position of the sounding shall normally be the center of the figures forming the sounding. However, where close development requires, a dot with a dashed leader line connecting the sounding to the dot is permissible. A maximum number of soundings shall be used except, there shall be a minimum of 1.00 mm. spacing between them. Soundings are preferably oriented perpendicular to the parallels or, as a second choice, to the direction of the sounding line. Both these preferences are waived when close development of significant features is required.

The required 100 fathom curve, and all depths shoreward of it, are to be taken from the nautical charts of the affected area. Where other depth curves are used to facilitate compilation they must be drawn in non-photographic blue ink.

Other general requirements are: Plotting sheets are to be maintained (corrected) periodically by applying data received subsequent to completion of original compilation. Original compilations and history overlays are to remain in the Coast and Geodetic Survey, with only black-line prints on stable-base film positives to be furnished IHB on their request. Important land geographic names may be shown, in upright type, if they do not encroach on the sea areas. The only topography to be shown is the HWL. The Coast and Geodetic Survey plotting sheets are basic. All prior (or current) IHB plotting sheets are to be used only as a reference or to fill in areas not covered by Coast and Geodetic Survey or Naval Oceanographic Office Surveys.

II

Training Program

To maintain a minimum of personnel with sufficient experience and endeavor, to discharge the essential functions of chart construction and revision, is the responsibility of the Chief, Nautical Chart Division and his designated subordinates.

The specialized and even unique operations required to arrive at the most advantageous presentation of a nautical chart, to assure the mariners safety and interests, demands engineering science combined with an artistic ability. A number of technicians may be utilized to support this effort. Extent of training would generally depend on the new employee's schooling and/or experience; however, additional training will be needed for the performance of the many and varied duties required.

A tabulation of all employees, their experience and special qualification, age and corresponding eligibility for retirement, expected retention rate based on job attraction etc. could aid in recognizing the need for training. Management and supervisor-caliber personnel must be detected and developed to fill such vacancies as may occur from time to time. Other employees must be properly prepared to assume the duties of the positions thus vacated. An accelerated training program may be employed when a considerable turnover is expected as a result of a reorganization, anticipated expansion of a unit or branch, or because of the adoption of new methods and procedures.

To establish a well-organized training system and to coordinate the various training programs the Chief of the Nautical Chart Division may designate an employee as coordinator to secure maximum efficiency. The coordinator should be responsible for the planning of the over-all training programs, to establish minimum requirements in adequacy and accuracy in the various phases according to needs. For this purpose he should consult with the affected supervisors and consider their opinions as to the specific needs and the length of time required. All this must be accomplished with the least possible interference with workload and time schedules.

Training may be accomplished by:

1. *Concentrated Class-Room Teaching*, where a selected group will be exposed to the basic elements of the subjects, and a capable instructor with a well-organized lesson plan and subsequent brief tests is placed in a position of recognizing potentials of the student and anticipated advantageous placement. This period of class-room teaching may be followed by an assignment of the trainee to a particular section or unit for further study of fitness. If his services prove satisfactory, further training should be given in some or all of the following categories to make him a more useful employee:

- a. Standards
- b. Navigation Aids
- c. Elementary drafting
- d. Hydrographic verification
- e. Chart revision
- f. Field assignment (hydrographic survey and combined operations)
- g. Chart construction and reconstruction
- h. Review of hydrographic surveys
- i. Review of revision and construction
- j. Development and planning
- k. Research
- l. Secondary division training

These phases are listed in their approximate order of normal advancement, however, rigid adherence to this particular sequence is not essential. A general outline for each of these subjects with particular emphasis on the important aspects of the duties involved should be a combined effort of the chief of the affected unit or section and the training officer. Such training outlines may change from time to time with improved methods and/or equipment. Minimum time allotments for each phase should be made for this training depending on time for the overall training schedule.

2. *On-the-job training*. This manner of training is the most direct and the most common and has been in use for many years. However, in the past, this method has often been a detriment to the employee and employer alike for lack of thoroughness and completeness. The new employee was often looked upon as an immediate additional helper and briefly told only what seemed apparent to get the total workload accomplished. There is no incentive or job attraction—nor can the employer have an intelligent helper, unless the employee knows how the information was obtained he is to utilize, why he should do this function one way and not another, how his part is related to other activities within the organization, and finally, how his efforts can best serve the ultimate purpose.

On-the-job training must be thorough and complete and should be guided by an established program to expose the new employee to the basic duties in each of the required categories. Even physical demonstration may be called for in discussions of proper and most efficient use of instruments, etc. Typical common problems should be pointed out along with a logical disposition. This type of training will be required, more or less, in addition to others as listed. In normal personnel turnover, this may be the only method needed and fulfill its purpose well, if carried out adequately.

3. *By attending lectures!* The Chief of the Division or his subordinates may choose a well-qualified employee to present a paper on a specific subject and to introduce typical situations or problems of a general nature and applicable solutions. For the presentation of such a paper a junior-level employee may be selected. He will have to do research and study in the preparation of his paper, which would then be subject to his immediate Chief's approval for adequacy and accuracy. This procedure would serve a multiple purpose: a. It could reasonably be assumed, that this type of employee would be of more value to the organization with the responsibility of subject assignment and be directly or indirectly rewarded for his efforts. b. He may be more receptive to the audience for being more nearly their equal on subject matter. c. Serve the primary purpose at the same time.

4. *By improving his general background for his services to the organization through additional schooling.*

Courses within the Bureau and Department are afforded the employee at times at little or no expense to him. The subject of the course may be directly or only indirectly associated with his work. A wider selection of courses may be made available to the employee through the Graduate School, U.S. Department of Agriculture. Organization's interest to further the employee's education may result in its financial support (whole or in part) towards tuition and books as required by the student. Financial support may even be extended to employees for special courses in recognized institutions or private industry for particularly advantageous subjects.

Most of all TRAINING is inherent in daily and separate assignments. "Training" is, after all, only a guide for "learning", therefore the ultimate responsibility rests with the individual. Those who recognize the opportunities offered and appreciate the time and efforts of those willing to teach and guide them, will find the rewards worthwhile. Display of personal initiative as well as formal or informal training will determine the more valuable employee, and accordingly result in appropriate advancement. With the intelligent and efficient disposition of routine and less difficult tasks one is in training for the gradual culmination of complex problems, which an adequate training period and conscientious effort will help bring a solution.

Everyone needs to be trained to understand fully his functions, for knowing the source of all related elements for the proper consideration of subsequent operations and to be sufficiently familiar with the overall effort and purpose.

III

Research and Development

The objectives of Research and Development activities in the Nautical Chart Division are basically two-fold: analysis and report on problems for decision-making where such problems require more data collecting and analysis than can be accomplished by means of production management; information gathering and reporting on developing technologies or cultural trends which may affect the chart program in time by causing new demands.

Work is generally carried on in the form of a Research Project as approved by the Chief of the Division and monthly reports are submitted on the progress of such work. The ultimate end of all such projects is to produce an organized body of information or record of experience which will have educational value to those directly interested in the type of problem studied and which will add to the fund of knowledge for general or public use.

IV

Electronic Computing

The Nautical Chart Division is able to call upon two of the three computers in the Bureau for aid in solving complex problems and for data retrieval.

The Electronic Computing Division of the Office of Physical Sciences retains general control over the two main computers used in the Bureau—IBM 650 and IBM 1620. A third computer—a Clary (medium size)—is in the Photogrammetry Division for its exclusive use.

The Nautical Chart Division uses the two main computers at present for three general problems:

1. Computation of local and State Plane coordinates and Grid Systems
2. Computation of Loran Curves
3. Collection of cost accounting and production management data for charts produced in the Nautical Chart Division

In addition to these uses, the Electronic Computing Division uses the computers in the following areas:

Scientific Engineering:

1. Processing of Geomagnetic Observatory data
2. Index Geodetic Data
3. Adjust triangulation
4. Adjust Aerial triangulation
5. Locate Epi Centers of earthquakes and man-made disturbances

Administrative:

1. Cost, payroll, and leave accounting
2. Production control for divisions of Office of Cartography
3. Maintain Personnel Rosters

In addition to the above programs, the Coast and Geodetic Survey is conducting research and development activities with computers in the following areas:

Testing of Automatic Hydrographic Digital Recorder Equipment for recording and plotting hydrographic survey data aboard ship automatically.

Research into possible uses of automatic plotters in the construction of nautical and aeronautical charts.

Research and testing for applications of satellite triangulation.

Development of an automatic system of Production and Inventory Control for all charts and related publications produced by the Coast and Geodetic Survey to replace a semi-automatic system using edge-notched cards which is presently in use.

Research and development of programs in the field of seismology.

Research in all areas and functions for possible needs and uses for information and data retrieval.

Instructions for ordering computations from the Electronic Computing Division:

Submit request for computational work to be done on one of the computers in memorandum form to the Chief, Electronic Computing Division, Office of Physical Sciences, stating what is to be done. Attach raw data to the memorandum.

TERMINOLOGY

The following definitions, primarily for physiographic terms, are given to clarify and standardize usage on C&GS nautical charts. These definitions are limited to connotations applicable to nautical and bathymetric charting.

<i>Archipelagic apron</i>	A gentle slope with a generally smooth surface on the sea floor found around groups of islands or seamounts.
<i>Archipelago</i>	A sea or broad expanse of water studded with many islands or a groups of islands; also, such a group of islands.
<i>Arroyo</i>	The course of an intermittent stream steep-cut in loose earth; a coulee; a steep-walled trenchlike valley. (Local in South-west.)
<i>Atoll</i>	A ring-shaped reef with or without islands encircling a lagoon.
<i>Bald</i>	A high rounded knob or mountain top, bare of forest. (Local in Southern States.)
<i>Bank</i>	The edge of a cut or fill; the margin of a watercourse; an elevation of the sea floor located on a Continental Shelf or an Island Shelf and over which the depth of water is relatively shallow but sufficient for safe surface navigation. (Reefs or shoals, dangerous to surface navigation, may rise above the general depths of a bank.)
<i>Bar</i>	A ridge or mound of sand, gravel, or other unconsolidated material below high-water level, especially at the mouth of a river or estuary, or lying a short distance from and usually parallel to the beach.
<i>Barrier beach</i>	A beach separated from the mainland by a lagoon or marsh.
<i>Barrier island</i>	A detached portion of a barrier beach between two inlets.
<i>Basin</i>	A large depression of a general circular, elliptical, or oval shape; the drainage or catchment area of a stream or lake; a depression of the sea floor more or less equidimensional in form (when the length is much greater than the width, the feature is a trough).
<i>Bathymetry</i>	Submarine topography (q.v.), esp. as applied to oceanographic studies.
<i>Bay</i>	A recess in the shore, or an inlet of a sea or lake between two capes or headlands, not as large as a gulf but larger than a cove.
<i>Bayou</i>	A widely (and loosely) used term along the Gulf Coast, most often applied to a creek or small river with tortuous course and sluggish current; a lake, often in an abandoned stream channel; a connecting channel.
<i>Beach</i>	The gently sloping shore which is washed by waves or tides, especially the parts covered by sand or pebbles.
<i>Bed</i>	The floor or bottom on which any body of water rests.
<i>Bench</i>	A strip or relatively level earth or rock, raised and narrow. A small terrace, or comparatively level platform, breaking the continuity of a declivity.
<i>Bery</i>	A hill or mountain. Local in Hudson River Valley. Also, an iceberg.

<i>Berth</i> -----	The place where a vessel lies when tied up or anchored.
<i>Bight</i> -----	A bend or curve; a bend in a coast forming an open bay; a small open bay formed by an indentation in the coast; a minor feature which affords little protection for vessels.
<i>Bluff (A-2)</i> -----	A bold, steep headland or promontory. A high, steep bank or low cliff.
<i>Bog</i> -----	A small open marsh which yields under the foot.
<i>Bottom</i> -----	The bed of a body of still or running water.
<i>Bottom land</i> -----	Lowland formed by alluvial deposit along a stream or in a lake basin; a flood plain.
<i>Boulder</i> -----	A more or less rounded rock, larger than a cobblestone and as much as 10 feet or more in diameter.
<i>Branch</i> -----	A creek or brook, as used locally in Southern States. Also used to designate one of the bifurcations of a stream, as a fork.
<i>Breakwater (G-6)</i> -----	A structure built in the water to break the force of the waves in order to provide shelter for vessels and to protect a harbor or anchorage.
<i>Brook</i> -----	A stream of less length and volume than a creek, as used locally in the Northeast. Generally, one of the smallest branches or ultimate ramifications of a drainage system.
<i>Butte</i> -----	A lone hill, especially one with steep or precipitous sides.
<i>Canal (H-13)</i> -----	A long, fairly straight natural channel with steep sloping sides. Any watercourse or channel. A sluggish coastal stream (local on Atlantic Coast).
<i>Canyon</i> -----	A relatively narrow, deep depression with steep side slopes, the bottom of which grades continuously downward.
<i>Cape</i> -----	A relatively extensive land area jutting seaward from a continent or large island, which prominently marks a change in, or interrupts notably, the coastal trend; a prominent feature.
<i>Carse</i> -----	A low, fertile river bottom. (Scot. origin.) (See "bottom land.")
<i>Cascade</i> -----	A fall of water over steeply sloping rocks, usually comparatively small or one of a series.
<i>Cataract</i> -----	A waterfall, usually larger than a cascade, over a precipice.
<i>Cavern</i> -----	A large, natural, underground cave or series of caves. Often but not always used to imply largeness or indefinite extent to distinguish from "cave."
<i>Cay</i> -----	A key; a comparatively small and low coastal island of sand or coral. Pronounced "key". The spelling "kay" is common in the West Indies.
<i>Ceja</i> -----	The cliff at a mesa edge; an escarpment. Local in Southwest. (Sp.)
<i>Cerrito (or cerrillo)</i> -----	A small hill. Local in Southwest.
<i>Cerro</i> -----	Hill, highland; ridge. Local in Southwest. (Sp.)
<i>Channel</i> -----	The deepest portion of a stream, bay, or strait through which the main volume or current of water flows; the natural bed occupied by a stream of water.
<i>Chasm</i> -----	A deep breach in the earth's surface; an abyss; a gorge; a deep canyon.

<i>Cliff (A-3)</i> -----	A high and very steep declivity; a high steep face of rock; a precipice.
<i>Coast</i> -----	The seashore or the land near it.
<i>Coastal plain</i> -----	Any plain which has its margin on the shore of a large body of water, particularly the sea, and generally represents a strip of recently emerged sea bottom.
<i>Continental borderland</i> -----	A Province adjacent to a continent, normally occupied by or bordering a Continental Shelf, that is highly irregular with depths well in excess of those typical of a continental shelf.
<i>Continental rise</i> -----	A gentle slope with a generally smooth surface found at the base of a continental slope.
<i>Continental shelf</i> -----	A zone adjacent to a continent and extending from the low water line to a depth at which there is a marked increase of slope to a greater depth.
<i>Continental slope</i> -----	A declivity from the outer edge of a continental shelf or continental borderland into greater depths.
<i>Coral Reef</i> -----	A reef made up of coral, fragments of coral and other organisms, and the limestone resulting from their consolidation.
<i>Cordillera</i> -----	An entire mountain province, including all the subordinate mountain ranges and groups and the interior plateaus and basins.
<i>Coulee</i> -----	A steep-walled, trenchlike valley; a wash, gulch, or arroyo through which water flows intermittently. (Western U.S.)
<i>Cove</i> -----	A small sheltered recess in a shore or coast generally inside a larger embayment.
<i>Crag</i> -----	A steep, rugged rock; a rough, broken cliff of a projecting point of rock; also a detached fragment of rock.
<i>Crater</i> -----	The bowl-shaped depression around the vent or a volcano or a geyser; also hole formed by the impact of a meteorite, the detonation of a mine, or the like.
<i>Creek (C-13, 14)</i> -----	A stream of less volume than a river. A small tidal channel through a coastal marsh.
<i>Crest</i> -----	The summit land of any eminence; the highest natural projection which crowns a hill or mountain, from which the surface dips downward in opposite directions.
<i>Crevasse</i> -----	A deep crevice, or fissure, especially in a glacier. A break in a levee or other stream embankment.
<i>Current (T-18-20-Td)</i> -----	The horizontal movement or flow of water.
<i>Cut-off</i> -----	A new and relatively short channel formed when a stream cuts through the neck of an oxbow or horseshoe bend; an artificial straightening or shortcut in a channel.
<i>Dale</i> -----	A vale or small valley.
<i>Dalles</i> -----	The nearly vertical walls of a canyon or gorge, usually containing a rapid. Local in Northwest.
<i>Deep</i> -----	A relatively small area of exceptional depth found in a depression. The term is generally restricted to depths greater than 3000 fathoms.
<i>Defile</i> -----	A deep and narrow mountain pass.

- Dell* A small secluded valley or vale; a dale; a ravine.
- Delta* The low alluvial land, deposited in a more or less triangular form at the mouth of a river, which is often cut by several distributaries of the main stream.
- Depression* A general term signifying any depressed or lower area in the ocean floor; a hollow completely surrounded by higher ground and having no natural outlet for surface drainage.
- Dike (G-6a)* A bank of earth or stone to form a barrier; a levee.
- Dismal* A swamp bordering on, or near, the sea, often enclosing knobs or hummocks; a pocosin. Local in South Atlantic States.
- Divide* The line of separation between drainage systems; the summit of an interfluve. The highest summit of a pass or gap.
- Dock (G-35)* The slip or waterway between two piers, or cut into the land for the reception of ships.
- Dome* A smoothly rounded, rock-capped mountain summit, roughly resembling the dome or cupola of a building.
- Drain* A channel; a trench; a watercourse, especially a narrow one.
- Dry dock (G-36)* An artificial basin fitted with gate or caisson into which a vessel may be floated and from which the water may be pumped out to expose the bottom of the vessel. (Sometimes referred to as a graving dock.)
- Dry wash* A wash, arroyo, or coulee in the bed of which there is no water, except at infrequent intervals and for short periods.
- Dune (A-4)* A hill or ridge formed by the wind from sand or other granular material.
- Eddy (O-19)* A current of water running contrary to the main current or moving circularly; a whirlpool.
- Escarpment* An extended line of cliffs or bluffs; a high steep face of rock; an elongated and comparatively steep slope of the sea floor, separating flat or gently sloping areas.
- Estuary* That portion of a stream influenced by the tide of the body of water into which it flows; an arm of the sea at a river mouth.
- Everglade* A tract of swampy land covered mostly with tall grass; a swamp or inundated tract of low land. Local in the South.
- Fall (falls) (C-20)* A cascade, waterfall, or cataract; the flow or descent of one body of water into another. (Usually pl.)
- Fan* A gently sloping, cone-shaped accumulation of material normally located at the mouth of a canyon.
- Flat* A level tract lying at a small depth below the surface of water, or alternately covered and left bare by the tide ("tidal flat", "mud flat").
- Floating dock (G-37)* A floating structure which can be submerged to receive a vessel, and then floated to expose the bottom of the vessel.
- Floodgate* A gate for shutting out, admitting, or releasing a body of water; a sluice.
- Floor* The bed or bottom of the ocean. A comparatively level valley bottom; any low-lying ground surface.
- Foot* The bottom of a slope, grade or declivity. A term for the lower part of any elevated land form.

<i>Foothill</i>	One of the lower subsidiary hills at the foot of a mountain, or of higher hills. (Commonly used in the plural.)
<i>Fork</i>	One of the major bifurcations of a stream; a branch.
<i>Fracture zone</i>	A zone of unusually irregular topography of the sea floor averaging 60 nautical miles in width and normally greater than 1000 nautical miles in length. This zone is characterized by large seamounts, steep-sided or nonsymmetrical ridges, troughs or escarpments.
<i>Gap</i>	A deep notch, ravine or opening between hills or in a ridge or mountain chain; a steep-sided depression cutting transversely across a ridge or rise.
<i>Geyser</i>	A spring which throws forth intermittent jets of heated water or steam.
<i>Glacial gorge</i>	A deeply cut valley in U-shaped cross section, resulting from glacial erosion.
<i>Glacial lake</i>	A lake, the basin of which has been carved by glacial action; also—a body of water held in place by the damming action of a glacier.
<i>Glacial drift</i>	Sand, clay, or boulders transported by glaciers to their present locations.
<i>Glacier (C-3)</i>	A field or body of ice, formed where snowfall exceeds melting and moving down a mountain slope or over a wide area.
<i>Glade</i>	A grassy opening or natural meadow in the woods; a small park. Applied in western Maryland to a bushy, grassy, or swampy opening in the woods.
<i>Glen</i>	A secluded and small narrow valley; a dell, dale or vale.
<i>Gorge</i>	A canyon; a rugged and deep ravine or gulch.
<i>Grade</i>	A slope of uniform inclination.
<i>Gradient</i>	Any departure from the horizontal; a grade; a slope; a part of a road or railroad which slopes upward or downward; frequently used in connection with the slope of streams.
<i>Groin (G-11)</i>	A narrow shore-protection and improvement structure projecting out from the shore, built usually to trap littoral drift or retard erosion of the shore.
<i>Grotto</i>	A small, picturesque cave, vault, or cavern.
<i>Gulch</i>	A small ravine; a small, shallow canyon with smoothly inclined slopes and steep sides.
<i>Gulf</i>	A part of an ocean or sea extending into the land, usually larger than a bay.
<i>Gully</i>	A small channel recently cut by running water; smaller than a gulch or ravine.
<i>Gut</i>	A narrow passage or contracted strait connecting two bodies of water.
<i>Hammock</i>	Variation of hummock, but usually characterized more by soil type and vegetation than by elevation. (Southern U.S., esp. Fla. and Gulf Coast.)
<i>Harbor</i>	A water area nearly surrounded by land or artificial dikes forming a safe anchorage for ships.
<i>Head</i>	A headland or promontory.

<i>Headland</i>	A cape or promontory of some boldness or elevation.
<i>Heath</i>	A tract of wasteland; peat bog, usually covered by a low shrubby growth, but may have scattered small open water holes. Local in eastern Maine.
<i>Height of land</i>	The highest part of a plain or plateau.
<i>High-water line (A-9)</i>	The line along the shore to which the waters normally reach at high water; in tidal waters, generally taken to mean the line where the plane of Mean High Water intersects the land.
<i>Hill</i>	An eminence, less than a mountain, rising above the surrounding land.
<i>Hillock</i>	A small hill.
<i>Hole</i>	A small bay, as Woods Hole, Mass. Local in New England.
<i>Hollow</i>	A small ravine; a low tract of land encompassed by hills or mountains.
<i>Hummock</i>	A rounded elevation of ground, of limited size, rising out of a level surface (often swamp), frequently densely wooded.
<i>Inlet</i>	A narrow waterway or a gap in the land, which connects a small body of water with a larger body; a small narrow bay or creek.
<i>Island</i>	A body of land extending above and completely surrounded by water at the Mean High Water stage; an area of dry land entirely surrounded by water or swamp; an area of swamp entirely surrounded by open water.
<i>Island shelf</i>	A zone adjacent to an island and extending from the low-water line to a depth at which there is a marked increase of slope to greater depth.
<i>Island slope</i>	A declivity from the outer edge of an island shelf into greater depths.
<i>Islet</i>	A small island.
<i>Isthmus</i>	A narrow strip of land connecting two larger bodies of land.
<i>Jetty (G-8, 8a, Ga)</i>	A structure built out into the water to restrain or direct currents, usually to protect a river mouth or harbor entrance from silting.
<i>Key</i>	A low island or reef; a cay.
<i>Kill</i>	A channel, creek, stream, as the kills between Staten Island and Bergen Neck.
<i>Knob</i>	A rounded hill or mountain, especially an isolated one.
<i>Knoll</i>	A small round hill; a mound; a seamount rising less than 500 fathoms from the sea floor and having a pointed or rounded top.
<i>Lagoon</i>	A shallow body of water, as a pond or lake, which usually has a shallow restricted outlet to the sea.
<i>Lake (C-15)</i>	Any standing body of inland water, generally of considerable size.
<i>Landslide</i>	Earth and rock which becomes loosened from a hillside by moisture or snow, and slides or falls down the slope.
<i>Lava (C-12)</i>	Fluid rock such as that which issues from a volcano or a fissure in the earth's surface; the same after cooling.

- Ledge (A-11d)*----- A rocky formation continuous with and fringing the shore. The area that uncovers is usually represented on charts by symbols.
- Levee (H-3d)*----- An artificial bank confining a stream channel or limiting areas subject to flooding; an embankment bordering on one or both sides of a submarine canyon or seachannel, usually occurring along the outer edge of a curve or meander.
- Littoral*----- Of or pertaining to a shore, especially seashore; a coastal region. (In the U.S., generally an adjective; also, not a material.)
- Low-water line (A-10)*----- The line where the established low-water datum intersects the shore. The plane of reference that constitutes the low-water datum differs in different regions.
- Marina*----- A harbor facility for recreational craft where supplies, repairs, and various services are available.
- Marsh (C-17)*----- A tract of low, wet ground, usually miry and covered with rank vegetation. It may, at times be sufficiently dry to permit tillage or haycutting, but requires drainage to make it permanently arable.
- Mattress*----- Mass of interwoven brush, poles, etc., used to protect a bank from erosion.
- Mesa*----- A flat-topped, rocky hill with steep sides. (Southwestern U.S.)
- Moat*----- An annular depression that may not be continuous, located at the base of a seamount or an island.
- Moraine*----- Any accumulation of loose material deposited by a glacier.
- Mound*----- A low hill of earth, natural or artificial; in general, any prominent, more or less isolated hill.
- Mount*----- A mountain, or high hill. Used always instead of "mountain" before a proper name.
- Mountain*----- An elevation of the surface of the earth greater than a hill and rising high above the surrounding country.
- Mountain range*----- A series of connected and aligned mountains or mountain ridges.
- Mouth*----- The exit or point of discharge of a stream into another stream, lake, or sea.
- Muskeg*----- A bog or marsh. Local in north central United States, Canada, and Alaska.
- Neck*----- The narrow strip of land which connects a peninsula with the mainland, or connects two ridges. A lava-filled conduit of an extinct volcano, exposed by erosion.
- Notch*----- A short defile through a hill, ridge, or mountain. A deep, close pass; a defile; gap. Local in New England.
- Ocean*----- The great body of salt water which occupies two-thirds of the surface of the earth, or one of its major subdivisions. The sea as opposed to the land.
- Outlet*----- The opening by or through which any body of water discharges its content.

- Palisade* A picturesque, extended rock cliff rising steeply from the margin of a stream or lake; a line of bold cliffs, especially one showing basaltic columns. (Usually pl.)
- Pass* A gap, defile, or other relatively low break in a mountain range through which a road or trail may pass; an opening in a ridge forming a passageway. A narrow, connecting channel between two bodies of water.
- Peak (D-S)* A pointed mountain summit; the topmost point; summit; a seamount rising more than 500 fathoms from the sea floor and having a pointed or rounded top.
- Peninsula* A body of land jutting into and nearly surrounded by water, frequently (but not necessarily) connected to a larger body of land by a neck or isthmus.
- Pier (G-9)* A structure built out into the water, usually with its greatest dimension at right angles to the shore, forming a landing place or a place alongside which vessels can lie.
- Pinnacle* A tall, slender, spire-topped tower, hence any formation suggesting such shape, as a pinnacle rock projecting from a level or more gently sloping sea floor.
- Plain* A region of uniform general slope, comparatively level, of considerable extent, and not broken by marked elevations and depressions (it may be an extensive valley floor or a plateau summit); an extent of level or nearly level land; a flat, gently sloping or nearly level region of the sea floor.
- Plateau* An elevated plain, tableland, or flat-topped region of considerable extent; a comparatively flat-topped elevation of the sea floor greater than 60 nautical miles across the summit and normally rising more than 100 fathoms on all sides.
- Pocosin* A swamp; a dismal. (Southern U.S.)
- Point* The extreme end of a cape, or the outer end of any land area protruding into the water (less prominent than a cape).
- Pond* A small fresh-water lake.
- Pool* A water hole or small pond; a small body of standing water a small and rather deep body of (usually) fresh water, as one in a stream.
- Prairie* A treeless and grassy plain; an extensive tract of grassland; a low, sandy, grassy tract in the Florida pine woods.
- Precipice* The brink or edge of a high and very steep cliff; an abrupt declivity.
- Promontory* A high cape with bold termination; a headland.
- Prong* A fork of a drain. Local in southern Appalachian Mountains.
- Province* A region composed of a group of similar bathymetric features whose characteristics are markedly in contrast with surrounding areas.
- Race* A swift current; a constricted channel through which such current flows.
- Rapid (C-19)* A part in a stream where an increase in its gradient accelerates the velocity of the current over that in its adjoining parts. (Usually pl.)

- Ravine*..... A gulch; a small gorge or canyon, the sides of which have comparatively uniform slopes.
- Reach*..... An extended portion of water or land; a straight portion of a stream or river; a level stretch, as between locks in a canal; an arm of the sea extending into the land; a promontory, tongue.
- Reef (O-10)*..... An off-shore consolidated rock hazard to navigation with a least depth of 10 fathoms or less (see also *coral reef*).
- Relief (C-1 to 2b)*..... The elevations or the inequalities, collectively, of a land surface.
- Ridge*..... A long and narrow elevation with steep sides; a long, narrow elevation of the sea floor, with steep sides and more irregular topography than a rise.
- Rincon*..... Corner or cove; an angular recess or hollow bend in a mountain, riverbank, cliff, or the like (Local in Southwest) (Sp. origin.)
- Rise*..... A long, broad elevation that rises gently and generally smoothly from the sea floor.
- River (C-13)*..... A natural stream of running water, larger than a creek or brook.
- Run*..... A brook or small creek; a small, swift watercourse.
- Saddle*..... A low point on a ridge or crestline; a ridge connecting two higher elevations; a low point on a ridge or between seamounts.
- Sand dune*..... Low hills or ridges of sand formed by action of the wind (See "dune").
- Scarp*..... An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or bench.
- Sea*..... A large body of salt water, second in rank to an ocean, more or less landlocked and generally part of, or connected with, an ocean or a larger sea.
- Seachannel*..... A long, narrow, U-shaped or V-shaped, shallow depression of the sea floor, usually occurring on a gently sloping plain or fan.
- Seamount*..... An elevation of the sea floor having a nearly equidimensional plan less than 60 nautical miles across the summit.
- Seamount chain*..... Three or more seamounts in a line and with bases separated by a relatively flat sea floor.
- Seamount group*..... Three or more seamounts not in a line and with bases separated by a relatively flat sea floor.
- Seamount range*..... Three or more seamounts having connected bases and aligned along a ridge or rise.
- Shelf edge*..... A line along which there is a marked increase of slope at the outer margin of a continental shelf or an island shelf. (For charting purposes the 100-fathom depth contour is normally accepted as the shelf edge; the actual depth usually is less but may be more.)
- Shoal*..... An off-shore hazard to navigation with a least depth of 10 fathoms or less composed of unconsolidated material.
- Shore (A-1 to A-11)*..... The narrow zone of land fronting any body of water.

<i>Shoreline</i>	The line of contact between the land and a body of water. (The line delineating the shoreline on Coast and Geodetic Survey nautical charts and surveys approximates the high-water line.)
<i>Sill</i>	A ridge or rise separating partially closed basins from one another or from the adjacent sea floor.
<i>Sill depth</i>	The greatest depth over a sill.
<i>Sink, sinkhole</i>	A depression which has subsurface drainage only, through natural holes and caverns in limestone or by seepage into a lower-lying water table.
<i>Slope</i>	The inclined surface of a hill, mountain, plateau, plain, or any part of the surface of the earth; the angle at which such surfaces deviate from the horizontal.
<i>Slough</i>	A minor, muddy marshland or tidal waterway which usually connects other tidal areas.
<i>Slue</i>	A slough, or swamp.
<i>Sluice (H-13)</i>	A floodgate.
<i>Sound</i>	A relatively long arm of the sea or ocean forming a channel between an island and a mainland or connecting two larger bodies, as a sea and the ocean, or two parts of the same body; usually wider and more extensive than a strait.
<i>Spit</i>	A small point of land or narrow shoal projecting into a body of water from the shore.
<i>Spring (S-76)</i>	A place where water issues naturally from the rock or soil upon the land or into a body of surface water.
<i>Spur</i>	A subordinate ridge or rise projecting outward from a larger feature of elevation.
<i>Strait</i>	A relatively narrow body of water connecting two larger bodies.
<i>Strand</i>	The shore or beach of the ocean or a large lake.
<i>Strath</i>	A broad, elongated depression, with relatively steep walls, located on a continental shelf. The longitudinal profile of the floor is gently undulating with the greatest depths often found in the inshore portion.
<i>Stream (C-13, 14)</i>	Any body of flowing water or other fluid, great or small.
<i>Stream channel</i>	The bed where a natural stream of water runs; the trench or depression washed in the surface of the earth by running water; a wash, arroyo or coulee.
<i>Summit (D-3)</i>	The highest point, as the highest peak of a mountain range, the highest elevation reached by a road, etc.
<i>Swamp (C-17)</i>	A track of stillwater abounding in certain species of trees and coarse grass or boggy protuberances; a track of wet, spongy land, saturated, but not usually covered with water; a boggy marshland and stream; a slough.
<i>Swash</i>	A body of dashing, splashing water. Specifically, a narrow sound or channel of water lying within a sandbank, or between a sandbank and a shore; a bar over which a sea washes.
<i>Tableknoll</i>	A seamount rising less than 500 fathoms from the sea floor and having a comparatively smooth, flat top with minor irregularities.

<i>Tablemount</i>	A seamount rising more than 500 fathoms from the sea floor and having a comparatively smooth, flat top with minor irregularities.
<i>Terminal moraine</i>	A moraine formed across the course of a glacier at its farthest advance, at or near a relatively stationary edge, or at places marking the termination of important glacial advances.
<i>Terrace</i>	A bench-like feature bordering an elevation of the sea floor. A terrace does not include the continental shelf or island shelf but may include bench-like features on the shelf.
<i>Tidal marsh or flat</i>	Any marsh or flatland, the surface of which is wetted by a tidal flow.
<i>Tide gate</i>	An opening through which water may flow freely when the tide sets in one direction, but which closes automatically and prevents the water from flowing in the other direction.
<i>Tide rips (O-18)</i>	Turbulence caused by the meeting of conflicting tidal currents or by a tidal current flowing over irregular bottom.
<i>Tongue</i>	A long, narrow strip of land, projecting into a body of water; a long, narrow body of water indenting the land or bounded by islands.
<i>Topography</i>	The configuration (relief) of the land surface; the graphic delineation or portrayal of that configuration in map form, as by contour lines.
<i>Trench</i>	A long, narrow, depression of the sea floor, having relatively steep sides.
<i>Tributary</i>	Any stream which feeds a larger stream or lake.
<i>Trough</i>	A long depression of the sea floor, having relatively gentle sides, normally wider and shallower than a trench.
<i>Tundra</i>	One of the level or undulating treeless plains characteristic of arctic regions, having a black muck soil with a permanently frozen subsoil.
<i>Upland</i>	A highland; ground elevated above the lowlands along rivers or between hills.
<i>Valley</i>	A relatively shallow, wide depression with gentle slopes, the bottom of which grades continuously downward. This term is used for features that do not have canyon proportions in any significant part of their extent.
<i>Volcano</i>	An opening in the earth's crust through which lava and ash issue; a mountain (usually conical) formed wholly or in part by such volcanic action.
<i>Wash</i>	A broad, dry bed of a stream.
<i>Watershed</i>	The area drained by a stream.
<i>Wharf (G-18)</i>	A structure extending parallel to the shoreline so that vessels may lie close alongside to receive and discharge cargo.

APPENDIX

(FIGURES)

Large chart (heavy border line)		.060"
Small chart (heavy border line)		.040"
Chart index border		.020"
International boundary; State boundary (land only)		.015"
Roads (single line)		.012"
Shoreline (heavy)		.011"
Depth curves (dots)		.010"
Channel (wide)	Channel (medium)	Channel (narrow)
Railroad		Contours (heavy)
Canals		Ditches
.007"		.007"
Ray lines		.007"
Outer marsh line	Streams	Shoreline (light)
Open buildings		.006"
Overhead power cable		Trails
Projection		Neatline
Fine border line		Railroad ties
Reservation line		.005"
Depth curves (blue plate)	Range line	.005"
Transmission line	Depth curves	Trial course
.005"		.005"
Depth curves (black plate)	Contours (light)	.003"
inner marsh limits		.004"
Chart index outline	SUBMARINE OPERATING AREA	
DANGER AREA		RESTRICTED AREA
DANGER AREA (when required)		PROHIBITED AREA
.010"		DEFENSIVE SEA AREA
.010"		.010"
Var 2° W		Var 1° W
.008"		.007"
Isogonic lines (separated)	Isogonic lines (close spaced)	
COURSE 198½ TRUE 36.6M	RULES OF THE ROAD	
.007"		.007"
Track lines	ANCHORAGE	
ANCHORAGE FOR EXPLOSIVES		.007"
Fish Trap Area		.007"
SUBMARINE TRIAL AREA		.007"
Cable Area		Pipeline Area
.006"		.006"
Minimum width for double line roads.	Road line weights	
1:5 000 to 1:10 000	.006"	
1:15 000 to 1:25 000	.006"	
1:30 000 to 1:50 000	.005"	
1:60 000 to 1:100 000	.005"	
AREA A		
(chart 9010)		
(see note)		
14	G	
.030"	0.76mm	Position of Light
.10"	2.5mm	Lighted Buoy
.120"	3.0mm	Lighted Beacon Lightship
		Lighthouse Aero Light
.284"	7.1mm	Radiobeacon

FIGURE 1 — Line Weights



UNITED STATES — EAST COAST
DELAWARE — PENNSYLVANIA — NEW JERSEY

DELAWARE RIVER
WILMINGTON TO PHILADELPHIA

Mercator Projection
Scale 1:40,000 at Lat. 39°51'

SOUNDINGS IN FEET
AT MEAN LOW WATER

Place	TIDAL INFORMATION			
	Height referred to datum of soundings (MLW)			
	Mean High Water	Mean Tide Level	Mean Low Water	Extreme Low Water
Wilmington, Del.	53	29	00	-40
Chester, Pa	54	29	00	-40
Billingsport, N J	55	30	00	-45
Phila Pier 9N, Pa	58	31	00	-50

(463)

ABBREVIATIONS (For complete list of Symbols and Abbreviations, see C. & G. S. Chart No 1)

Lights (Lights are white unless otherwise indicated)

F fixed	S-L short-long	OBSC. obscured	Rot. rotating
Fl flashing	Occ occulting	WHIS. whistle	SEC. sector
Qk. quick	Alt alternating	DIA. diaphone	m. minutes
Gp group	I Qk interrupted quick	M nautical miles	sec seconds

Buoys. T B. temporary buoy	N. nun	B. black	Or. orange	W white
C. can	S spar	R red	G green	Y yellow

Bottom characteristics

Cl. clay	M. mud	hrd hard	bk. black	gy. gray
Co coral	Rk rock	rky rocky	br. brown	rd red
G gravel	S sand	sft. soft	bu blue	wh' white
Gr. grass	Sh shells	stk. sticky	gn green	yl yellow

21 Wreck, rock, obstruction, or shoal swept clear to the depth indicated

(2) Rocks that cover and uncover, with heights in feet above datum of soundings

AERO aeronautical	R. Bn. radiobeacon	C. G. Coast Guard station
Bn. daybeacon	R. TR radio tower	D F S. distance finding station

AUTH authorized. Obstr. obstruction; P.A. position approximate; E D. existence doubtful

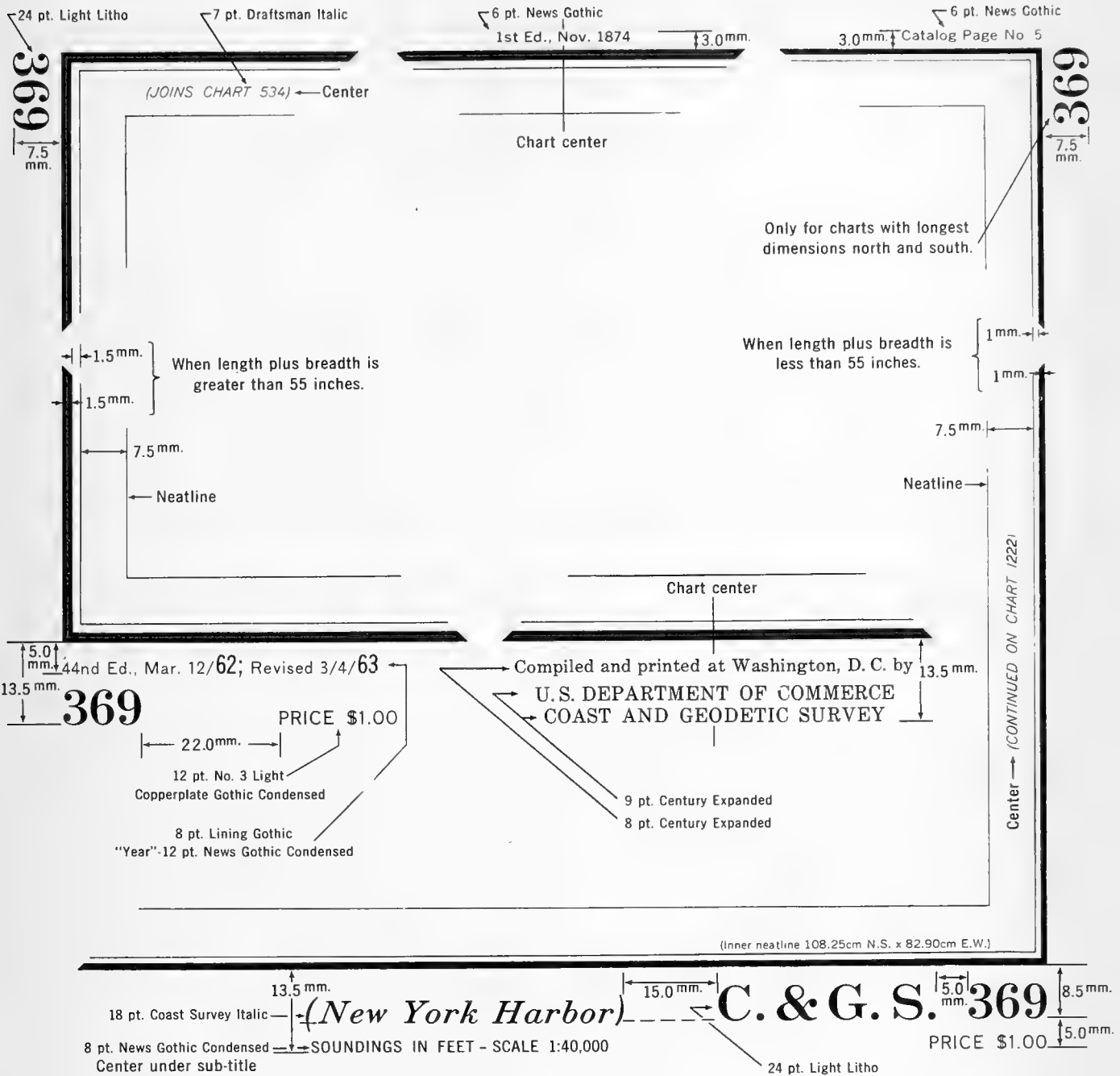
HEIGHTS

Heights in feet above Mean High Water

AUTHORITIES

Hydrography and topography by the Coast and Geodetic Survey
with additions and revisions from the Corps of Engineers

FIGURE 2 — Title Layout



For marginal scales on small-scale charts see Figure 6.

FIGURE 3— Border Layouts

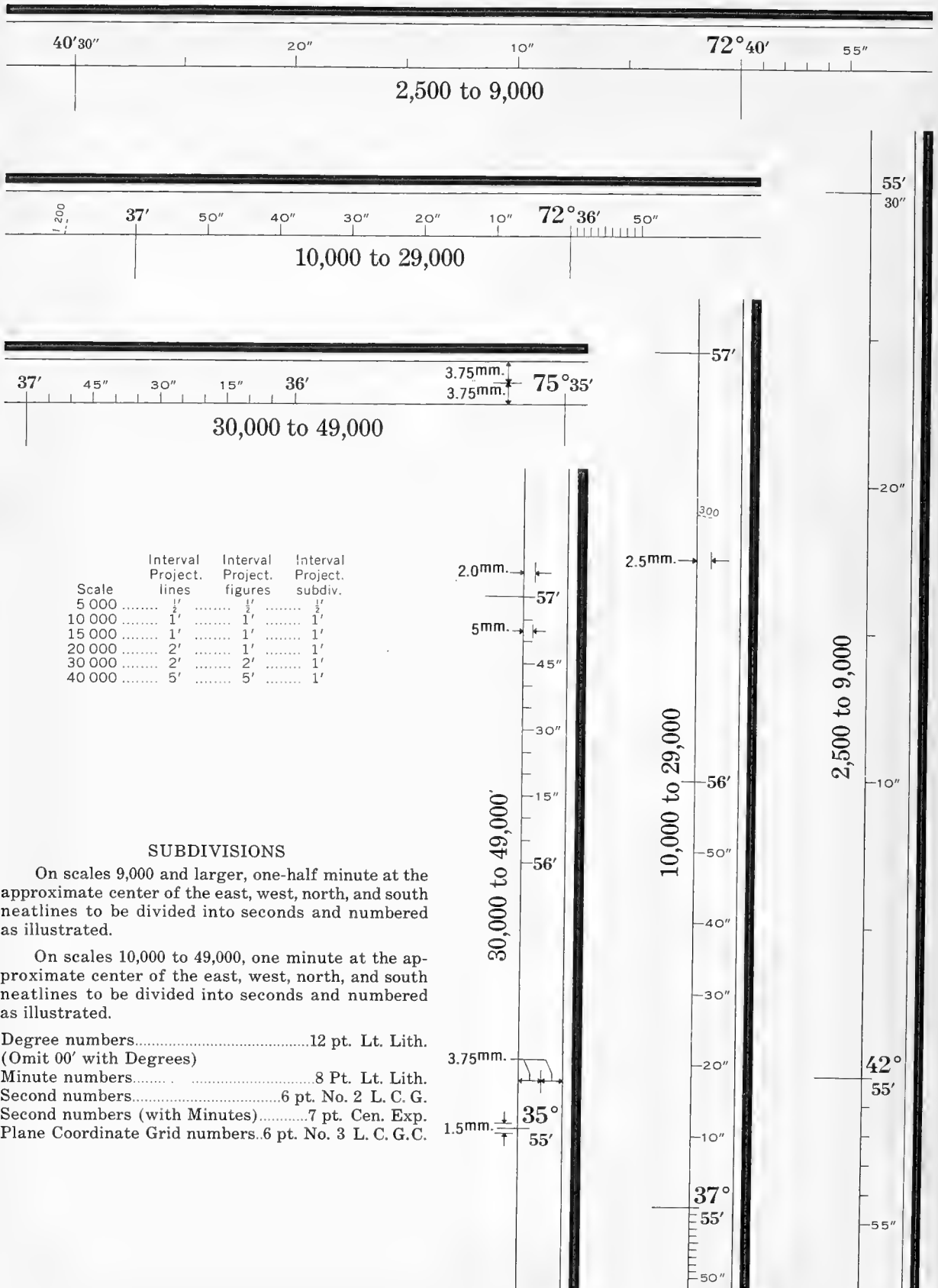


FIGURE 4 — Border Subdivisions

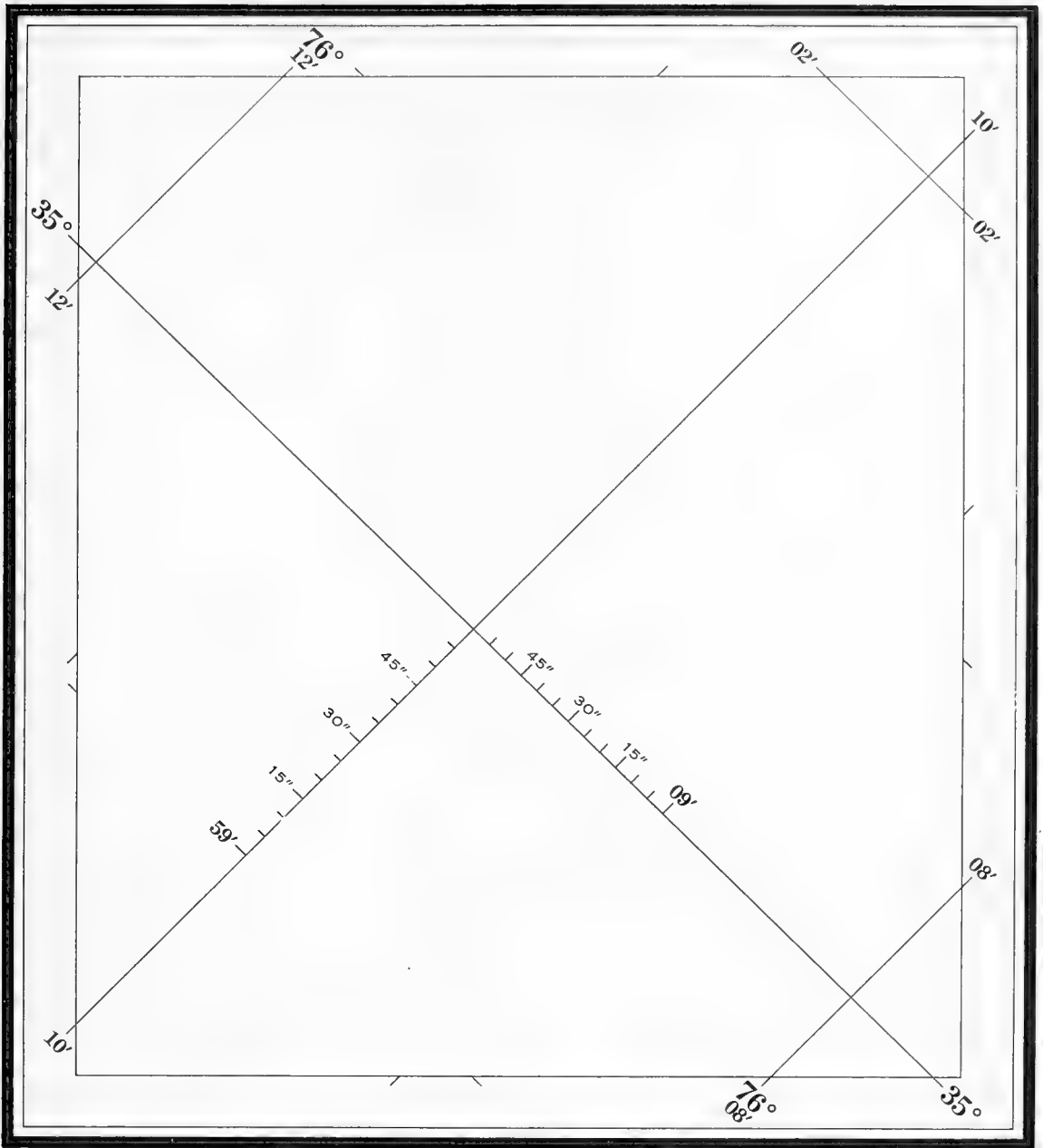


FIGURE 4A – Subdivisions for skewed projections, 1:40,000 Scale

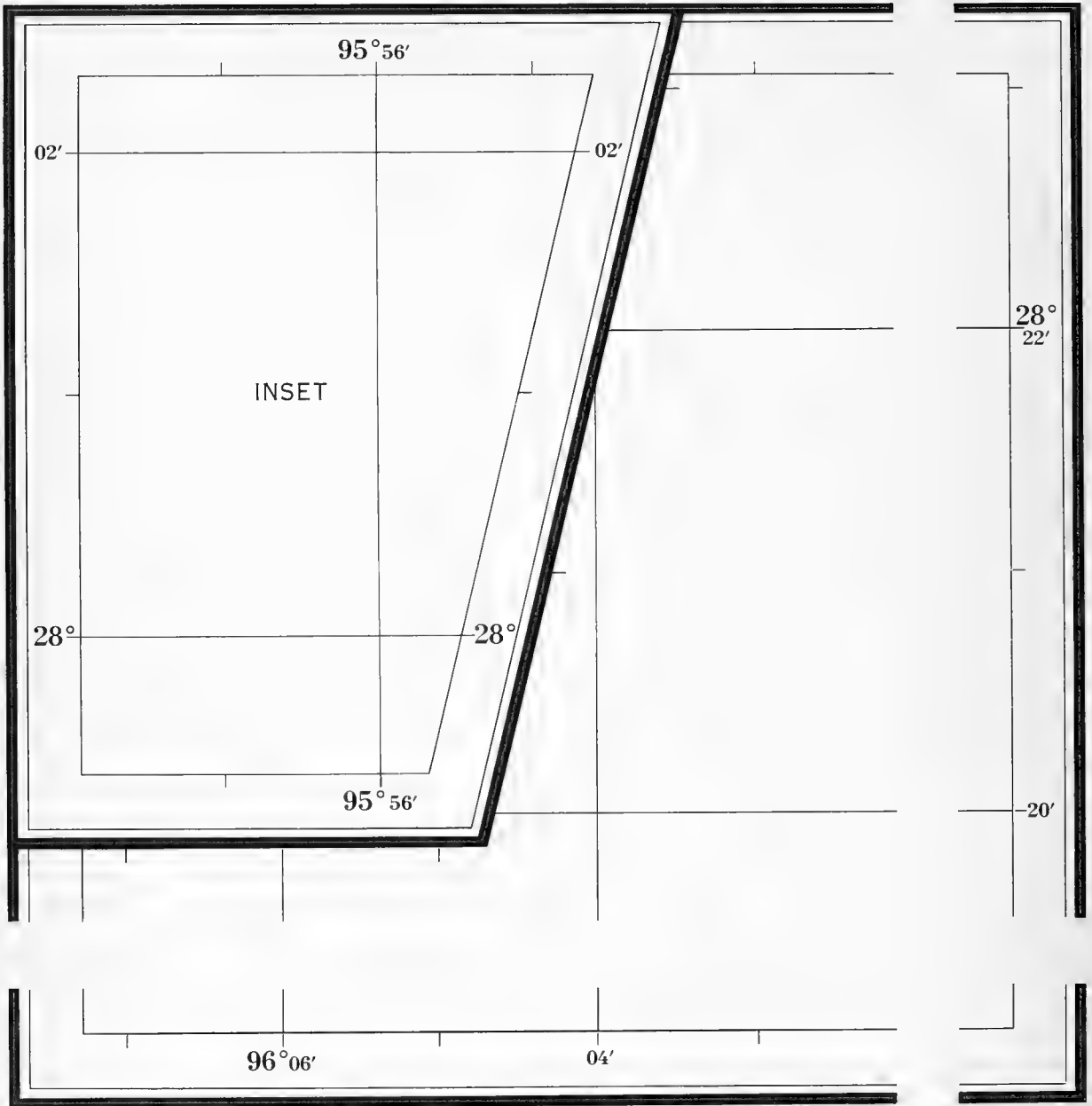


FIGURE 5 — Border Layout of Inset on Chart

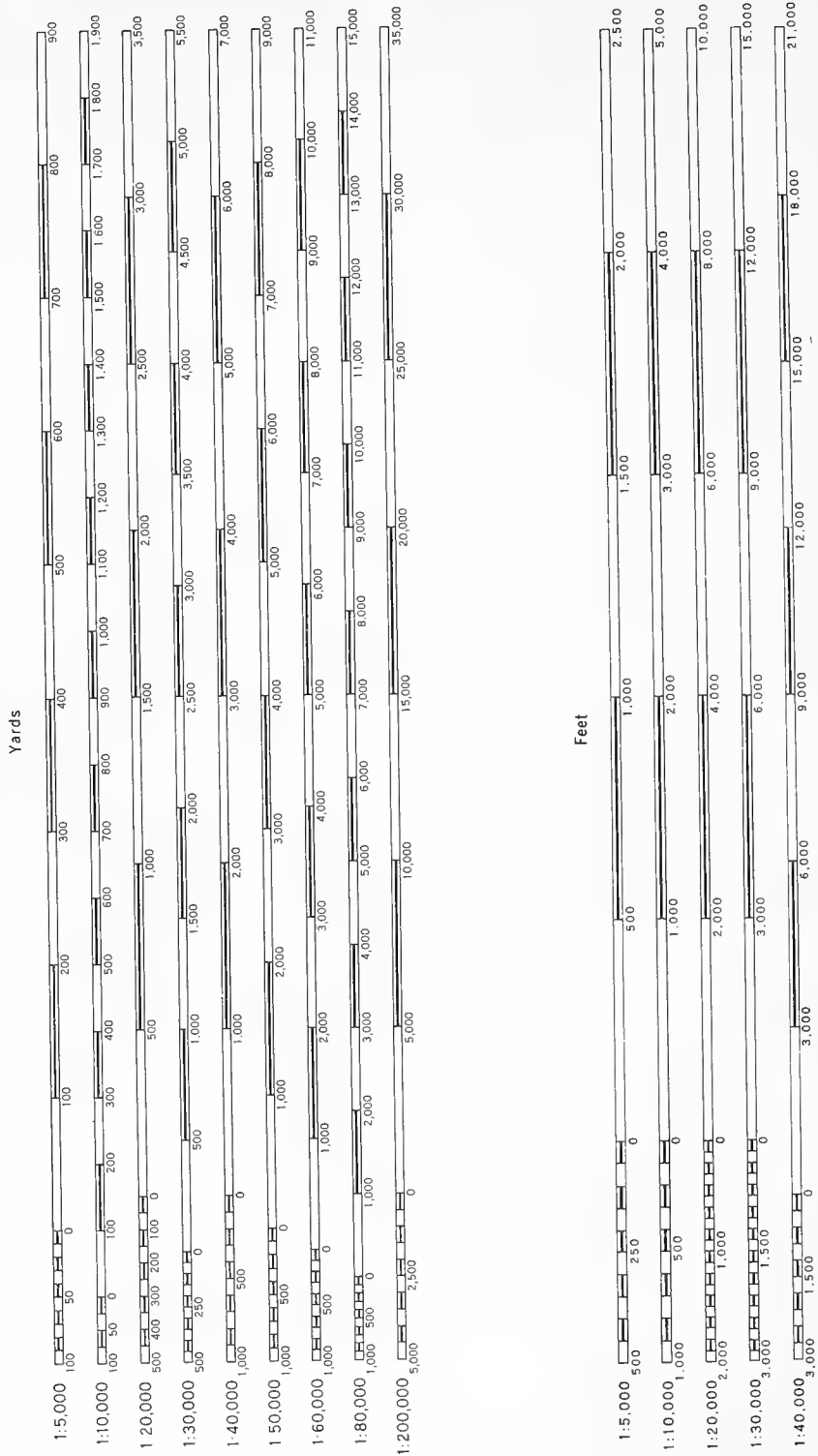


FIGURE 7 — Graphic Scales

SOUNDINGS IN FEET
AT MEAN LOW WATER

SOUNDINGS IN FATHOMS
(FATHOMS AND FEET TO ELEVEN FATHOMS)
AT MEAN LOW WATER

SOUNDINGS IN FEET
AT MEAN LOWER LOW WATER

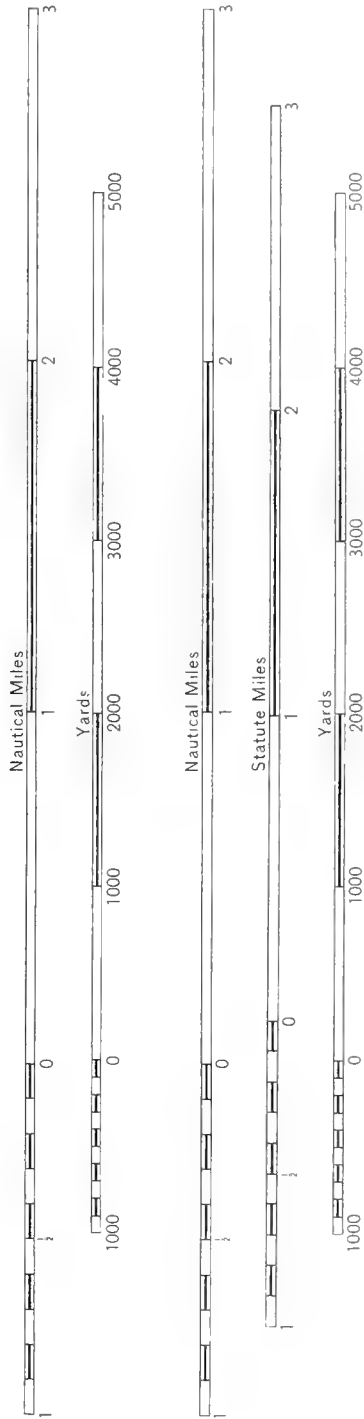
SOUNDINGS IN FATHOMS
(FATHOMS AND FEET TO ELEVEN FATHOMS)
AT MEAN LOWER LOW WATER

SOUNDINGS IN FEET
AT MEAN LOW WATER

CONTINUATION TO BANGOR

Scale 1:40,000

(For offshore navigation only.)



Note: The above 3 scales to be placed on all charts at scale of 1:80,000 or larger.

FIGURE 8 — Standard Notes and Scales

CAUTION

Improved channels shown by broken lines are subject to shoaling, particularly at the edges.

CAUTION

Temporary defects in aids to navigation are not indicated on this chart except where a buoy replaces a fixed aid. See Notices to Mariners.

CAUTION

Southeast Channel Entrance is subject to continual change.

1240

Caution

Extremely heavy tide rips and strong currents may be encountered in the vicinity of the islands shown on this chart.

9030

CAUTION

Vessels entering Long Beach Channel should pass eastward of lighted whistle buoy "LB," and vessels departing should pass westward.


5147

CAUTION

The shoreline is subject to continual change in this area

887-SC

CAUTION

Mariners are warned to stay clear of the protective riprap surrounding navigational light structures shown thus: 

NAVAL TRAIL COURSE

The line of buoys in the entrance to Penobscot Bay between Latitude 44°01' and 44°08' mark a Naval trial course. Vessels must keep clear of this course while trial tests are in progress

1203

PLANES OF REFERENCE

Depths charted in Caloosahatchee River and St. Lucie River are referred to mean low water. Depths in the Caloosahatchee Canal are referred to a low water elevation which is 10 feet above mean sea level. Depths in Lake Okeechobee and St. Lucie Canal are referred to a low water elevation which is 12½ feet above mean sea level.

1289

PRIVATE BUOYS

Private buoys are maintained in most of the bays, ponds and inlets on this chart.

259

DUMPING GROUNDS

Regulations and permission for dumping in the areas indicated may be obtained at the office of the District Engineer, Corps of Engineers, New York, N. Y.

INTRACOASTAL WATERWAY

Use chart 845-SC. The depths and channel markers are not shown hereon.

1247

ST. LUCIE INLET

The channel is subject to continual change. Entrance buoys and lights are not shown because they are frequently shifted in position. Use chart 845-SC.

1247

VEGETATION

The land is generally heavily wooded. The woods decrease in density with the elevation, leaving the higher elevations bare.

8148

STORM WARNINGS

The U. S. Weather Bureau displays storm warnings on the following lightships:

Pollock Rip (41°36'-69°51')
Nantucket Shoals (40°33'-69°28')
Ambrose Channel (40°27'-73°49')
Scotland (40°26'-73°55')
Barnegat (39°46'-73°56')
Five Fathom Bank (38°47'-74°35')

For a complete list of storm warning stations, see large scale charts.

1108

STORM WARNINGS

The U. S. Weather Bureau displays storm warnings at the following approximate locations:

Custom House, Boston (42°21.5'-71°03.2')
Boston C. G. Station (42°22.1'-71°03.1')
Boston Lightship (42°20.4'-70°45.5')
Deer Island Light Station (42°20.4'-70°57.3')
*Old Colony Yacht Club (42°18.0'-71°02.7')
*Hingham Yacht Club (42°15.7'-70°53.7')
Pt Allerton C. G. Station (42°18.4'-70°54')
*Winthrop (42°22.1'-70°59.3')
*Seasonal

246

PLANE COORDINATE GRID

Oregon State grid, north zone, is indicated by dotted ticks at 5,000 foot intervals

6155

TRAFFIC LIGHTS

Traffic lights are in operation at Reedy Point Entrance, at Lorewood Grove, about one mile west of the P. R. R. bridge, and at a point one mile west of Chesapeake City Bridge

Consult the Regulations for the Control of Traffic in the Canal before entering

570

*PLANE COORDINATE GRID

Oregon State Grid, north zone, is indicated by dashed ticks at 5,000 foot intervals. The last three digits are omitted.

*On new and reconstructed charts, grids are now being shown by dashed lines instead of dotted ticks.

6158

Lake Washington Ship Canal
Traffic Signals

Red (stop) green (go) lights are maintained on the guide pier below the Great Northern R. R. bridge for the guidance of vessels going through the large lock.

690-SC

FISH TRAP AREAS

Boundary lines of fish trap areas are shown thus: ——— ——— ———

Caution: Submerged piling may exist in these areas.

1216

LIGHTS

Only the principal lights along the outer coast are shown.

1000

BERTH NUMBERS

The numbers on land along the waterfront are the berth numbers.

5147

RACING BUOYS

Racing buoys within the limits of this chart are not shown hereon. For location and description see the Coast Guard Local Notices to Mariners and Light List.

1206

THIMBLE SHOAL CHANNEL DEPTHS								
Tabulated from surveys by the Corps of Engineers - report of Aug. 1962								
Controlling depths in channels entering from seaward in feet at Mean Low Water						Project Dimensions		
Name of Channel	Left outside quarter	Left inside quarter	Right inside quarter	Right outside quarter	Date of Survey	Width (feet)	Length (naut. miles)	Depth M.L.W. (feet)
Thimble Shoal Channel ^a	37.5	40.0	40.0	39.8	5,6-62	1000	9.9	40
North Auxiliary Channel	32.0	30.2	30.1	30.0	5,6-62	450	9.9	32
South Auxiliary Channel	28.8	29.0	29.3	32.0	5,6-62	450	9.9	32

a. This channel is restricted to exclude vessels and tows drawing less than 20 feet. There is no restriction to passenger ships.
NOTE: The Corps of Engineers should be consulted for changing conditions subsequent to above.

1222

FIGURE 10—Standard Notes

CHANNEL DEPTHS

The project depth in the channels of the Columbia and Willamette Rivers are, 48 feet from the entrance to Clatsop Spit Lighted Whistle Buoy 14, thence 35 feet to Portland, Oregon, and 30 feet from the mouth of the Willamette River to Vancouver, Washington.

Freshets occur annually during the months of May, June, and July which may cause some shoaling; however, channels are restored to project depth as soon thereafter as possible.

The controlling depths are published monthly in the local Notice to Mariners by the U.S. Coast Guard and monthly in the U.S. Naval Oceanographic Office Notice to Mariners. Additional information may be obtained from the Corps of Engineers, U. S. Army, Portland, Oregon.

6152

WIRE DRAGGED AREAS

The area tinted green has been swept by wire drag to a depth which in deep waters materially exceeds the draft of the largest vessels.

In shoal waters the drag was set to pass as close as practicable to the bottom

8094

(Green overprint)

Information blocked out in green is now obsolete. Corrections in green to Oct. 30, 1950.

(Green overprint)

PROHIBITED AREA

The area in and about Womens Bay, west of the dashed magenta line is a Naval Defensive Sea Area. No vessels, except those authorized by the Secretary of the Navy, shall be navigated in this area. The U. S. Naval Reservation is an Air Space Reservation. No aircraft, except those authorized by the Secretary of the Navy, shall be navigated above this area.

8545

PROHIBITED AREA

Unalaska Island is a Naval Defensive Sea Area and Airspace Reservation. No vessels or aircraft, except those authorized by the Secretary of the Navy, shall be navigated in or above the area within the three mile limit.

9302

PROHIBITED AREA 207.174

(Seaplane Landing)

A navigation channel 300 feet wide outside the limits of the prohibited area is available to surface craft.

576

CAUTION

Boundary limits and designations of Submarine Operating Areas are shown in solid magenta lines and are indicated by letters, thus: AREA "G" As submarines may be operating in these areas, vessels should proceed with caution. During torpedo practice firing, all vessels are cautioned to keep well clear of Naval Target Vessels flying a large red flag.

359

CAUTION

This chart is not intended for use in navigating the tributaries of Chesapeake Bay and the aids to navigation maintained by the U. S. Coast Guard are not charted in those waters.

78

CAUTION

Numerous oil well drilling structures are located within the limits of this chart.

523

CAUTION

Oil well drilling structures may be found outside the obstruction areas which are indicated by dashed magenta lines.

881-SC

CAUTION!!

Construction equipment may be stationed in this vicinity.

CAUTION

Bridge is under construction, and within the tinted area are numerous lights, buoys and piles used in its construction.

NOTE A

Navigation regulations are published in Chapter 2, Coast Pilot 2, or subsequent yearly supplements and weekly Notices to Mariners. Copies of the regulations may be obtained at the office of the District Engineer, Corps of Engineers in New York.

Refer to section numbers shown with area designation.

541

WARNING

San Clemente Island is a NAVAL RESERVATION and is closed to the public.

All vessels are warned that the vicinity of the island is dangerous on account of gunfire and bombing.

5111

*PROHIBITED DUMPING GROUND

Dumping of all objects or materials of a metallic nature is strictly prohibited.

* Dumping ground notes may vary according to the regulations authorized by the Corps of Engineers District.

*SUBMARINE
OPERATING AREA
207.640 (see note A)*

5532

SPECIAL ANCHORAGE

Anchor lights not required on vessels
less than sixty-five feet long.

358

CABLE AND PIPELINE AREAS

*The cable and pipeline areas falling within
the areas of the larger scale charts are shown
thereon and are not repeated on this chart.*

1208

LOCAL MAGNETIC DISTURBANCE

Differences of as much as 3° from the normal
variation have been observed on Cuttyhunk Is and
between Buzzards Bay and Vineyard Sound.

RESTRICTED AREA

*Anchoring, trawling, fishing and
dragging are prohibited in this area
207.158 (see note A)*

1222

RESTRICTED AREA

*204.30
(see note A)*

*SEAPLANE LANE A
207.50 (see note A)*

INTRACOASTAL WATERWAY

The Intracoastal Waterway is indicated
by a magenta line. Distances are shown in
International Nautical Miles. Courses are true.

INTRACOASTAL WATERWAY

Project Depths

12 feet Norfolk, Va. to Fort Pierce, Fla.

9 feet Norfolk to Albemarle Sound, via
Dismal Swamp Canal

8 feet Fort Pierce to Miami, Fla.

7 feet Miami, Fla. to Cross Bank, Florida
Bay.

From Cross Bank to Key West, Fla., the
controlling depth is 5 feet. Rep. June 1962.

The controlling depths are published
weekly in the Notice to Mariners.

INTRACOASTAL WATERWAY AIDS

Intracoastal Waterway aids are character-
ized by a yellow band or border. Proceeding
from Norfolk, Va. to Key West, Fla.:

1. Aids with red reflectors are on the star-
board side; green reflectors are on the port
side.

2. Where the Intracoastal Waterway co-
incides with another waterway, the dual-
purpose aids have distinctive yellow triangles
on the starboard side and yellow squares on
the port side.

829-SC

INTRACOASTAL WATERWAY

The Intracoastal Waterway between the east
and west limits of this chart is not completely
shown. Use chart No. 837-SC

The project depth from Charleston to Beaufort,
S. C. is 12 feet.

The controlling depths are published in the
weekly Notice to Mariners.

792

OKEECHOBEE WATERWAY

The routes are indicated by a magenta line.

The project depths from St. Lucie River to Fort
Meyers are:

8 feet via Routes 1 and 1B,

6 feet via Route 2.

Locks are operated during daylight hours.
The controlling depths are published in the weekly
Notice to Mariners.

1289

ANCHORAGE AREAS

202.155 (see note A)

Limits and assigned numbers of anchorage areas are shown in magenta.

- | | |
|---|---|
| <p>(20) (20A) (20B)</p> <p>(20A)</p> <p>(20B)</p> <p>(21A) (21B)</p> <p>(23)</p> <p>(24)</p> <p>(49E)</p> | <p>GENERAL ANCHORAGES</p> <p>TEMPORARY ANCHORAGE—limited to 72 hours without permit.</p> <p>NAVAL ANCHORAGE—commercial vessels may anchor for 24 hours with permission of Captain of the Port.</p> <p>BARGE AND STEAMER ANCHORAGE—limited to 30 days without permit.</p> <p>TEMPORARY GENERAL ANCHORAGE — limited to 48 hours without permit.</p> <p>QUARANTINE ANCHORAGE—vessels shall clear area after being granted pratique. The southern portion of (23) may be used when anchorage (24) is fully utilized.</p> <p>ANCHORAGE FOR EXPLOSIVES—load in excess of 20 tons of high explosives prohibited.</p> |
|---|---|

541

CURRENT DIAGRAM
GEORGES BANK AND NANTUCKET SHOALS

Explanation

Directions and velocities of tidal currents at eighteen stations are shown by arrows. The length of the arrow from the center of the circle represents the average velocity on a scale of one inch equals three knots. The figures at the arrow heads are the hours after the time of maximum flood at Pollock Rip Channel, (Stone Horse Shoal Lightship), the daily predicted times of which are given in the Coast and Geodetic Survey Atlantic Coast Current Tables. The velocities plotted should be increased by 20 per cent when the moon is full or new and decreased by 20 per cent when the moon is in first or third quarters. For effect of wind and tidal currents, see Current Tables, Atlantic Coast.

541



FIGURE 14—Standard Notes

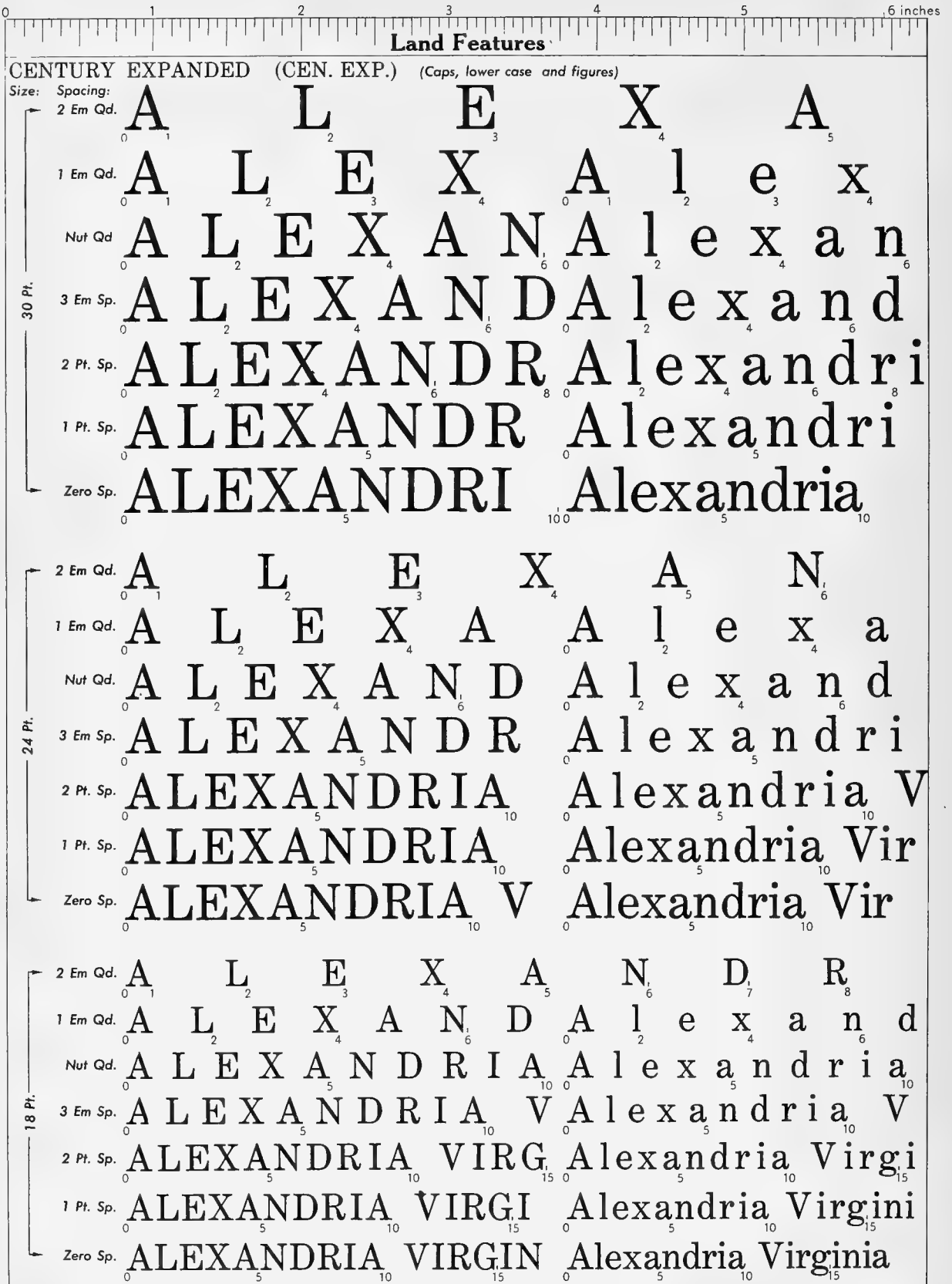


FIGURE 15 — Standard Type for Nautical Charts

Land Features

CENTURY EXPANDED (CEN. EXP.) (Caps, lower case and figures)

Size	Spacing	A L E X A N D R I A									
	2 Em Qd.	0	2	4	6	8	10				
14 Pt.	1 Em Qd.	0	5	10	15	20	25	30	35	40	45
	Nut Qd.	0	5	10	15	20	25	30	35	40	45
	3 Em Sp.	0	5	10	15	20	25	30	35	40	45
	2 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
	1 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
	Zero Sp.	0	5	10	15	20	25	30	35	40	45
12 Pt.	2 Em Qd.	0	2	4	6	8	10	12			
	1 Em Qd.	0	5	10	15	20	25	30	35	40	45
	Nut Qd.	0	5	10	15	20	25	30	35	40	45
	3 Em Sp.	0	5	10	15	20	25	30	35	40	45
	2 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
	1 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
10 Pt.	2 Em Qd.	0	5	10	15	20	25	30	35	40	45
	1 Em Qd.	0	5	10	15	20	25	30	35	40	45
	Nut Qd.	0	5	10	15	20	25	30	35	40	45
	3 Em Sp.	0	5	10	15	20	25	30	35	40	45
	2 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
	1 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
8 Pt.	2 Em Qd.	0	5	10	15	20	25	30	35	40	45
	1 Em Qd.	0	5	10	15	20	25	30	35	40	45
	Nut Qd.	0	5	10	15	20	25	30	35	40	45
	3 Em Sp.	0	5	10	15	20	25	30	35	40	45
	2 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
	1 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
6 Pt.	2 Em Qd.	0	5	10	15	20	25	30	35	40	45
	1 Em Qd.	0	5	10	15	20	25	30	35	40	45
	Nut Qd.	0	5	10	15	20	25	30	35	40	45
	3 Em Sp.	0	5	10	15	20	25	30	35	40	45
	2 Pt. Sp.	0	5	10	15	20	25	30	35	40	45
	1 Pt. Sp.	0	5	10	15	20	25	30	35	40	45

FIGURE 16 — Standard Type for Nautical Charts

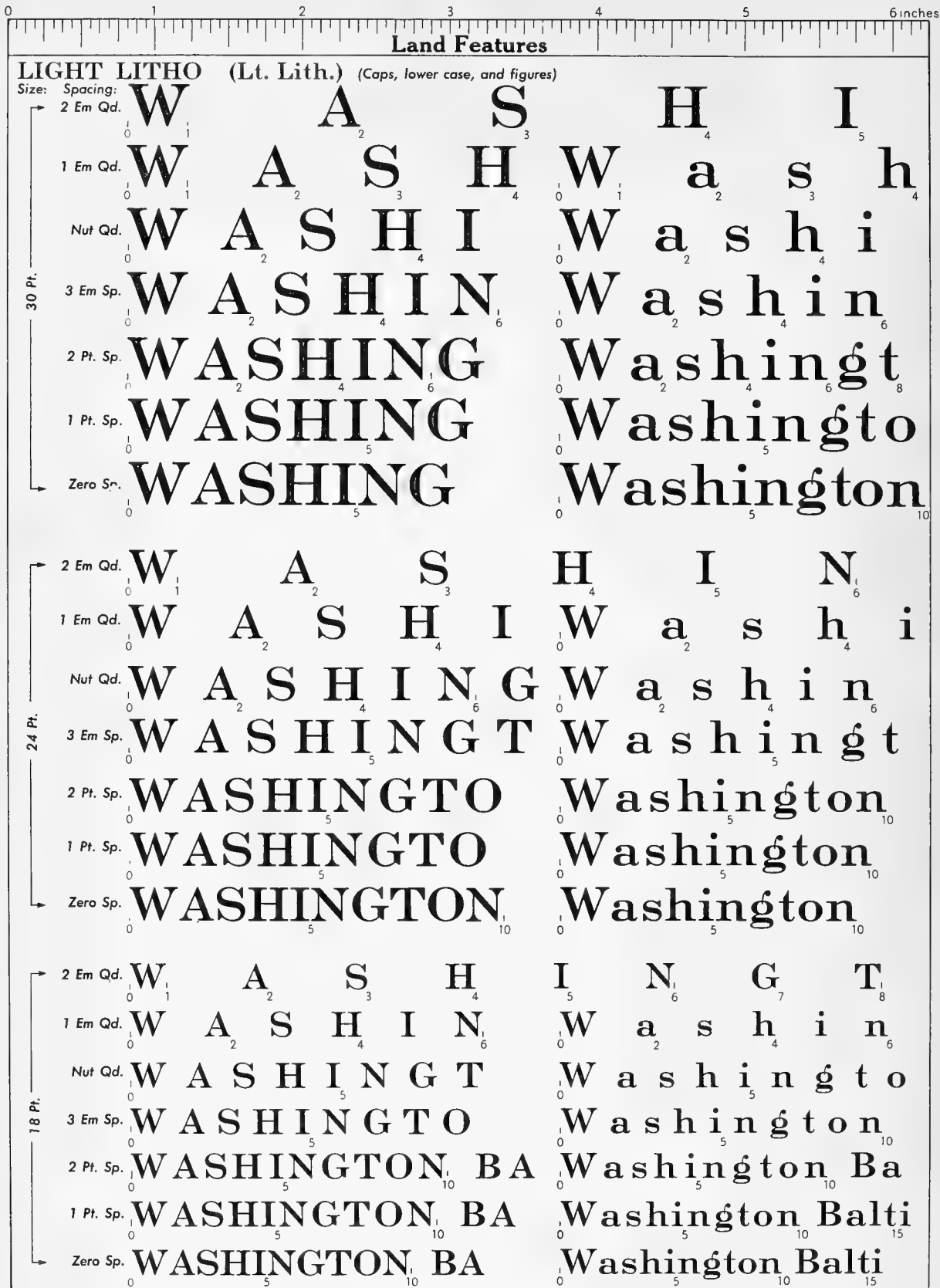


FIGURE 17 — Standard Type for Nautical Charts

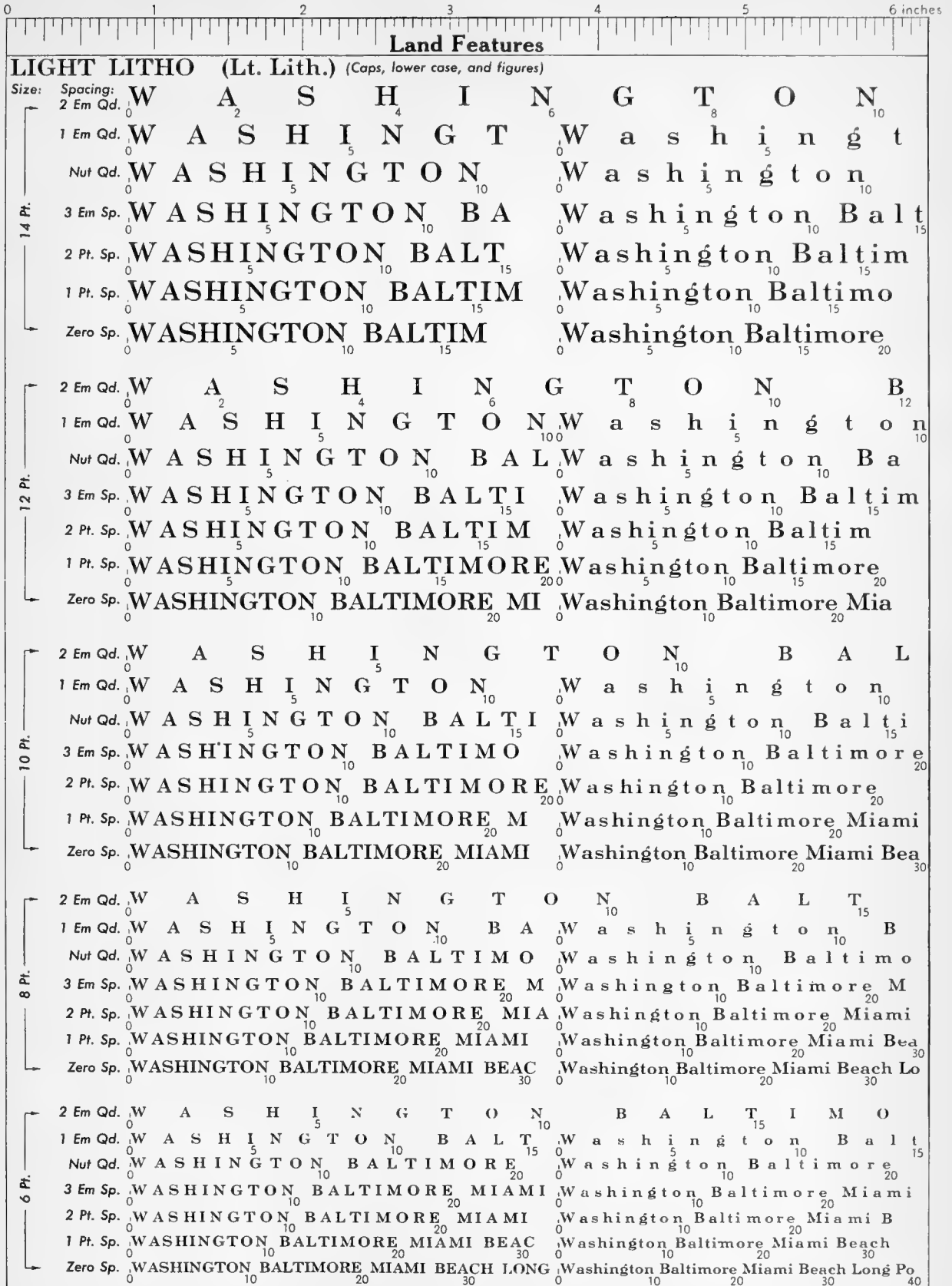


FIGURE 18 — Standard Type for Nautical Charts

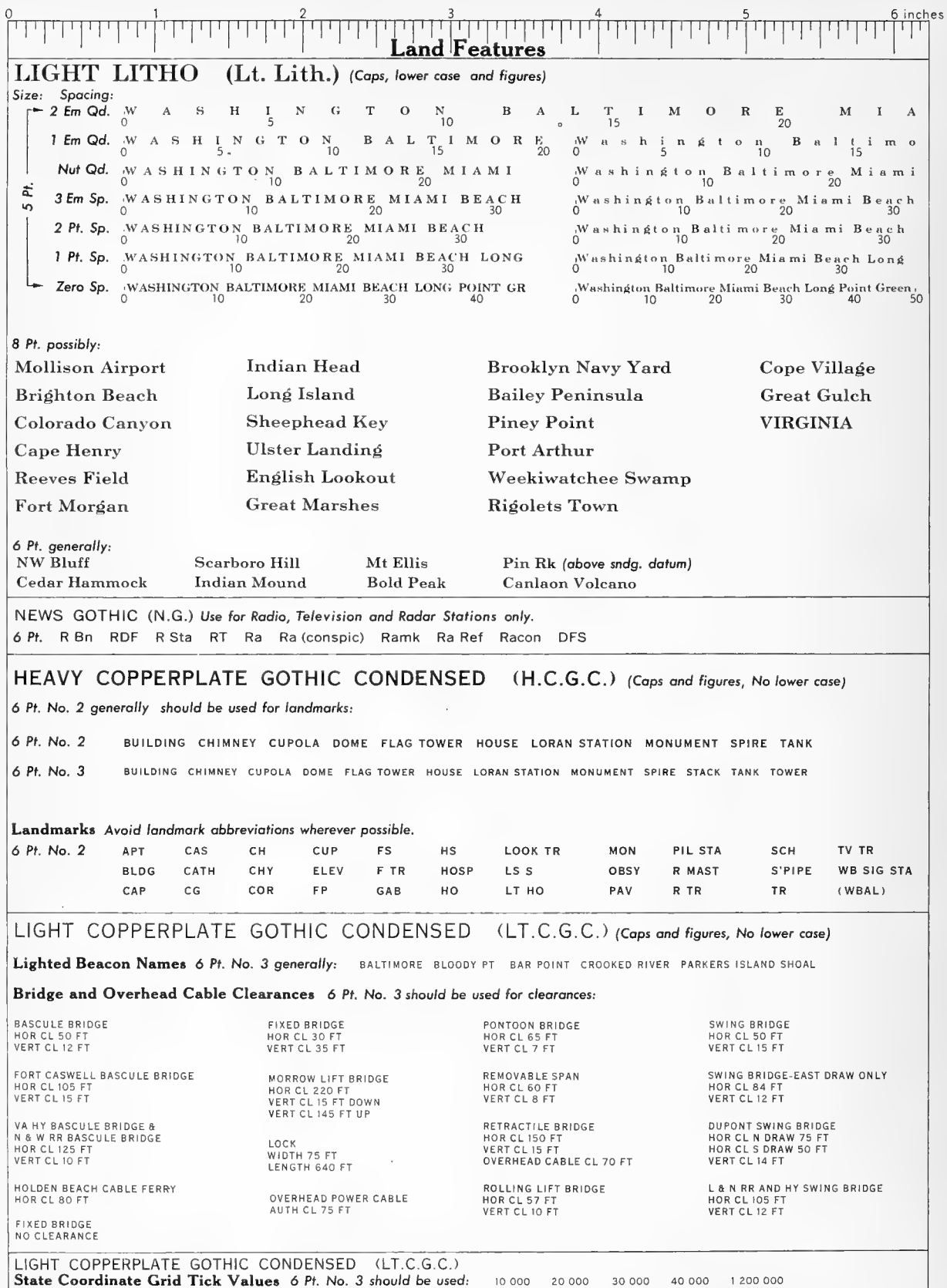


FIGURE 19 — Standard Type for Nautical Charts

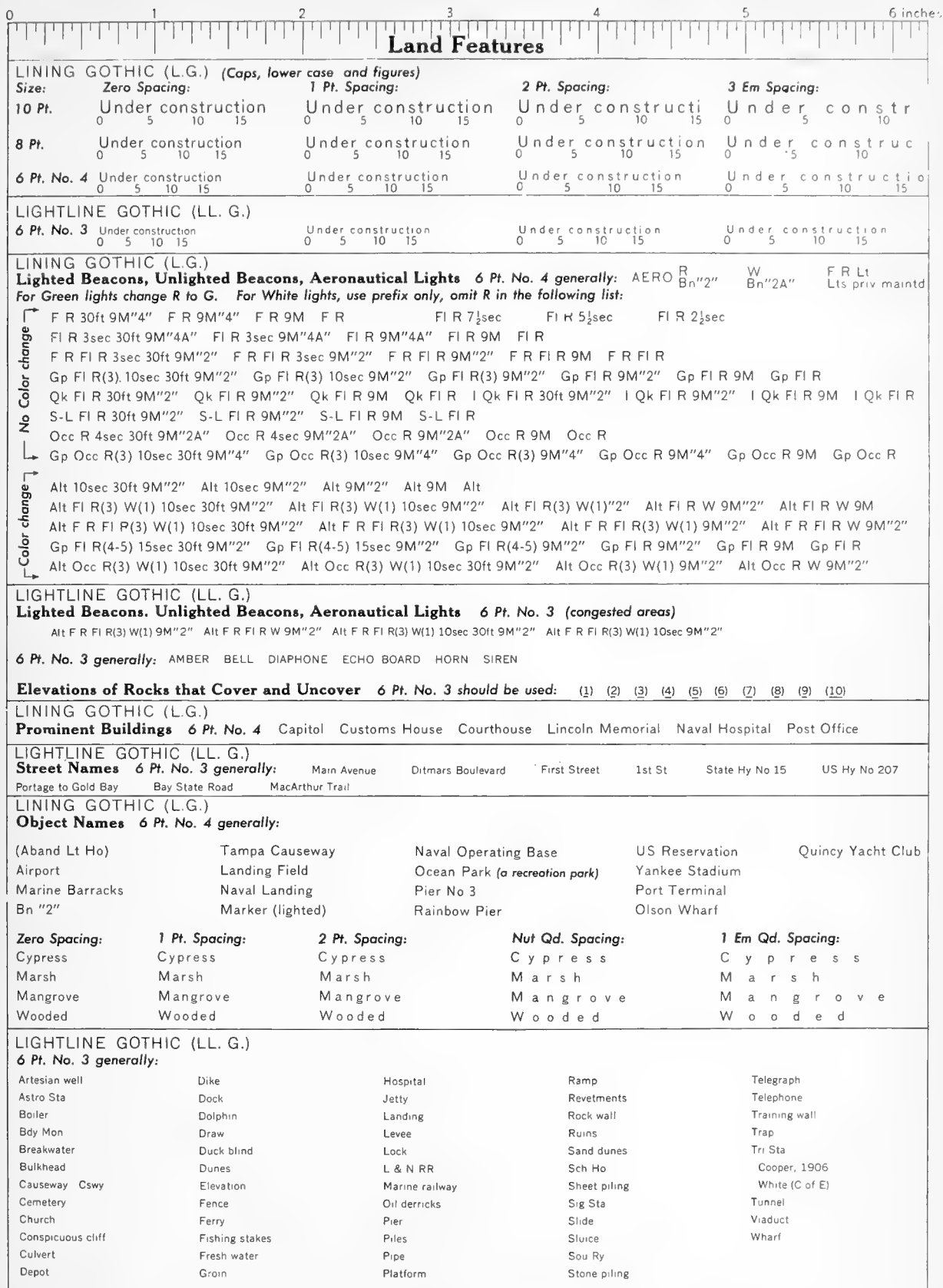


FIGURE 20 — Standard Type for Nautical Charts



FIGURE 21 — Standard Type for Nautical Charts

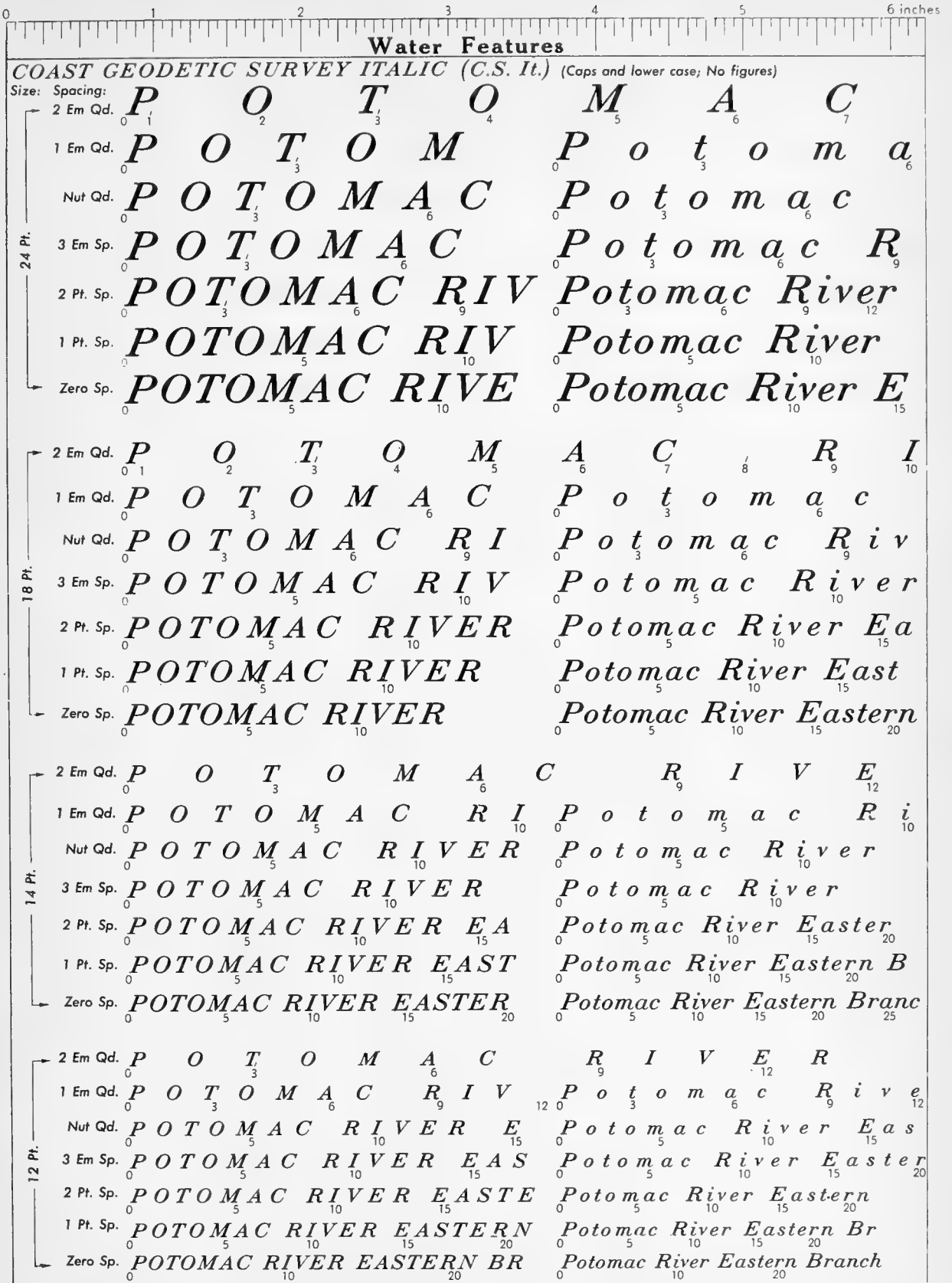
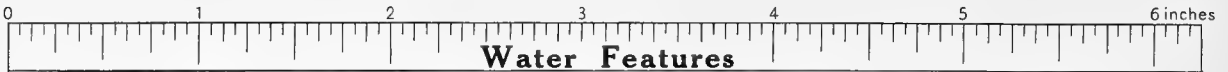


FIGURE 22 — Standard Type for Nautical Charts



Water Features

COAST GEODETIC SURVEY ITALIC (C.S. It.) (Caps and lower case; No figures)

Size: Spacing:

2 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A												
1 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	P	o	t	o	m	a	c	R	i	v	e	r		
Nut Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	E	A	S	T	E	R	N
3 Em Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	E	A	S	T	E	R	N
2 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	E	A	S	T	E	R	N
1 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	E	A	S	T	E	R	N
Zero Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	E	A	S	T	E	R	N

2 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N
1 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N
Nut Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N
3 Em Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N
2 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N
1 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N
Zero Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N

CENTURY EXPANDED ITALIC (Cen. Exp. It.) (Caps, lower case, and figures)

Size: Spacing:

2 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
1 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
Nut Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
3 Em Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
2 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
1 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
Zero Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R

2 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
1 Em Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
Nut Qd.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
3 Em Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
2 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
1 Pt. Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R
Zero Sp.	P	O	T	O	M	A	C	R	I	V	E	R	E	A	S	T	E	R	N	B	R

COAST GEODETIC SURVEY ITALIC (C.S. It.) 10 Pt. Possibly:

West Arroyo	Bailey Creek	Jarvis Lagoon	Mitchell Rock (below sndg. datum)
Glades Bank	Willies Cut	Kitty Hawk Lake	Colington Seavalley
Eureka Bar	East Entrance	Davis Ledge	Stratford Shoal
Miller Basin	Cowen Escarpment	Atlantic Ocean	Grays Slough
Florida Bay	Tar Flat	Round Hammock Pass	Buzzard Sound
Bates Bayou	Northeast Ford	Parker Pond	Tobias Spit
Chittenden Bend	Middle Ground	Wells Prong	Mikes Strait
Minots Canal	Smith Gulch	Broad Rapids	Mill Stream
Osher Canyon	Gulf of Mexico	Pingleton Reef	The Thoroughfare
Blake Channel (natural channel)	Sanders Harbor	Poplar Branch Rip	Lewis Wash
Sandy Cove	Whale Head Inlet	Potuxent River	
	Lone Oak Kill	Hampton Roads	

FIGURE 23 — Standard Type for Nautical Charts

1. Aero Radiobeacon:

Characteristics
 SANTA ANA (EL TORO)
 AERO
 R. Bn.
 440
 ⋮⋮⋮
 ⋮⋮⋮

Type
 6 pt. No. 4 Lining Gothic
 6 pt. No. 4 Lining Gothic
 6 pt. News Gothic
 6 pt. News Gothic
 Stock Film No. 375

2. Distance Finding Station and Radiobeacon:

Characteristics
 GRASSY PT LT
 Fl G 15sec 73ft 14M
 DFS
 DIAPHONE
 R Bn 286

 10m-20m & 40m-50m

Type
 6 pt. No. 3 Light Cop. Gothic Cond.
 6 pt. No. 4 Lining Gothic
 6 pt. News Gothic
 6 pt. No. 3 Lightline Gothic
 6 pt. News Gothic
 Stock Film No. 375
 6 pt. No. 4 Lining Gothic

3. Lightship, Distance Finding Station, Radiobeacon:

Characteristics
 HOLLINGERS ISLAND
 Fl 6sec 65ft 14M
 DFS BELL
 R Bn 176

 10m-20m & 40m-50m

Type
 6 pt. Draftsman's Italic
 6 pt. Draftsman's Italic
 6 pt. Draftsman's Italic
 6 pt. Draftsman's Italic
 Stock Film No. 375
 6 pt. Draftsman's Italic

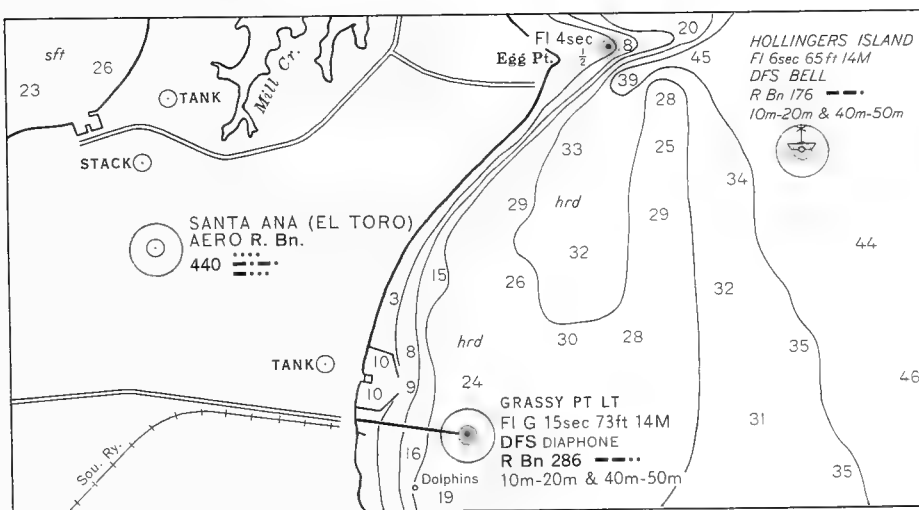


FIGURE 24 — Radiobeacon Symbols and Respective Type Styles

Feet to the inch	Natural Scale	$\frac{1}{2500}$	$\frac{1}{5000}$	$\frac{1}{10,000}$	$\frac{1}{15,000}$	$\frac{1}{20,000}$	$\frac{1}{25,000}$	$\frac{1}{30,000}$	$\frac{1}{40,000}$	$\frac{1}{80,000}$
1"=50'	1:600	387	214							
1"=60'	1:720	447	252							
1"=80'	1:960	555	322	175						
1"=100'	1:1200	649	387	214						
1"=200'	1:2400	979	649	387	276	214	175			
1"=300'	1:3600		837	529	387	305	252	214		
1"=400'	1:4800		979	649	485	387	322	276	214	
1"=600'	1:7200			837	680	530	447	387	305	
1"=800'	1:9600			979	781	649	555	485	387	214
1"=1000'	1:12,000		589	909	889	750	649	572	462	261
1"=83 $\frac{1}{3}$ '	1:1,000	571	333	182						
1"=166 $\frac{2}{3}$ '	1:2,000	888	571	333	235	182				
1"=250'	1:3,000		750	461	333	261	214	182		
1"=333 $\frac{1}{3}$ '	1:4,000		888	571	421	333	276	235	182	
1"=416 $\frac{2}{3}$ '	1:5,000			667	500	400	333	286	222	
1"=500'	1:6,000		909	750	571	461	387	333	261	
1"=833 $\frac{1}{3}$ '	1:10,000				800	667	571	500	400	222
1"=1041 $\frac{2}{3}$ '	1:12,500				909	769	667	589	476	270
1"=1250'	1:15,000					857	750	667	545	316
1"=1666 $\frac{2}{3}$ '	1:20,000						889	800	667	400
1"=2000'	1:24,000		345	588	769	909	980	889	750	462
1"=2083 $\frac{1}{3}$ '	1:25,000							909	769	476
1"=2604 $\frac{1}{6}$ '	1:31,250		276	485	649	781	889	980	877	562
1"=5208 $\frac{1}{3}$ '	1:62,500			276	387	485	572	649	780	877
1"=8000'	1:96,000			188	271	345	413	476	588	910
1"=10,416 $\frac{2}{3}$ '	1:125,000				214	276	333	387	485	780

FIGURE 25 — Proportional Divider Settings

MAP SCALES AND EQUIVALENTS

(The term "scale" as used in the formulas at the bottom of the table is the reciprocal of the fractional scale.)

Fractional scale	Feet per in.	In. per 1,000 ft.	Inches per stat. mile	Stat. miles per in.	Meters per in.	Acres per sq. in.	Sq. in. per acre	Sq. stat. mi. per sq. inch
1:500	41.667	24.00	126.72	0.008	12.700	0.0399	25.091	0.00006
1:600	50.00	20.00	105.60	0.009	15.240	0.0574	17.424	0.00009
1:1,000	83.333	12.00	63.36	0.016	25.400	0.1594	6.274	0.00025
1:1,200	100.00	10.00	52.80	0.019	30.480	0.2296	4.356	0.00036
1:1,500	125.00	8.00	42.24	0.024	38.100	0.3587	2.788	0.00056
1:2,000	166.667	6.00	31.68	0.032	50.800	0.6377	1.568	0.00100
1:2,400	200.00	5.00	26.40	0.038	60.960	0.9183	1.089	0.0014
1:2,500	208.333	4.80	25.344	0.039	63.500	0.9964	1.004	0.0016
1:3,000	250.00	4.00	21.12	0.047	76.200	1.4348	0.697	0.0022
1:3,600	300.00	3.333	17.60	0.057	91.440	2.0661	0.484	0.0032
1:4,000	333.333	3.00	15.84	0.063	101.600	2.6508	0.392	0.0040
1:4,800	400.00	2.50	13.20	0.076	121.920	3.6731	0.272	0.0057
1:5,000	416.667	2.40	12.672	0.079	127.000	3.9856	0.251	0.0062
1:6,000	500.00	2.00	10.56	0.095	152.400	5.7392	0.174	0.0090
1:7,000	583.333	1.714	9.051	0.110	177.800	7.8117	0.128	0.0122
1:7,200	600.00	1.667	8.80	0.114	182.880	8.2645	0.121	0.0129
1:7,500	660.00	1.515	8.00	0.125	201.168	10.00	0.100	0.0156
1:8,000	666.667	1.500	7.92	0.126	203.200	10.203	0.098	0.0159
1:8,400	700.00	1.429	7.543	0.133	213.360	11.249	0.089	0.0176
1:9,000	750.00	1.333	7.04	0.142	228.600	12.913	0.077	0.0202
1:9,600	800.00	1.250	6.60	0.152	243.840	14.692	0.068	0.0230
1:10,000	833.333	1.200	6.336	0.158	254.000	15.942	0.063	0.0249
1:10,800	900.00	1.111	5.867	0.170	274.321	18.595	0.054	0.0291
1:12,000	1,000.00	1.0	5.280	0.189	304.801	22.957	0.044	0.0359
1:13,200	1,100.00	0.909	4.800	0.208	335.281	27.778	0.036	0.0434
1:14,400	1,200.00	0.833	4.400	0.227	365.761	33.058	0.030	0.0517
1:15,000	1,250.00	0.80	4.224	0.237	381.001	35.870	0.028	0.0560
1:15,600	1,300.00	0.769	4.062	0.246	396.241	38.797	0.026	0.0606
1:16,000	1,320.00	0.758	4.00	0.250	402.337	40.000	0.025	0.0625
1:16,800	1,333.333	0.750	3.96	0.253	406.401	40.812	0.025	0.0638
1:18,000	1,400.00	0.714	3.771	0.265	426.721	44.995	0.022	0.0703
1:18,200	1,500.00	0.667	3.52	0.284	457.201	51.653	0.019	0.0807
1:18,400	1,600.00	0.625	3.30	0.303	487.681	58.770	0.017	0.0918
1:19,200	1,866.667	0.60	3.168	0.316	508.001	63.769	0.016	0.0996
1:20,000	1,700.00	0.588	3.106	0.322	518.161	66.345	0.015	0.1037
1:20,400	1,760.00	0.568	3.00	0.333	536.449	71.111	0.014	0.1111
1:21,120	1,800.00	0.556	2.933	0.341	548.641	74.380	0.013	0.1162
1:22,800	1,900.00	0.528	2.779	0.360	579.121	82.874	0.012	0.1295
1:24,000	2,000.00	0.50	2.640	0.379	609.601	91.827	0.011	0.1435
1:25,000	2,083.333	0.480	2.534	0.395	635.001	99.639	0.010	0.1557
1:31,680	2,640.00	0.379	2.000	0.500	804.674	160.000	0.006	0.2500
1:40,000	3,333.333	0.30	1.584	0.631	1,016.002	255.076	0.004	0.3986
1:48,000	4,000.00	0.250	1.320	0.758	1,219.202	367.309	0.003	0.5739
1:62,500	5,208.333	0.192	1.014	0.986	1,587.503	622.744	0.0016	0.9730
1:82,500	5,280.00	0.189	1.000	1.000	1,609.347	640.00	0.0016	1.0000
1:83,350	6,666.667	0.150	0.792	1.263	2,032.004	1,020.304	0.0010	1.5942
1:80,000	8,000.00	0.125	0.660	1.515	2,438.405	1,469.24	0.0007	2.2957
1:96,000	10,000.00	0.10	0.528	1.894	3,048.006	2,295.684	0.0004	3.5870
1:120,000	10,416.667	0.096	0.507	1.973	3,175.006	2,490.98	0.0004	3.8922
1:126,720	10,560.00	0.095	0.500	2.00	3,218.694	2,560.00	0.0004	4.00
1:250,000	20,833.333	0.048	0.253	3.946	6,350.012	9,963.907	0.0001	15.5886
1:253,440	21,120.00	0.047	0.250	4.00	6,437.389	10,240.00	0.0001	16.00
1:500,000	41,666.667	0.024	0.127	7.891	12,700.025	39,855.627	0.0001	62.2744
1:1,000,000	83,333.333	0.012	0.063	15.783	25,400.050	159,422.508	0.0001	249.0977
Formulas	$\frac{\text{Scale}}{12}$	$\frac{12,000}{\text{Scale}}$	$\frac{63,360}{\text{Scale}}$	$\frac{\text{Scale}}{63,360}$	$\text{Ft. per in.} \times 0.3048006$	$\frac{(\text{Scale})^2}{43,560 \times 144}$	$\frac{43,560 \times 144}{(\text{Scale})^2}$	$\frac{(\text{Ft. per in.})^2}{(5,280)^2}$

LINEAR DISTANCE CONVERSION — FATHOMS — METERS — FEET — YARDS

	Fathoms to—		Meters to—			Feet to—		Yards to—
	Feet	Meters	Fathoms	Yards	Feet	Meters	Fathoms	Meters
1	6	1.82880	0.54681	1.09361	3.28083	0.30480	0.16667	0.91440
2	12	3.65761	1.09361	2.18722	6.56167	0.60960	0.33333	1.82880
3	18	5.48641	1.64042	3.28083	9.84250	0.91440	0.50000	2.74320
4	24	7.31521	2.18722	4.37444	13.12333	1.21920	0.66667	3.65761
5	30	9.14402	2.73403	5.46806	16.40417	1.52400	0.83333	4.57201
6	36	10.97282	3.28083	6.56167	19.68500	1.82880	1.00000	5.48641
7	42	12.80163	3.82764	7.65528	22.96583	2.13360	1.16667	6.40081
8	48	14.63043	4.37444	8.74889	26.24667	2.43840	1.33333	7.31521
9	54	16.45923	4.92125	9.84250	29.52750	2.74320	1.50000	8.22962

FIGURE 26 — Tables

CONVERSION TABLE

Feet to Fathoms

Ft.	Fms.	Ft.	Ft.	Fms.	Ft.	Fms.		
1	----	0	83-88	----	14	359-364	----	60
2	----	0	89-94	15	365-370	61		
3	----	0	95-100	16	371-376	62		
4	----	0	101-106	----	17	377-382	----	63
5	----	0	107-112	18	383-388	64		
6	----	1	113-118	----	19	389-394	----	65
7	----	1	119-124	20	395-400	66		
8	----	1	125-130	----	21	401-406	----	67
9	----	1	131-136	22	407-412	68		
10	----	1	137-142	----	23	413-418	----	69
11	----	1	143-148	24	419-424	70		
12	----	2	149-154	----	25	425-430	----	71
13	----	2	155-160	26	431-436	72		
14	----	2	161-166	----	27	437-442	----	73
15	----	2	167-172	28	443-448	74		
16	----	2	173-178	----	29	449-454	----	75
17	----	2	179-184	30	455-460	76		
18	----	3	185-190	----	31	461-466	----	77
19	----	3	191-196	32	467-472	78		
20	----	3	197-202	----	33	473-478	----	79
21	----	3	203-208	34	479-484	80		
22	----	3	209-214	----	35	485-490	----	81
23	----	3	215-220	36	491-496	82		
24	----	4	221-226	----	37	497-502	----	83
25	----	4	227-232	38	503-508	84		
26	----	4	233-238	----	39	509-514	----	85
27	----	4	239-244	40	515-520	86		
28	----	4	245-250	----	41	521-526	----	87
29	----	4	251-256	42	527-532	88		
30	----	5	257-262	----	43	533-538	----	89
31	----	5	263-268	44	539-544	90		
32	----	5	269-274	----	45	545-550	----	91
33	----	5	275-280	46	551-556	92		
34	----	5	281-286	----	47	557-562	----	93
35	----	5	287-292	48	563-568	94		
36	----	6	293-298	----	49	569-574	----	95
37	----	6	299-304	50	575-580	96		
38	----	6	305-310	----	51	581-586	----	97
39	----	6	311-316	52	587-592	98		
40	----	6	317-322	----	53	593-598	----	99
41	----	7	323-328	54	599-604	100		
42	----	7	329-334	----	55	605-610	----	101
43	----	7	335-340	56	611-616	102		
44	----	7	341-346	----	57	617-622	----	103
45	----	7	347-352	58	623-628	104		
46	----	8	353-358	----	59	629-634	----	105
47	----	8						
48	----	8						
49	----	8						
50	----	8						
51	----	8						
52	----	8						
53	----	8						
54	----	9						
55	----	9						
56	----	9						
57	----	9						
58	----	9						
59	----	9						
60	----	10						
61	----	10						
62	----	10						
63	----	10						
64	----	10						
65	----	10						
66-70	----	11						
71-76	----	12						
77-82	----	13						

FIGURE 27—Tables

Feet to Fathoms

Ft.	Fms.	Ft.	Fms.	Ft.	Fms.
635-640	106	911-916	152	1187-1192	198
641-646	107	917-922	153	1193-1198	199
647-652	108	923-928	154	1199-1204	200
653-658	109	929-934	155	1205-1210	201
659-664	110	935-940	156	1211-1216	202
665-670	111	941-946	157	1217-1222	203
671-676	112	947-952	158	1223-1228	204
677-682	113	953-958	159	1229-1234	205
683-688	114	959-964	160	1235-1240	206
689-694	115	965-970	161	1241-1246	207
695-700	116	971-976	162	1247-1252	208
701-706	117	977-982	163	1253-1258	209
707-712	118	983-988	164	1259-1264	210
713-718	119	989-994	165	1265-1270	211
719-724	120	<u>995-1000</u>	166	1271-1276	212
725-730	121	1001-1006	167	1277-1282	213
731-736	122	1007-1012	168	1283-1288	214
737-742	123	1013-1018	169	1289-1294	215
743-748	124	1019-1024	170	<u>1295-1300</u>	216
749-754	125	1025-1030	171	1301-1306	217
755-760	126	1031-1036	172	1307-1312	218
761-766	127	1037-1042	173	1313-1318	219
767-772	128	1043-1048	174	1319-1324	220
773-778	129	1049-1054	175	1325-1330	221
779-784	130	1055-1060	176	1331-1336	222
785-790	131	1061-1066	177	1337-1342	223
791-796	132	1067-1072	178	1343-1348	224
797-802	133	1073-1078	179	1349-1354	225
803-808	134	1079-1084	180	1355-1360	226
809-814	135	1085-1090	181	1361-1366	227
815-820	136	1091-1096	182	1367-1372	228
821-826	137	<u>1097-1102</u>	183	1373-1378	229
827-832	138	1103-1108	184	1379-1384	230
833-838	139	1109-1114	185	1385-1390	231
839-844	140	1115-1120	186	1391-1396	232
845-850	141	1121-1126	187	<u>1397-1402</u>	233
851-856	142	1127-1132	188	1403-1408	234
857-862	143	1133-1138	189	1409-1414	235
863-868	144	1139-1144	190	1415-1420	236
869-874	145	1145-1150	191	1421-1426	237
875-880	146	1151-1156	192	1427-1432	238
881-886	147	1157-1162	193	1433-1438	239
887-892	148	1163-1168	194	1439-1444	240
893-898	149	1169-1174	195	1445-1450	241
<u>899-904</u>	150	1175-1180	196	1451-1456	242
905-910	151	1181-1186	197		

LENGTH—METERS TO FEET

[Reduction factor: 1 meter = 3.280833333 feet]

Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet						
0		100	328.08333	200	656.16667	300	984.25000	400	1,312.33333	500	1,640.41667	600	1,968.50000	700	2,296.58333	800	2,624.66667	900	2,952.75000		
1	3.28083	1	331.36417	1	659.44750	1	987.53083	1	1,315.61417	1	1,643.69750	1	1,971.78083	1	2,299.86417	1	2,627.94750	1	2,956.03083	1	3,284.11417
2	6.56167	2	334.64500	2	662.72833	2	990.81167	2	1,318.89500	2	1,646.97833	2	1,975.06167	2	2,303.14500	2	2,631.22833	2	2,962.31167	2	3,317.40000
3	9.84250	3	337.92583	3	666.00917	3	994.09250	3	1,322.17583	3	1,650.25917	3	1,978.34250	3	2,306.42583	3	2,634.50917	3	2,965.59250	3	3,331.67500
4	13.12333	4	341.20667	4	669.29000	4	997.37333	4	1,325.45667	4	1,653.54000	4	1,981.62333	4	2,309.70667	4	2,637.79000	4	2,968.87333	4	3,345.95000
5	16.40417	5	344.48750	5	672.57083	5	1,000.65417	5	1,328.73750	5	1,656.82083	5	1,984.90417	5	2,312.98750	5	2,641.07083	5	2,972.14517	5	3,360.32500
6	19.68500	6	347.76833	6	675.85167	6	1,003.93500	6	1,332.01833	6	1,660.10167	6	1,988.18500	6	2,316.28833	6	2,644.35167	6	2,975.43500	6	3,374.60000
7	22.96583	7	351.04917	7	679.13250	7	1,007.21583	7	1,335.29917	7	1,663.38250	7	1,991.46583	7	2,319.54917	7	2,647.63250	7	2,978.72000	7	3,388.87500
8	26.24667	8	354.33000	8	682.41333	8	1,010.49667	8	1,338.58000	8	1,666.66333	8	1,994.74667	8	2,322.83000	8	2,650.91333	8	2,981.99667	8	3,403.15000
9	29.52750	9	357.61083	9	685.69417	9	1,013.77750	9	1,341.86083	9	1,669.94417	9	1,998.02750	9	2,326.11083	9	2,654.19417	9	2,985.27750	9	3,417.42500
10	32.80833	10	360.89167	10	688.97500	10	1,017.05833	10	1,345.14167	10	1,673.22500	10	2,001.30833	10	2,329.39167	10	2,657.47500	10	2,988.55833	10	3,431.70000
11	36.08917	11	364.17250	11	692.25583	11	1,020.33917	11	1,348.42250	11	1,676.50583	11	2,004.56917	11	2,332.67250	11	2,660.75833	11	2,991.84167	11	3,445.97500
12	39.37000	12	367.45333	12	695.53667	12	1,023.62000	12	1,351.70333	12	1,679.78667	12	2,007.80000	12	2,335.95333	12	2,664.03667	12	2,994.12000	12	3,460.25000
13	42.65083	13	370.73417	13	698.81750	13	1,026.90833	13	1,354.98417	13	1,683.06750	13	2,011.15083	13	2,339.23417	13	2,667.31750	13	2,996.40083	13	3,474.52500
14	45.93167	14	374.01500	14	702.09833	14	1,030.18167	14	1,358.26500	14	1,686.34833	14	2,014.43167	14	2,342.51500	14	2,670.59833	14	2,998.68167	14	3,488.80000
15	49.21250	15	377.29583	15	705.37917	15	1,033.46250	15	1,361.54583	15	1,689.62917	15	2,017.71250	15	2,345.79583	15	2,673.87917	15	2,999.96250	15	3,503.07500
16	52.49333	16	380.57667	16	708.66000	16	1,036.74333	16	1,364.82667	16	1,692.91000	16	2,020.99333	16	2,349.07667	16	2,677.16000	16	3,001.24333	16	3,517.35000
17	55.77417	17	383.85750	17	711.94083	17	1,040.02417	17	1,368.10750	17	1,696.19083	17	2,024.27417	17	2,352.35750	17	2,680.44083	17	3,002.52417	17	3,531.62500
18	59.05500	18	387.13833	18	715.22167	18	1,043.30500	18	1,371.38833	18	1,699.47167	18	2,027.55500	18	2,355.63833	18	2,683.72167	18	3,003.80500	18	3,545.90000
19	62.33583	19	390.41917	19	718.50250	19	1,046.58583	19	1,374.66917	19	1,702.75250	19	2,030.83583	19	2,358.91917	19	2,687.00250	19	3,005.08583	19	3,560.17500
20	65.61667	120	393.70000	220	721.78333	320	1,049.86667	420	1,377.95000	520	1,705.03333	620	2,034.11667	720	2,362.20000	820	2,690.28333	920	3,018.36667	1020	3,574.45000
1	68.89750	1	396.98083	1	725.06417	1	1,053.14750	1	1,381.23083	1	1,709.31417	1	2,037.39750	1	2,365.48083	1	2,693.56417	1	3,021.64750	1	3,588.72500
2	72.17833	2	400.26167	2	728.34500	2	1,056.42833	2	1,384.51167	2	1,712.59500	2	2,040.67833	2	2,368.76167	2	2,696.84500	2	3,024.92833	2	3,603.00000
3	75.45917	3	403.54250	3	731.62583	3	1,059.70917	3	1,387.79250	3	1,715.87583	3	2,043.95917	3	2,372.04250	3	2,700.12583	3	3,028.20917	3	3,617.27500
4	78.74000	4	406.82333	4	734.90667	4	1,062.99000	4	1,391.07333	4	1,719.15667	4	2,047.24000	4	2,375.32333	4	2,703.40667	4	3,031.49000	4	3,631.55000
5	82.02083	5	410.10417	5	738.18750	5	1,066.27083	5	1,394.35417	5	1,722.43750	5	2,050.52083	5	2,378.60417	5	2,706.68750	5	3,034.77083	5	3,645.82500
6	85.30167	6	413.38500	6	741.46833	6	1,069.55167	6	1,397.63500	6	1,725.71833	6	2,053.80167	6	2,381.88500	6	2,709.96833	6	3,038.05167	6	3,660.10000
7	88.58250	7	416.66583	7	744.74917	7	1,072.83250	7	1,400.91583	7	1,728.99917	7	2,057.08250	7	2,385.16583	7	2,713.24917	7	3,041.33250	7	3,674.37500
8	91.86333	8	419.94667	8	748.03000	8	1,076.11333	8	1,404.19667	8	1,732.28000	8	2,060.36333	8	2,388.44667	8	2,716.53000	8	3,044.61333	8	3,688.65000
9	95.14417	9	423.22750	9	751.31083	9	1,079.39417	9	1,407.47750	9	1,735.56083	9	2,063.64417	9	2,391.72750	9	2,719.81083	9	3,047.89417	9	3,702.92500
100	426.50833	130	456.50833	230	754.59167	330	1,082.67500	430	1,410.75833	530	1,738.84167	630	2,066.92500	730	2,395.00833	830	2,723.09167	930	3,051.17500	1030	3,651.17500
101	429.78917	131	459.78917	231	757.87250	331	1,085.95583	431	1,414.03917	531	1,742.12250	631	2,070.20583	731	2,398.28917	831	2,726.37250	931	3,054.45583	1031	3,665.45583
102	433.07000	132	463.07000	232	761.15333	332	1,089.23667	432	1,417.32000	532	1,745.40333	632	2,073.48667	732	2,401.57000	832	2,729.65333	932	3,057.73667	1032	3,679.73667
103	436.35083	133	466.35083	233	764.43417	333	1,092.51750	433	1,420.60083	533	1,748.68417	633	2,076.77500	733	2,404.85083	833	2,732.93417	933	3,061.01750	1033	3,694.01750
104	439.63167	134	469.63167	234	767.71500	334	1,095.79917	434	1,423.88167	534	1,751.96500	634	2,081.06000	734	2,411.41250	834	2,736.21500	934	3,064.30000	1034	3,708.30000
105	442.91250	135	472.91250	235	770.99583	335	1,099.07917	435	1,427.16250	535	1,755.24583	635	2,084.32917	735	2,414.69333	835	2,739.49583	935	3,067.57917	1035	3,722.57917
106	446.19333	136	476.19333	236	774.27667	336	1,102.36000	436	1,430.44333	536	1,758.52667	636	2,087.60000	736	2,417.97417	836	2,742.77667	936	3,070.86000	1036	3,738.86000
107	449.47417	137	479.47417	237	777.55750	337	1,105.64083	437	1,433.72417	537	1,761.80750	637	2,089.89833	737	2,421.25500	837	2,746.05750	937	3,074.14083	1037	3,754.14083
108	452.75500	138	482.75500	238	780.83833	338	1,108.92167	438	1,437.00500	538	1,765.08833	638	2,093.17167	738	2,424.53583	838	2,749.33833	938	3,077.42167	1038	3,769.42167
109	456.03583	139	486.03583	239	784.11917	339	1,112.20250	439	1,440.28583	539	1,768.36917	639	2,096.45250	739	2,427.81667	839	2,752.61917	939	3,080.70250	1039	3,784.70250
140	459.31667	140	459.31667	240	787.40000	340	1,115.48333	440	1,443.56667	540	1,771.65000	640	2,099.73333	740	2,431.09500	840	2,755.90000	940	3,083.98333	1040	3,799.98333
141	462.59750	141	462.59750	241	790.68083	341	1,118.76417	441	1,446.84750	541	1,774.93083	641	2,103.01417	741	2,434.37833	841	2,759.18083	941	3,087.26417	1041	3,815.26417
142	465.87833	142	465.87833	242	793.96167	342	1,122.04500	442	1,450.12833	542	1,778.21167	642	2,106.29500	742	2,437.66167	842	2,762.46167	942	3,090.54500	1042	3,830.54500
143	469.15917	143	469.15917	243	797.24250	343	1,125.32583	443	1,453.40917	543	1,781.49250	643	2,109.57583	743	2,440.94500	843	2,765.74250	943	3,093.82583	1043	3,845.82583
144	472.44000	144	472.44000	244	800.52333	344	1,128.60667	444	1,456.69000	544	1,784.77333	644	2,112.85667	744	2,444.22833	844	2,769.02333	944	3,097.10667	1044	3,861.10667
145	475.72083	145	475.72083	245	803.80417	345	1,131.88750	445	1,459.97083	545	1,788.05417	645	2,116.13750	745	2,447.51667	845	2,772.30417	945	3,100.38750	1045	3,876.38750
146	479.00167	146	479.00167	246	807.08500	346	1,135.16833	446	1,463.25167	546	1,791.33500	646	2,119.41833	746	2,450.79500	846	2,775.58500	946	3,103.66833	1046	3,891.66833
147	482.28250	147	482.28250	247	810.36583	347	1,138.44917	447	1,466.53250	547	1,794.61583	647	2,122.69917	747	2,454.07833	847	2,778.86583	947	3,10		

50	164, 04167	150	492, 12500	260	820, 20833	350	1,148, 29167	450	1,476, 37500	550	1,804, 45833	650	2,132, 54167	750	2,460, 62500	850	2,788, 70833	950	3,116, 79167
1	167, 32250	1	495, 40583	1	823, 48917	1	1,151, 57250	1	1,479, 63583	1	1,807, 73917	1	2,135, 82250	1	2,463, 90583	1	2,791, 98917	1	3,120, 07250
2	170, 60333	2	498, 68667	2	826, 77000	2	1,154, 83333	2	1,482, 93867	2	1,812, 02000	2	2,139, 10333	2	2,467, 18667	2	2,793, 27000	2	3,123, 35333
3	173, 88417	3	501, 96750	3	830, 05083	3	1,158, 13417	3	1,486, 21750	3	1,814, 30083	3	2,142, 38417	3	2,470, 46750	3	2,798, 50083	3	3,126, 63417
4	177, 16500	4	505, 24833	4	833, 33167	4	1,161, 41500	4	1,489, 49833	4	1,817, 58167	4	2,147, 74833	4	2,801, 83167	4	3,129, 91500	4	3,129, 91500
5	180, 44583	5	508, 52917	5	836, 61250	5	1,164, 69583	5	1,492, 77917	5	1,820, 86250	5	2,148, 94583	5	2,805, 11250	5	3,133, 19583	5	3,133, 19583
6	183, 72667	6	511, 81000	6	839, 89333	6	1,167, 97500	6	1,496, 06000	6	1,824, 14333	6	2,152, 22667	6	2,477, 02000	6	2,808, 39333	6	3,136, 47667
7	187, 00750	7	514, 09083	7	843, 17417	7	1,171, 23750	7	1,499, 34083	7	1,827, 42417	7	2,155, 50750	7	2,483, 59083	7	2,811, 67417	7	3,139, 75750
8	190, 28833	8	518, 37167	8	846, 45500	8	1,174, 53333	8	1,502, 62167	8	1,830, 70500	8	2,158, 78833	8	2,486, 87167	8	2,814, 95500	8	3,143, 03833
9	193, 56917	9	521, 65250	9	849, 73583	9	1,177, 81917	9	1,505, 90250	9	1,833, 98583	9	2,162, 06917	9	2,490, 15250	9	2,818, 23583	9	3,146, 31917
60	196, 85000	160	524, 93333	260	853, 01667	360	1,181, 10000	460	1,509, 18333	560	1,847, 26667	660	2,165, 35000	760	2,493, 43333	860	2,821, 51667	960	3,149, 60000
1	200, 13083	1	528, 21417	1	856, 29750	1	1,184, 30000	1	1,512, 46417	1	1,840, 54750	1	2,168, 63083	1	2,496, 71417	1	2,824, 79750	1	3,152, 80000
2	203, 41167	2	531, 49500	2	859, 57833	2	1,187, 66167	2	1,515, 74500	2	1,843, 82833	2	2,171, 91167	2	2,499, 99500	2	2,828, 07833	2	3,156, 16167
3	206, 69250	3	534, 77583	3	862, 85917	3	1,190, 94250	3	1,519, 02583	3	1,847, 10917	3	2,175, 19250	3	2,503, 27583	3	2,831, 35917	3	3,159, 44250
4	209, 97353	4	538, 05667	4	866, 14000	4	1,194, 22333	4	1,522, 30667	4	1,850, 39000	4	2,178, 47333	4	2,506, 55667	4	2,834, 64000	4	3,162, 72333
5	213, 25417	5	541, 33750	5	869, 42083	5	1,197, 50417	5	1,525, 58750	5	1,853, 67083	5	2,181, 75417	5	2,509, 83750	5	2,837, 92083	5	3,166, 00417
6	216, 53500	6	544, 61833	6	872, 70167	6	1,200, 78500	6	1,528, 86833	6	1,856, 95167	6	2,185, 03500	6	2,513, 11833	6	2,841, 20167	6	3,169, 28500
7	219, 81583	7	547, 89917	7	875, 98250	7	1,204, 06583	7	1,532, 14917	7	1,860, 32350	7	2,188, 31583	7	2,516, 39917	7	2,844, 48250	7	3,172, 56583
8	223, 09667	8	551, 18000	8	879, 26333	8	1,207, 34667	8	1,535, 43000	8	1,863, 61333	8	2,191, 59667	8	2,519, 68000	8	2,847, 76333	8	3,175, 84667
9	226, 37750	9	554, 46083	9	882, 54417	9	1,210, 62750	9	1,538, 71083	9	1,866, 79417	9	2,194, 87750	9	2,522, 96083	9	2,851, 04417	9	3,179, 12750
70	229, 65833	170	557, 74167	270	885, 82500	370	1,213, 90833	470	1,541, 99167	570	1,870, 07500	670	2,198, 15833	770	2,526, 24167	870	2,854, 32500	970	3,182, 40833
1	232, 93917	1	561, 02250	1	889, 10583	1	1,217, 18917	1	1,545, 27250	1	1,873, 35583	1	2,201, 43917	1	2,529, 52250	1	2,857, 60383	1	3,185, 68917
2	236, 22000	2	564, 30333	2	892, 38667	2	1,220, 47000	2	1,548, 55333	2	1,876, 63667	2	2,204, 72000	2	2,532, 80333	2	2,860, 89667	2	3,188, 97000
3	239, 50083	3	567, 58417	3	895, 66750	3	1,223, 75083	3	1,551, 83417	3	1,879, 91750	3	2,208, 00083	3	2,536, 08417	3	2,864, 10750	3	3,192, 25083
4	242, 78167	4	570, 86500	4	898, 94833	4	1,227, 03167	4	1,555, 11500	4	1,883, 19833	4	2,211, 28167	4	2,539, 36500	4	2,867, 48833	4	3,195, 53167
5	246, 06250	5	574, 14583	5	902, 22917	5	1,230, 31250	5	1,558, 39583	5	1,886, 47917	5	2,214, 56250	5	2,542, 64583	5	2,870, 72917	5	3,198, 81250
6	249, 34333	6	577, 42667	6	905, 51000	6	1,233, 59333	6	1,561, 67667	6	1,889, 76000	6	2,217, 84333	6	2,545, 92667	6	2,874, 01000	6	3,202, 09333
7	252, 62417	7	580, 70750	7	908, 79083	7	1,236, 87417	7	1,564, 95750	7	1,893, 04083	7	2,221, 12417	7	2,549, 20750	7	2,877, 29083	7	3,205, 37417
8	255, 90500	8	583, 98833	8	912, 07167	8	1,240, 15500	8	1,568, 23833	8	1,896, 32167	8	2,224, 40500	8	2,552, 48833	8	2,880, 57167	8	3,208, 65500
9	259, 18583	9	587, 26917	9	915, 35250	9	1,243, 43583	9	1,571, 51917	9	1,899, 60250	9	2,227, 68583	9	2,555, 76917	9	2,883, 85750	9	3,211, 93583
80	262, 46667	180	590, 55000	280	918, 63333	380	1,246, 71667	480	1,574, 80000	580	1,902, 88333	680	2,230, 96667	780	2,559, 05000	880	2,887, 13333	980	3,215, 21667
1	265, 74750	1	593, 83083	1	921, 91417	1	1,249, 09750	1	1,578, 08083	1	1,906, 16417	1	2,234, 24750	1	2,562, 33083	1	2,890, 41417	1	3,218, 49750
2	269, 02833	2	597, 11167	2	925, 19500	2	1,253, 27833	2	1,581, 36167	2	1,909, 44500	2	2,237, 52833	2	2,565, 61167	2	2,893, 69500	2	3,221, 77833
3	272, 30917	3	600, 39250	3	928, 47583	3	1,256, 55917	3	1,584, 64333	3	1,912, 72583	3	2,240, 80917	3	2,568, 80250	3	2,896, 97583	3	3,225, 05917
4	275, 59000	4	603, 67333	4	931, 75667	4	1,259, 84000	4	1,587, 92353	4	1,916, 00667	4	2,244, 09000	4	2,572, 17333	4	2,900, 25667	4	3,228, 34000
5	278, 87083	5	606, 95417	5	935, 03750	5	1,263, 12083	5	1,591, 20417	5	1,919, 28750	5	2,247, 37083	5	2,575, 45417	5	2,903, 53750	5	3,231, 62083
6	282, 15167	6	610, 23500	6	938, 31833	6	1,266, 40167	6	1,594, 48500	6	1,922, 56633	6	2,250, 65167	6	2,578, 73500	6	2,906, 81333	6	3,234, 90167
7	285, 43250	7	613, 51583	7	941, 59917	7	1,269, 68250	7	1,597, 76583	7	1,925, 84917	7	2,253, 93250	7	2,582, 01583	7	2,910, 09917	7	3,238, 18250
8	288, 71333	8	616, 79667	8	944, 88000	8	1,272, 96433	8	1,601, 04667	8	1,929, 13000	8	2,257, 21333	8	2,585, 29667	8	2,913, 38000	8	3,241, 46333
9	291, 99417	9	620, 07750	9	948, 16083	9	1,276, 24317	9	1,604, 32750	9	1,932, 41083	9	2,260, 49417	9	2,589, 57750	9	2,916, 66083	9	3,244, 74417
90	295, 27500	190	623, 35833	290	951, 44167	390	1,279, 52500	490	1,607, 60833	590	1,935, 69167	690	2,263, 77500	790	2,591, 85833	890	2,916, 94167	990	3,248, 02500
1	298, 55583	1	626, 63917	1	954, 72250	1	1,282, 80583	1	1,610, 88917	1	1,938, 97250	1	2,267, 05583	1	2,595, 13917	1	2,923, 22250	1	3,251, 30583
2	301, 83667	2	629, 92000	2	958, 00333	2	1,286, 08667	2	1,614, 17000	2	1,942, 25333	2	2,270, 33583	2	2,598, 42000	2	2,926, 50333	2	3,254, 58667
3	305, 11750	3	633, 20083	3	961, 28417	3	1,289, 36750	3	1,617, 45083	3	1,945, 53417	3	2,273, 61750	3	2,601, 70083	3	2,929, 78417	3	3,257, 86750
4	308, 39833	4	636, 48167	4	964, 56500	4	1,292, 64833	4	1,620, 73167	4	1,948, 81500	4	2,276, 89167	4	2,604, 98167	4	2,933, 06500	4	3,261, 14833
5	311, 67917	5	639, 76250	5	967, 84583	5	1,295, 92917	5	1,624, 01250	5	1,952, 09583	5	2,280, 17917	5	2,608, 26250	5	2,936, 34583	5	3,264, 42917
6	314, 96000	6	643, 04333	6	971, 12667	6	1,299, 21000	6	1,627, 29333	6	1,955, 37667	6	2,283, 46000	6	2,611, 54333	6	2,939, 62667	6	3,267, 71000
7	318, 24083	7	646, 32417	7	974, 40750	7	1,302, 49083	7	1,630, 57417	7	1,958, 65750	7	2,286, 70833	7	2,614, 82417	7	2,942, 90750	7	3,270, 99083
8	321, 52167	8	649, 60500	8	977, 68833	8	1,305, 71667	8	1,633, 85500										

LENGTH—FEET TO METERS

[Reduction factor: 1 foot = 0.3048006096 meter]

Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters						
0	0.30480	100	30.48006	200	60.96012	300	91.44018	400	121.92024	500	152.40030	600	182.88037	700	213.36043	800	243.84049	900	274.32055		
1	0.30481	1	30.78486	1	61.26492	1	91.74492	1	122.22504	1	152.70511	1	183.18517	1	213.66523	1	244.14529	1	274.62535	1	305.10541
2	0.60960	2	31.08966	2	61.86972	2	92.04978	2	122.52504	2	153.00991	2	183.48997	2	213.97003	2	244.45009	2	274.93015	2	305.41046
3	0.91440	3	31.39446	3	62.48444	3	92.35458	3	122.83966	3	153.31471	3	183.79477	3	214.27483	3	244.75489	3	275.23495	3	305.71541
4	1.21920	4	31.69926	4	62.81932	4	92.65926	4	123.13944	4	153.61951	4	184.09957	4	214.57963	4	245.05969	4	275.53975	4	306.02041
5	1.52400	5	32.00406	5	62.48442	5	92.96419	5	123.44422	5	153.92431	5	184.40437	5	214.88443	5	245.36449	5	275.84455	5	306.28046
6	1.82880	6	32.30886	6	62.78892	6	93.26889	6	123.74905	6	154.22911	6	184.70917	6	215.18923	6	245.66923	6	276.14930	6	306.54042
7	2.13360	7	32.61367	7	63.09373	7	93.57379	7	124.05388	7	154.53911	7	185.01939	7	215.49403	7	245.97409	7	276.45415	7	306.80043
8	2.43840	8	32.91847	8	63.39853	8	93.87859	8	124.35865	8	154.83871	8	185.31877	8	215.79883	8	246.27889	8	276.75895	8	307.06044
9	2.74321	9	33.22327	9	63.70333	9	94.18339	9	124.66345	9	155.14351	9	185.62357	9	216.10363	9	246.58369	9	277.06375	9	307.32045
10	3.04801	110	33.52807	110	64.00813	110	94.48819	110	124.96825	110	155.44831	110	185.92837	110	216.40843	110	246.88849	110	277.36855	110	307.58046
1	3.35281	1	33.83287	1	64.31293	1	94.79299	1	125.27305	1	155.75311	1	186.23317	1	216.71323	1	247.19329	1	277.67336	1	307.84047
2	3.65761	2	34.13767	2	64.61773	2	95.09779	2	125.57785	2	156.05791	2	186.53797	2	217.01803	2	247.49809	2	277.97816	2	308.10048
3	3.96241	3	34.44247	3	64.92253	3	95.40259	3	125.88265	3	156.36263	3	186.84277	3	217.32283	3	247.80290	3	278.28296	3	308.36049
4	4.26721	4	34.74727	4	65.22733	4	95.70739	4	126.18745	4	156.66735	4	187.14757	4	217.62764	4	248.10770	4	278.58776	4	308.62050
5	4.57201	5	35.05207	5	65.53213	5	96.01219	5	126.49225	5	156.97211	5	187.45237	5	217.93244	5	248.41250	5	278.89256	5	308.88051
6	4.87681	6	35.35687	6	65.83693	6	96.31699	6	126.79705	6	157.27711	6	187.75719	6	218.23724	6	248.71730	6	279.19736	6	309.14052
7	5.18161	7	35.66167	7	66.14173	7	96.62179	7	127.10185	7	157.58191	7	188.06198	7	218.54204	7	249.02210	7	279.50216	7	309.40053
8	5.48641	8	35.96647	8	66.44653	8	96.92659	8	127.40665	8	157.88672	8	188.36678	8	218.84684	8	249.32690	8	279.80692	8	309.66054
9	5.79121	9	36.27127	9	66.75133	9	97.23139	9	127.71146	9	158.19152	9	188.67158	9	219.15164	9	249.63170	9	280.11176	9	309.92055
20	6.09601	120	36.57607	120	67.05613	120	97.53620	120	128.01626	120	158.49632	120	188.97638	120	219.45644	120	249.93650	120	280.41656	120	310.18177
1	6.40081	1	36.88087	1	67.36093	1	97.84100	1	128.32106	1	158.80112	1	189.28118	1	219.76124	1	250.24130	1	280.72136	1	310.44178
2	6.70561	2	37.18567	2	67.66574	2	98.14580	2	128.62586	2	159.10592	2	189.58598	2	220.06604	2	250.54610	2	281.02616	2	310.70179
3	7.01041	3	37.49047	3	67.97054	3	98.45060	3	128.93066	3	159.41072	3	189.89078	3	220.37094	3	250.85090	3	281.33096	3	310.96180
4	7.31521	4	37.79528	4	68.27534	4	98.75540	4	129.23546	4	159.71552	4	190.19558	4	220.67584	4	251.15570	4	281.63576	4	311.22181
5	7.62001	5	38.10008	5	68.58014	5	99.06020	5	129.54026	5	160.02032	5	190.50038	5	220.98074	5	251.46050	5	281.94056	5	311.48182
6	7.92481	6	38.40488	6	68.88494	6	99.36500	6	129.84506	6	160.32512	6	190.80518	6	221.28564	6	251.76530	6	282.24536	6	311.74183
7	8.22961	7	38.70968	7	69.18974	7	99.66980	7	130.14986	7	160.62992	7	191.10998	7	221.59054	7	252.07010	7	282.55017	7	312.00184
8	8.53441	8	39.01448	8	69.49454	8	99.97460	8	130.45466	8	160.93472	8	191.41478	8	221.89544	8	252.37490	8	282.85497	8	312.26185
9	8.83921	9	39.31928	9	69.79934	9	100.27940	9	130.75946	9	161.23952	9	191.71978	9	222.19964	9	252.67970	9	283.15977	9	312.52186
30	9.14402	130	39.62408	130	70.10414	130	100.58420	130	131.06426	130	161.54432	130	192.02438	130	222.50454	130	252.98451	130	283.46457	130	312.78187
1	9.44882	1	39.92888	1	70.40894	1	100.88900	1	131.36906	1	161.84912	1	192.32918	1	222.80925	1	253.28931	1	283.76937	1	313.04188
2	9.75362	2	40.23368	2	70.71374	2	101.19380	2	131.67386	2	162.15392	2	192.63939	2	223.11405	2	253.59411	2	284.07417	2	313.30189
3	10.05842	3	40.53848	3	71.01854	3	101.49860	3	131.97866	3	162.45872	3	192.93979	3	223.41885	3	253.89891	3	284.37897	3	313.56190
4	10.36322	4	40.84328	4	71.32334	4	101.80340	4	132.28346	4	162.76354	4	193.24359	4	223.72365	4	254.20371	4	284.68377	4	313.82191
5	10.66802	5	41.14808	5	71.62814	5	102.10820	5	132.58827	5	163.06833	5	193.54839	5	224.02845	5	254.50851	5	284.98857	5	314.08192
6	10.97282	6	41.45288	6	71.93294	6	102.41300	6	132.89307	6	163.37313	6	193.85319	6	224.33325	6	254.81331	6	285.29337	6	314.34193
7	11.27762	7	41.75768	7	72.23774	7	102.71781	7	133.19787	7	163.67793	7	194.15799	7	224.63805	7	255.11811	7	285.59817	7	314.60194
8	11.58242	8	42.06248	8	72.54255	8	103.02261	8	133.50267	8	163.98273	8	194.46279	8	224.94285	8	255.42291	8	285.90297	8	314.86195
9	11.88722	9	42.36728	9	72.84735	9	103.32741	9	133.80747	9	164.28753	9	194.76759	9	225.24765	9	255.72771	9	286.20777	9	315.12196
40	12.19202	140	42.67208	140	73.15215	140	103.63221	140	134.11227	140	164.59233	140	195.07230	140	225.55245	140	256.03251	140	286.51257	140	315.38197
1	12.49682	1	42.97688	1	73.45695	1	103.93701	1	134.41707	1	164.89713	1	195.37710	1	225.85725	1	256.33731	1	286.81737	1	315.64198
2	12.80163	2	43.28169	2	73.76175	2	104.24181	2	134.72187	2	165.20193	2	195.68190	2	226.16205	2	256.64211	2	287.12217	2	315.90199
3	13.10643	3	43.58649	3	74.06655	3	104.54661	3	135.02667	3	165.50673	3	195.98679	3	226.46685	3	256.94691	3	287.42697	3	316.16199
4	13.41123	4	43.89129	4	74.37133	4	104.85141	4	135.33147	4	165.81153	4	196.29159	4	226.77165	4	257.25171	4	287.73177	4	316.42199
5	13.71603	5	44.19609	5	74.67615	5	105.15621	5	135.63627	5	166.11633	5	196.59639	5	227.07645	5	257.55652	5	288.03658	5	316.68199
6	14.02083	6	44.50089	6	74.98095	6	105.46101	6	135.94107	6	166.42113	6	196.90119	6	227.38125	6	257.86132	6	288.34138	6	316.94199
7	14.32563	7	44.80569	7	75.28575	7	105.76581	7	136.24587	7	166.72593	7	197.20599	7	227.68606	7	258.16612	7	288.64618	7	317.20199
8	14.63043	8	45.11049	8	75.59055	8	106.07061	8	136.55067	8	167.03073	8	197.51080	8	227.99086	8	258.47092	8	288.95098	8	317.46199
9	14.93523	9	45.41529	9	75.89535	9	106.37541	9	136.85547	9	167.33553	9	197.81560	9	228.29566	9	258.77572	9	289.25578	9	317.72199

FIGURE 31— Tables

50	15	13.6483	1	106.98501	1	137.46507	1	167.64034	1	198.42520	1	228.90526	1	259.38532	1	289.56588
	2	13.64963	2	106.98502	2	137.46508	2	167.64035	2	198.42521	2	228.90527	2	259.38533	2	289.56589
	3	13.65093	3	107.59681	3	138.07688	3	168.24994	3	199.03660	3	229.51066	3	259.99012	3	290.14708
	4	16.15445	4	107.59682	4	138.07689	4	168.24995	4	199.03661	4	229.51067	4	259.99013	4	290.14709
	5	16.43923	5	107.89942	5	138.37948	5	168.55954	5	199.33960	5	229.81366	5	260.29972	5	290.47978
	6	16.76403	6	108.20422	6	138.68248	6	168.86914	6	199.64440	6	230.12446	6	260.60452	6	291.08458
	7	17.06883	7	108.50902	7	138.98908	7	169.16914	7	199.94920	7	230.43296	7	260.90932	7	291.38938
	8	17.37363	8	108.81382	8	139.29388	8	169.47794	8	200.25400	8	230.74046	8	261.21412	8	291.69418
	9	17.67844	9	109.11862	9	139.59868	9	170.07874	9	200.55880	9	231.04886	9	261.51892	9	291.99898
	10	17.98324	10	109.42342	10	139.90348	10	170.38354	10	200.86360	10	231.34366	10	261.82372	10	292.30378
60	16	18.28804	16	109.72822	16	140.20828	16	170.68834	16	201.16840	16	231.64846	16	262.12852	16	292.60858
	17	18.59284	17	110.03302	17	140.51308	17	170.99314	17	201.47320	17	231.95326	17	262.43332	17	292.91338
	18	18.89764	18	110.33776	18	140.81788	18	171.29794	18	201.77800	18	232.25800	18	262.73812	18	293.21818
	19	19.20244	19	110.64262	19	141.12262	19	171.60274	19	202.08280	19	232.56280	19	263.04292	19	293.52298
	20	19.50724	20	110.94746	20	141.42746	20	171.90754	20	202.38760	20	232.86760	20	263.34772	20	293.82778
	21	19.81204	21	111.25232	21	141.73232	21	172.21234	21	202.69240	21	233.17242	21	263.65252	21	294.13258
	22	20.11684	22	111.55716	22	142.03716	22	172.51716	22	202.99720	22	233.47722	22	263.95732	22	294.43738
	23	20.42164	23	111.86202	23	142.34202	23	172.82202	23	203.30200	23	233.78202	23	264.26212	23	294.74218
	24	20.72644	24	112.16686	24	142.64686	24	173.12686	24	203.60680	24	234.08686	24	264.56692	24	295.04698
	25	21.03124	25	112.47172	25	142.95172	25	173.43152	25	203.91160	25	234.39166	25	264.87172	25	295.35178
70	21	21.33604	27	112.77652	27	143.25628	27	173.73632	27	204.21640	27	234.69646	27	265.17652	27	295.65658
	22	21.64084	28	113.08132	28	143.56108	28	174.04112	28	204.52120	28	235.00126	28	265.48132	28	295.96138
	23	21.94564	29	113.38612	29	143.86588	29	174.34592	29	204.82600	29	235.30600	29	265.78612	29	296.26618
	24	22.25044	30	113.69092	30	144.17068	30	174.65072	30	205.13080	30	235.61080	30	266.09092	30	296.57098
	25	22.55524	31	114.00000	31	144.47548	31	174.95552	31	205.43560	31	235.91560	31	266.39572	31	296.87578
	26	22.86004	32	114.30916	32	144.78028	32	175.26032	32	205.74040	32	236.22042	32	266.70052	32	297.18058
	27	23.16484	33	114.61832	33	145.08508	33	175.56512	33	206.04520	33	236.52522	33	267.00532	33	297.48538
	28	23.46964	34	114.92748	34	145.38988	34	175.86992	34	206.35000	34	236.83002	34	267.31012	34	297.79018
	29	23.77444	35	115.23664	35	145.69468	35	176.17472	35	206.65480	35	237.13482	35	267.61492	35	298.09500
	30	24.07924	36	115.54580	36	146.00000	36	176.47952	36	206.95960	36	237.43962	36	267.91972	36	298.39980
80	24	24.38404	37	115.85500	37	146.30428	37	176.78432	37	207.26440	37	237.74442	37	268.22452	37	298.70460
	25	24.68884	38	116.16416	38	146.60908	38	177.08912	38	207.56920	38	238.04922	38	268.52932	38	299.00940
	26	24.99364	39	116.47332	39	146.91388	39	177.39392	39	207.87400	39	238.35402	39	268.83412	39	299.31420
	27	25.29844	40	116.78248	40	147.21868	40	177.69872	40	208.17880	40	238.65882	40	269.13892	40	299.61900
	28	25.60324	41	117.09164	41	147.52352	41	178.00356	41	208.48360	41	238.96362	41	269.44372	41	299.92380
	29	25.90804	42	117.40080	42	147.82832	42	178.30836	42	208.78840	42	239.26842	42	269.74852	42	300.22860
	30	26.21284	43	117.71000	43	148.13312	43	178.61316	43	209.09320	43	239.57322	43	270.05332	43	300.53340
	31	26.51764	44	118.01916	44	148.43792	44	178.91796	44	209.39800	44	239.87802	44	270.35812	44	300.83820
	32	26.82244	45	118.32832	45	148.74272	45	179.22276	45	209.70280	45	240.18288	45	270.66292	45	301.14300
	33	27.12724	46	118.63748	46	149.04752	46	179.52756	46	210.00760	46	240.48768	46	270.96772	46	301.44780
90	27	27.43204	47	118.94664	47	149.35232	47	179.83236	47	210.31240	47	240.79248	47	271.27252	47	301.75260
	28	27.73684	48	119.25580	48	149.65712	48	180.13716	48	210.61720	48	241.09728	48	271.57732	48	302.05740
	29	28.04164	49	119.56500	49	149.96192	49	180.44196	49	210.92200	49	241.40208	49	271.88212	49	302.36220
	30	28.34644	50	120.00000	50	150.26672	50	180.74676	50	211.22680	50	241.70688	50	272.18692	50	302.66700
	31	28.65124	51	120.31516	51	150.57152	51	181.05156	51	211.53160	51	242.01168	51	272.49172	51	302.97180
	32	28.95604	52	120.63032	52	150.87632	52	181.35636	52	211.83640	52	242.31648	52	272.79652	52	303.27660
	33	29.26084	53	120.94548	53	151.18112	53	181.66116	53	212.14120	53	242.62128	53	273.10132	53	303.58140
	34	29.56564	54	121.26064	54	151.48592	54	181.96596	54	212.44600	54	242.92608	54	273.40612	54	303.88620
	35	29.87044	55	121.57580	55	151.79072	55	182.27076	55	212.75080	55	243.23088	55	273.71092	55	304.19100
	36	30.17524	56	121.89100	56	152.09552	56	182.57552	56	213.05560	56	243.53568	56	274.01572	56	304.49580

1 inch = 0.02540 meter
 2 inches = .05080 meter
 3 inches = .07620 meter
 4 inches = 0.10160 meter
 5 inches = .12700 meter
 6 inches = .15240 meter
 7 inches = 0.17780 meter
 8 inches = .20320 meter
 9 inches = .22860 meter
 10 inches = 0.25400 meter
 11 inches = .27940 meter
 12 inches = .30480 meter

FIGURE 32— Tables

* NAUTICAL MILES TO STATUTE MILES

Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles
1	1.151	100	115.078	200	230.155	300	345.233	400	460.311	500	575.389	600	690.466	700	805.544	800	920.622	900	1035.699
2	2.302	1	116.228	1	231.306	1	346.384	1	461.462	1	576.539	1	691.617	1	806.695	1	921.772	1	1036.850
3	3.453	2	117.379	2	232.457	2	347.535	2	462.612	2	577.690	2	692.768	2	807.846	2	922.923	2	1038.001
4	4.603	3	118.530	3	233.608	3	348.685	3	463.763	3	578.841	3	693.919	3	809.001	3	924.074	3	1039.152
5	5.754	4	119.681	4	234.759	4	349.836	4	464.914	4	579.992	4	695.069	4	810.147	4	925.225	4	1040.303
6	6.905	5	120.832	5	235.909	5	350.987	5	466.065	5	581.142	5	696.220	5	811.298	5	926.376	5	1041.453
7	8.055	6	121.982	6	237.060	6	352.138	6	467.216	6	582.293	6	697.371	6	812.449	6	927.526	6	1042.604
8	9.206	7	123.133	7	238.211	7	353.289	7	468.366	7	583.444	7	698.522	7	813.599	7	928.677	7	1043.755
9	10.357	8	124.284	8	239.362	8	354.439	8	469.517	8	584.595	8	699.673	8	814.750	8	929.828	8	1044.906
10	11.508	9	125.435	9	240.512	9	355.590	9	470.668	9	585.746	9	700.823	9	815.901	9	930.979	9	1046.056
11	12.659	110	126.585	210	241.663	310	356.741	410	471.819	510	586.896	610	701.974	710	817.052	810	932.129	910	1047.207
12	13.809	1	127.736	1	242.814	1	357.892	1	472.969	1	588.047	1	703.125	1	818.203	1	933.280	1	1048.358
13	14.960	2	128.887	2	243.965	2	359.042	2	474.120	2	589.198	2	704.276	2	819.353	2	934.431	2	1049.509
14	16.111	3	130.038	3	245.116	3	360.193	3	475.271	3	590.349	3	705.426	3	820.504	3	935.582	3	1050.660
15	17.262	4	131.189	4	246.266	4	361.344	4	476.422	4	591.499	4	706.577	4	821.655	4	936.733	4	1051.810
16	18.413	5	132.339	5	247.417	5	362.495	5	477.573	5	592.650	5	707.728	5	822.806	5	937.883	5	1052.961
17	19.564	6	133.490	6	248.568	6	363.646	6	478.723	6	593.801	6	708.879	6	823.956	6	939.034	6	1054.112
18	20.715	7	134.641	7	249.719	7	364.796	7	479.874	7	594.952	7	710.029	7	825.107	7	940.185	7	1055.263
19	21.866	8	135.792	8	250.869	8	365.947	8	481.025	8	596.103	8	711.180	8	826.258	8	941.336	8	1056.413
20	23.016	9	136.942	9	252.020	9	367.098	9	482.176	9	597.253	9	712.331	9	827.409	9	942.486	9	1057.564
21	24.166	120	138.093	220	253.171	320	368.249	420	483.326	520	598.404	620	713.482	720	828.560	820	943.637	920	1058.715
22	25.317	1	139.244	1	254.322	1	369.399	1	484.477	1	599.555	1	714.633	1	829.710	1	944.788	1	1059.866
23	26.468	2	140.395	2	255.473	2	370.550	2	485.628	2	600.706	2	715.783	2	830.861	2	945.939	2	1061.017
24	27.619	3	141.546	3	256.623	3	371.701	3	486.779	3	601.856	3	716.934	3	832.012	3	947.090	3	1062.167
25	28.769	4	142.696	4	257.774	4	372.852	4	487.930	4	603.007	4	718.085	4	833.163	4	948.240	4	1063.318
26	29.920	5	143.847	5	258.925	5	374.003	5	489.080	5	604.158	5	719.236	5	834.313	5	949.391	5	1064.469
27	31.071	6	144.998	6	260.076	6	375.153	6	490.231	6	605.309	6	720.386	6	835.464	6	950.542	6	1065.620
28	32.222	7	146.149	7	261.226	7	376.304	7	491.382	7	606.460	7	721.537	7	836.615	7	951.693	7	1066.770
29	33.373	8	147.299	8	262.377	8	377.455	8	492.533	8	607.610	8	722.688	8	837.766	8	952.843	8	1067.921
30	34.523	9	148.450	9	263.528	9	378.606	9	493.683	9	608.761	9	723.839	9	838.917	9	953.994	9	1069.072
31	35.674	130	149.601	230	264.679	330	379.756	430	494.834	530	609.912	630	724.990	730	840.067	830	955.145	930	1070.223
32	36.825	1	150.752	1	265.830	1	380.907	1	495.985	1	611.063	1	726.140	1	841.218	1	956.296	1	1071.374
33	37.976	2	151.903	2	266.980	2	382.058	2	497.136	2	612.213	2	727.291	2	842.369	2	957.447	2	1072.524
34	39.126	3	153.053	3	268.131	3	383.209	3	498.287	3	613.364	3	728.442	3	843.520	3	958.597	3	1073.675
35	40.277	4	154.204	4	269.282	4	384.360	4	499.437	4	614.515	4	729.593	4	844.670	4	959.748	4	1074.826
36	41.428	5	155.355	5	270.433	5	385.510	5	500.588	5	615.666	5	730.743	5	845.821	5	960.899	5	1075.977
37	42.579	6	156.506	6	271.583	6	386.661	6	501.739	6	616.817	6	731.894	6	846.972	6	962.050	6	1077.127
38	43.730	7	157.656	7	272.734	7	387.812	7	502.890	7	617.967	7	733.045	7	848.123	7	963.200	7	1078.278
39	44.880	8	158.807	8	273.885	8	388.963	8	504.040	8	619.118	8	734.196	8	849.274	8	964.351	8	1079.429
40	46.031	9	159.958	9	275.036	9	390.113	9	505.191	9	620.269	9	735.347	9	850.424	9	965.502	9	1080.580
41	47.182	140	161.109	240	276.187	340	391.264	440	506.342	540	621.420	640	736.497	740	851.575	840	966.653	940	1081.731
42	48.333	1	162.260	1	277.337	1	392.415	1	507.493	1	622.570	1	737.648	1	852.726	1	967.804	1	1082.881
43	49.483	2	163.411	2	278.488	2	393.566	2	508.643	2	623.721	2	738.799	2	853.877	2	968.954	2	1084.032
44	50.634	3	164.561	3	279.639	3	394.717	3	509.794	3	624.872	3	739.950	3	855.027	3	970.105	3	1085.183
45	51.785	4	165.712	4	280.790	4	395.867	4	510.945	4	626.023	4	741.100	4	856.178	4	971.256	4	1086.334
46	52.935	5	166.863	5	281.940	5	397.018	5	512.096	5	627.174	5	742.251	5	857.329	5	972.407	5	1087.485
47	54.086	6	168.013	6	283.091	6	398.169	6	513.247	6	628.324	6	743.402	6	858.480	6	973.557	6	1088.636
48	55.237	7	169.164	7	284.242	7	399.320	7	514.397	7	629.475	7	744.553	7	859.631	7	974.708	7	1089.787
49	56.388	8	170.315	8	285.393	8	400.470	8	515.548	8	630.626	8	745.704	8	860.781	8	975.859	8	1090.938
50	57.538	9	171.466	9	286.544	9	401.621	9	516.699	9	631.777	9	746.854	9	861.932	9	977.010	9	1092.088

FIGURE 33 — Tables











50	57-539	150	172-617	250	287-694	350	402-772	450	517-850	550	632-927	650	748-005	750	863-283	850	978-161	950	1093-238
1	58-590	1	173-767	1	288-845	1	403-923	1	519-000	1	634-078	1	749-166	1	864-234	1	979-311	1	1094-389
2	59-840	2	174-918	2	289-996	2	405-074	2	520-151	2	635-229	2	750-307	2	865-381	2	980-462	2	1095-540
3	60-991	3	176-069	3	291-147	3	406-222	3	521-302	3	636-380	3	751-457	3	866-535	3	981-613	3	1096-691
4	62-142	4	178-220	4	292-297	4	407-375	4	522-453	4	637-531	4	752-608	4	867-686	4	982-764	4	1097-841
5	63-293	5	179-370	5	293-448	5	408-526	5	523-604	5	638-681	5	753-759	5	868-837	5	983-842	5	1098-992
6	64-444	6	179-521	6	294-599	6	409-677	6	524-754	6	639-838	6	754-874	6	869-988	6	984-914	6	1100-173
7	65-594	7	180-672	7	295-750	7	410-827	7	525-905	7	640-983	7	755-961	7	870-138	7	985-065	7	1101-324
8	66-745	8	181-823	8	296-901	8	411-978	8	526-056	8	641-137	8	756-101	8	871-289	8	986-216	8	1102-474
9	67-896	9	182-974	9	298-051	9	413-129	9	528-207	9	642-284	9	757-213	9	872-440	9	987-367	9	1103-625
60	69-047	160	184-124	260	299-202	360	414-280	460	529-357	560	644-435	660	759-513	760	874-591	860	989-668	960	1104-765
1	70-197	1	185-275	1	300-353	1	415-431	1	530-508	1	645-586	1	760-604	1	875-747	1	990-819	1	1105-897
2	71-348	2	186-426	2	301-504	2	416-582	2	531-659	2	646-737	2	761-752	2	876-892	2	991-970	2	1106-948
3	72-499	3	187-577	3	302-654	3	417-732	3	532-810	3	647-888	3	762-847	3	877-103	3	992-121	3	1108-998
4	73-650	4	188-727	4	303-805	4	418-883	4	533-961	4	648-038	4	763-935	4	878-194	4	993-161	4	1109-349
5	74-801	5	189-878	5	304-956	5	420-034	5	535-111	5	649-189	5	764-119	5	880-345	5	994-271	5	1110-700
6	75-952	6	191-029	6	306-107	6	421-184	6	536-262	6	650-340	6	765-248	6	881-495	6	995-422	6	1111-851
7	77-102	7	192-180	7	307-257	7	422-335	7	537-413	7	651-491	7	766-348	7	882-646	7	996-573	7	1112-802
8	78-253	8	193-331	8	308-408	8	423-486	8	538-564	8	652-642	8	767-448	8	883-797	8	997-724	8	1113-952
9	79-404	9	194-481	9	309-559	9	424-637	9	539-714	9	653-791	9	768-547	9	884-948	9	998-875	9	1114-103
70	80-554	170	195-632	270	310-710	370	425-788	470	540-865	570	655-943	670	771-031	770	886-098	870	1001-176	970	1116-254
1	81-705	1	196-783	1	311-861	1	426-938	1	542-016	1	657-094	1	772-121	1	887-249	1	1002-327	1	1117-405
2	82-856	2	197-934	2	313-011	2	428-089	2	543-167	2	658-245	2	773-212	2	888-400	2	1003-478	2	1118-555
3	84-007	3	199-084	3	314-162	3	429-240	3	544-318	3	659-395	3	774-303	3	889-551	3	1004-628	3	1119-706
4	85-158	4	200-235	4	315-313	4	430-391	4	545-468	4	660-546	4	775-394	4	890-702	4	1005-779	4	1120-857
5	86-308	5	201-386	5	316-464	5	431-541	5	546-619	5	661-697	5	776-485	5	891-852	5	1006-930	5	1121-008
6	87-459	6	202-537	6	317-614	6	432-692	6	547-770	6	662-848	6	777-576	6	892-103	6	1008-081	6	1122-158
7	88-610	7	203-688	7	318-765	7	433-843	7	548-921	7	663-998	7	778-667	7	893-154	7	1009-232	7	1123-309
8	89-761	8	204-838	8	319-916	8	434-994	8	550-071	8	665-149	8	779-758	8	894-305	8	1010-382	8	1124-460
9	90-911	9	205-989	9	321-067	9	436-145	9	551-222	9	666-300	9	780-849	9	895-455	9	1011-532	9	1125-611
80	92-062	180	207-140	280	322-218	380	437-295	480	552-373	580	667-451	680	782-528	780	897-606	880	1012-684	980	1127-762
1	93-213	1	208-291	1	323-368	1	438-446	1	553-524	1	668-602	1	783-619	1	898-757	1	1013-835	1	1128-912
2	94-364	2	209-441	2	324-519	2	439-597	2	554-675	2	669-752	2	784-710	2	899-908	2	1014-985	2	1130-063
3	95-515	3	210-592	3	325-670	3	440-748	3	555-826	3	670-903	3	785-801	3	901-059	3	1016-136	3	1131-214
4	96-665	4	211-743	4	326-821	4	441-898	4	556-976	4	672-054	4	786-892	4	902-209	4	1017-287	4	1132-365
5	97-816	5	212-894	5	327-971	5	442-049	5	558-127	5	673-205	5	787-983	5	903-360	5	1018-438	5	1133-515
6	98-967	6	214-045	6	329-122	6	443-200	6	559-278	6	674-355	6	788-282	6	904-511	6	1019-589	6	1134-666
7	100-118	7	215-195	7	330-273	7	444-351	7	560-428	7	675-506	7	789-433	7	905-662	7	1020-739	7	1135-817
8	101-268	8	216-346	8	331-424	8	445-502	8	561-579	8	676-657	8	790-524	8	906-812	8	1021-890	8	1136-968
9	102-419	9	217-497	9	332-575	9	447-652	9	562-730	9	677-808	9	791-615	9	907-963	9	1023-041	9	1138-119
90	103-570	190	218-648	290	333-725	390	448-803	490	563-881	590	678-959	690	794-036	790	909-114	890	1024-192	990	1139-269
1	104-721	1	219-798	1	334-876	1	449-954	1	565-032	1	680-109	1	795-127	1	910-265	1	1025-342	1	1140-420
2	105-871	2	220-949	2	335-027	2	451-104	2	566-183	2	681-259	2	796-218	2	911-415	2	1026-493	2	1141-571
3	107-022	3	222-100	3	337-178	3	452-255	3	567-334	3	682-411	3	797-309	3	912-566	3	1027-644	3	1142-722
4	108-173	4	223-251	4	338-328	4	453-406	4	568-484	4	683-562	4	798-400	4	913-717	4	1028-795	4	1143-872
5	109-324	5	224-402	5	339-479	5	454-557	5	569-635	5	684-713	5	799-491	5	914-868	5	1029-946	5	1145-023
6	110-474	6	225-552	6	340-630	6	455-708	6	570-786	6	685-863	6	800-582	6	915-019	6	1031-096	6	1146-174
7	111-625	7	226-703	7	341-781	7	456-859	7	571-936	7	686-101	7	801-673	7	916-169	7	1032-247	7	1147-325
8	112-775	8	227-854	8	342-932	8	458-009	8	573-087	8	687-152	8	802-764	8	917-319	8	1033-398	8	1148-476
9	113-927	9	229-005	9	344-082	9	459-160	9	574-238	9	688-303	9	803-854	9	918-470	9	1034-549	9	1149-626

1955

Ratio 1 to 1.150777146

*International Nautical Mile -- 1852 meters

FIGURE 34 — Tables

CHARACTERISTIC LIGHT PHASES			
Illustration	Lights which do not change color	Phase Description	Lights which show color variations
	F. = Fixed	A continuous steady light.	Alt. = Alternating
	F. Fl. = Fixed and flashing	A fixed light varied at regular intervals by a flash of greater brilliance or different color.	Alt. F. Fl. = Alternating fixed and flashing
	F. Gp. Fl. = Fixed and group flashing	A fixed light varied at regular intervals by groups of two or more flashes of greater brilliance or different color, or both.	Alt. F. Gp. Fl. = Alternating fixed and group flashing
	Fl. = Flashing	Showing a single flash at regular intervals, the duration of light always being less than the duration of darkness. Shows not more than 30 flashes per minute.	Alt. Fl. = Alternating flashing
	Gp. Fl. = Group flashing	Showing at regular intervals groups of two or more flashes.	Alt. Gp. Fl. = Alternating group flashing
	Qk. Fl. = Quick flashing	Shows not less than 60 flashes per minute.	
	I. Qk. Fl. = Interrupted quick flashing	Shows quick flashes for about 6 seconds, followed by a dark period of about 6 seconds.	
	S-L. Fl. = Short-long flashing	Shows a short flash of about 0.4 second, followed by a long flash of 4 times that duration.	
	Occ. = Occulting	A steady light totally eclipsed at regular intervals.	Alt. Occ. = Alternating occulting
	Gp. Occ. = Group occulting	A steady light totally eclipsed by a group of 2 or more eclipses.	

Light colors used and abbreviations: W=White, R=Red, G=Green

FIGURE 35— Characteristic Light Phases

The tables below give several sizes of paper and, for each size, the neatline dimensions and the normal and extreme work size. The price of each chart is always based on the area within its neatlines.

Paper	Neatlines		Normal Work Size*	Extreme Work Size*
	Inches	mm.		
22"x 29"	18 $\frac{1}{8}$ " x 25 $\frac{7}{8}$ "	460.4 x 657.2	20" x 27"	20 $\frac{3}{4}$ " x 28"
30"x 42"	26 $\frac{1}{8}$ " x 38 $\frac{7}{8}$ "	663.6 x 987.4	28" x 40"	28 $\frac{3}{4}$ " x 41"
36"x 44"	32 $\frac{1}{8}$ " x 40 $\frac{7}{8}$ "	816.0 x 1038.2	34" x 42"	34 $\frac{3}{4}$ " x 43"
36"x 48"	32 $\frac{1}{8}$ " x 44 $\frac{7}{8}$ "	816.0 x 1139.8	34" x 46"	34 $\frac{3}{4}$ " x 47"
36"x 54"	32 $\frac{1}{8}$ " x 50 $\frac{7}{8}$ "	816.0 x 1292.2	34" x 52"	34 $\frac{3}{4}$ " x 53"

Paper	Area within Neatlines	Area within Neatlines	Price
	in Sq. Inches	in Sq. Inches	
22"x 29"	469.0	500 and under	\$0.25
30"x 42"	1015.6	501 - 800	0.50
36"x 44"	1313.1	801 - 1200	0.75
36"x 48"	1441.6	1201 and over	1.00
36"x 54"	1634.4		

*Includes outside lettering. Approximate size only; to find exact measurements for placing outside lettering, see Fig. 3.

By laying over the chart a special graph drawn on a transparent sheet, the cartographer can determine the price of the chart from its neatline dimensions.

There is also available a template showing the sizes of paper and the dimensions of the neatlines as shown below.

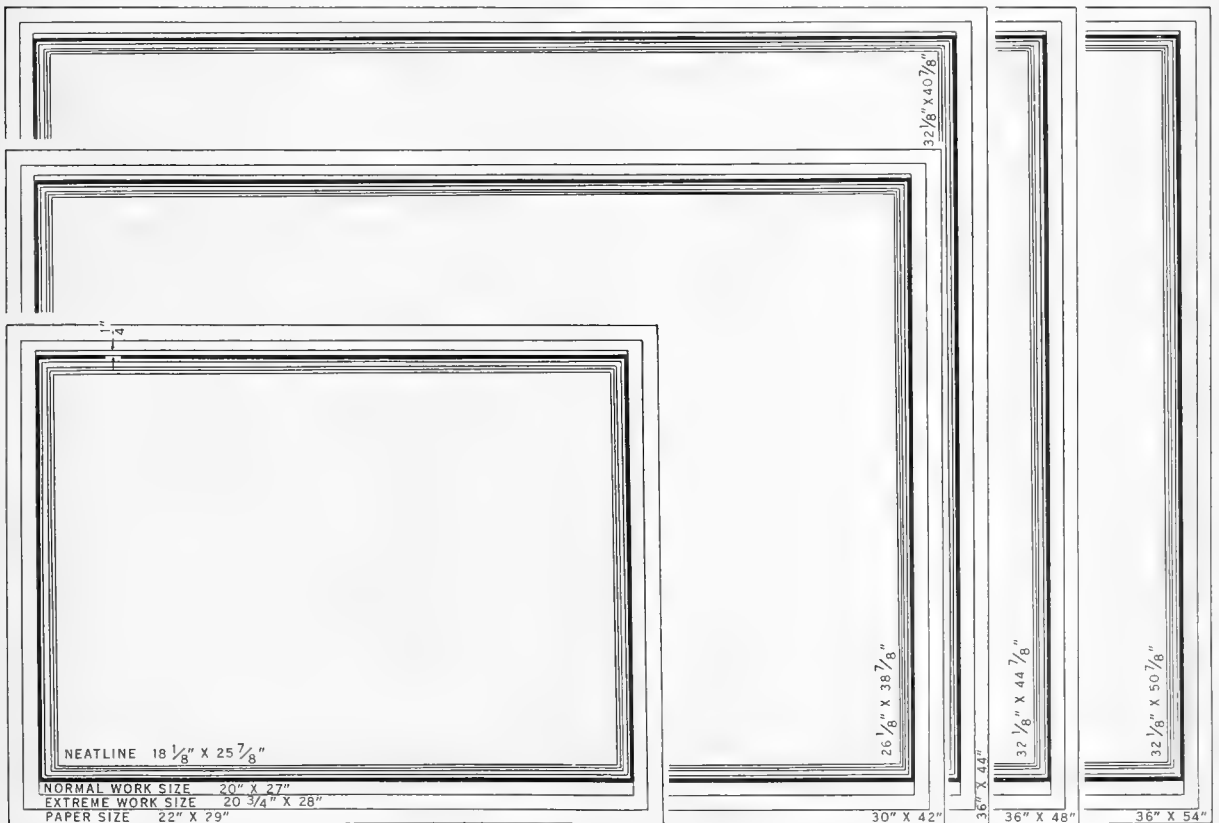


FIGURE 36 — Chart Sizes and Prices

MAP SCALES AND EQUIVALENTS

At Scale	One nautical mile =		One statute mile =	
	Inches	Centimeters	Inches	Centimeters
1:2,500	29.165	74.08	25.344	64.37
1:5,000	14.583	37.04	12.672	32.19
1:10,000	7.291	18.52	6.336	16.09
1:15,000	4.861	12.35	4.224	10.73
1:20,000	3.646	9.26	3.168	8.05
1:30,000	2.430	6.17	2.112	5.36
1:40,000	1.823	4.63	1.584	4.02
1:50,000	1.458	3.70	1.267	3.22
1:60,000	1.215	3.09	1.056	2.68
1:80,000	.911	2.32	.792	2.01
1:100,000	.729	1.85	.634	1.61
1:200,000	.365	.93	.317	.80
1:400,000	.182	.46	.158	.40
1:500,000	.146	.37	.127	.32
1:1,000,000	.073	.19	.063	.16
1:1,200,000	.061	.15	.053	.13

A nautical mile is a minute of an average great circle of the earth, and its length is 6,076.11 feet, or 1,852.0 meters. A statute mile is 5,280 feet, or 1,609.3 meters. One meter equals 39.37 inches; 1 centimeter equals 0.3937 inch; 1 inch equals 2.54 centimeters.

LOGARITHMIC SPEED SCALE



To find SPEED, place one point of dividers on nautical miles run and the other on minutes run. Without changing divider spread, place right point on 60 and left point will then indicate speed in knots. Example: with 4.0 miles run in 15 minutes, the speed is 16.0 knots.

Distance of Visibility of Objects at Sea

The following table gives the approximate geographic range of visibility for an object which may be seen by an observer whose eye is at sea level; in practice, therefore, it is necessary to add to these a distance of visibility corresponding to the height of the observer's eye above sea level.

Height, feet	Nautical miles	Height, feet	Nautical miles	Height, feet	Nautical miles	Height, feet	Nautical miles	Height, feet	Nautical miles
6	2.8	48	7.9	220	17.0	660	29.4	2,000	51.2
8	3.1	50	8.1	240	17.7	680	29.9	2,200	53.8
10	3.6	55	8.5	260	18.5	700	30.3	2,400	56.2
12	4.0	60	8.9	280	19.2	720	30.7	2,600	58.5
14	4.3	65	9.2	300	19.9	740	31.1	2,800	60.6
15	4.4	70	9.6	320	20.5	760	31.6	3,000	62.8
16	4.6	75	9.9	340	21.1	780	32.0	3,200	64.9
18	4.9	80	10.3	360	21.7	800	32.4	3,400	66.9
20	5.1	85	10.6	380	22.3	820	32.8	3,600	68.6
22	5.4	90	10.9	400	22.9	840	33.2	3,800	70.7
24	5.6	95	11.2	420	23.5	860	33.6	4,000	72.5
26	5.8	100	11.5	440	24.1	880	34.0	4,200	74.3
28	6.1	110	12.0	460	24.6	900	34.4	4,400	76.1
30	6.3	120	12.6	480	25.1	920	34.7	4,600	77.7
32	6.5	130	13.1	500	25.6	940	35.2	4,800	79.4
34	6.7	140	13.6	520	26.1	960	35.5	5,000	81.0
36	6.9	150	14.1	540	26.7	980	35.9	6,000	88.8
38	7.0	160	14.5	560	27.1	1,000	36.2	7,000	96.0
40	7.2	170	14.9	580	27.6	1,200	39.6	8,000	102.6
42	7.4	180	15.4	600	28.0	1,400	42.9	9,000	108.7
44	7.6	190	15.8	620	28.6	1,600	45.8	10,000	114.6
46	7.8	200	16.2	640	29.0	1,800	48.6		

FIGURE 37— Tables

LAND FEATURES

1. LANDMARKS - 6 pt. No. 2 Heavy Copperplate Gothic Condensed _____ TOWER
Congested areas - 6 pt. No. 3 Heavy Copperplate Gothic Condensed _____ TOWER
2. BRIDGE & OVERHEAD CABLE CLEARANCES - 6 pt. No. 3 Light Copperplate Gothic Condensed _____ DRAW BRIDGE
3. LIGHT NAMES - 6 pt. No. 3 Light Copperplate Gothic Condensed _____ BLOODY PT
4. RADIO, RADAR & TV STATIONS - 6 pt. News Gothic _____ R. Bn.
5. LIGHT CHARACTERISTICS - 6 pt. No. 4 Lining Gothic _____ FI R"4"
6. BUILDING & OBJECT NAMES - 6 pt. No. 4 Lining Gothic _____ Lincoln Memorial
7. ELEVATION OF ROCKS THAT COVER & UNCOVER - 6 pt. No. 3 Lightline Gothic _____ (!)
8. STREET NAMES - 6 pt. No. 3 Lightline Gothic _____ Main Avenue

WATER FEATURES

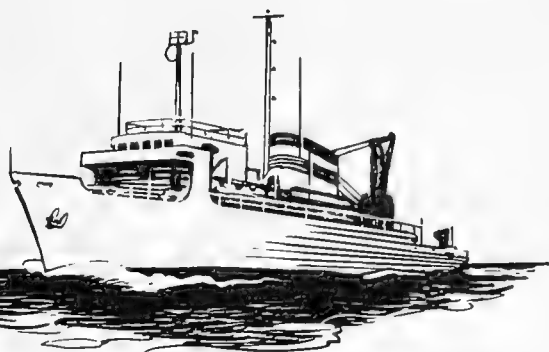
9. BUOY CHARACTERISTICS - 6 pt. Draftsman's Italic _____ FI G 5sec
10. CHANNEL NOTES - 6 pt. or 8 pt. Draftsman's Italic _____ 39 FT JAN 1955
11. FIXED FLOATING OBJECTS - 6 pt. Draftsman's Italic _____ FLOATING TARGET
12. LAND CONTOURS & ELEVATIONS - 6 pt. Draftsman's Italic _____ 50 75 (25)
13. RANGES - 6 pt. Draftsman's Italic _____ RANGE "A"
14. SECTOR DESCRIPTIONS - 6 pt. Draftsman's Italic _____ RED SECTOR
15. TRIAL COURSES - 6 pt. Draftsman's Italic _____ COURSE 152° 12' TRUE
16. BOTTOM CHARACTERISTICS - 7 pt. Draftsman's Italic _____ hrd hrd M S
17. UNDERWATER FEATURES - 7 pt. Draftsman's Italic _____ Shoal Area
18. COURSES - 7 pt. Draftsman's Italic _____ 68½° TRUE 5.8M
19. OBJECT NAMES (WATER) - 7 pt. Draftsman's Italic _____ Canal Ditch
20. INTRACOASTAL WATERWAY NAME - 6 pt. No. 3 Copperplate Gothic Bold Italic _____ INTRACOASTAL WATE
21. DEPTH CONTOURS - 5 pt. Clearface Italic _____ 5 10 15 20

MISCELLANEOUS

22. EXPLANATION NOTE REPLACING ABBREVIATION NOTE - 8 pt. Lining Gothic _____ For Symbols and Ab
23. ABBREVIATION NOTE - 6 pt. No. 3 Lining Gothic _____ ABBREVIATIONS (For
24. TIDE NOTE - 6 pt. No. 3 Lining Gothic _____ TIDAL INFORMATION
25. INDEX DIAGRAM CHART NOS. - 6 pt. No. 4 Lining Gothic _____ 395 940
26. INDEX DIAGRAM PROJECTION NOS. - 6 pt. No. 4 Lining Gothic _____ 35° 50'
27. FISH TRAP AREA NOTES - 6 pt. No. 4 Lining Gothic _____ FISH TRAP AREAS
28. ALL NOTES ON MAGENTA PLATE - 7 pt. Draftsman's Italic (Area Label) _____ Cable Area
29. RESTRICTED AREA - MAGENTA PLATE - 8 pt. Draftsman's Italic (Area Label) _____ RESTRICTED AREA
30. PROHIBITED AREA - MAGENTA PLATE - 8 pt. Draftsman's Italic (Area Label) _____ PROHIBITED AREA
31. JUNCTION NOTES - 7 pt. Draftsman's Italic _____ (JOINS CHART 495)
32. C. & G. S. & CHART NOS. - 24 pt. Light Litho _____ **S. 494**
33. ANCHORAGE AREA NOTES - MAGENTA PLATE - HEADING - 12 pt. Light Litho _____ **ANCHORA**
NOTE - 8 pt. News Gothic _____ Limits and design
34. PROVISIONAL CHART - 10 pt. Light Litho _____ **PROVISIONA**
35. PROJECTION NUMBERS - DEGREES - 12 pt. Light Litho _____ **24°**
36. PROJECTION NUMBERS - MINUTES - (Alone, with Degrees or Seconds) - 8 pt. Light Litho _____ **01'**
37. PROJECTION NUMBERS - SECONDS - (With Minutes) - 7 pt. Century Expanded _____ **10"**
38. PROJECTION SUB-DIVISION NUMBERS - SECONDS - 6 pt. No. 2 Light Copperplate Gothic _____ **10"**
39. CHART PRICE - 12 pt. No. 3 Light Copperplate Gothic Condensed _____ **PRICE \$1.00**
40. SUB-TITLE - 18 pt. Coast Survey Italic _____ **(Robinson**
41. GRID NOS. - 6 pt. No. 3 Light Copperplate Gothic Condensed _____ 10 000 20 000
42. SOUNDINGS IN FEET & CHART SCALE - 8 pt. News Gothic Condensed _____ SOUNDINGS IN FEET
43. EDITION DATES - (Bottom of Chart) - 8 pt. Lining Gothic _____ 1st Ed., Mar 1/
44. YEAR DATE - 12 pt. News Gothic Condensed _____ **55;**
45. CHART CATALOG PAGE NO. - 6 pt. News Gothic _____ Catalog Page No. 5
46. EDITION DATE & MEDIUM - (Top of Chart) - 6 pt. News Gothic _____ 1st Ed., Nov. 1874

CHART NO. 1

SEPTEMBER 1965



UNITED STATES OF AMERICA

NAUTICAL CHART SYMBOLS
AND
ABBREVIATIONS



GENERAL REMARKS

Chart No. 1 contains the standard symbols and abbreviations which have been approved for use on nautical charts published by the United States of America.

Symbols and abbreviations shown on Chart No. 1 apply to the regular nautical charts and may differ from those shown on certain reproductions and special charts.

Terms, symbols and abbreviations are numbered in accordance with a standard form approved by a Resolution of the Sixth International Hydrographic Conference, 1952.

Vertical figures indicate those items where the symbol and abbreviation are in accordance with the Resolutions of the International Hydrographic Conferences.

Slanting figures indicate those items where the symbol and/or abbreviation differ from the Resolutions of the Conferences, or for which Resolutions do not yet exist.

(Those items which differ from the Resolutions are underlined.)

Slanting letters in parentheses indicate that the items are in addition to those shown on the approved standard form.

Colors are optional for characterizing various features and areas on the charts.

Lettering styles and capitalization as used on Chart No. 1 are not always rigidly adhered to on the charts.

Longitudes are referred to the Meridian of Greenwich.

Scales are computed on the middle latitude of each chart, or on the middle latitude of a series of charts.

Buildings - A conspicuous feature on a building may be shown by a landmark symbol with descriptive note (See L-63 & I-n). Prominent buildings that are of assistance to the mariner are crosshatched (See I-3a, 5, 47 & 66).

Shoreline is the line of Mean High Water, except in marsh or mangrove areas, where the outer edge of vegetation (berm line) is used. A heavy line (A-9) is used to represent a firm shoreline. A light line (A-7) represents a berm line.

Heights of land and conspicuous objects are given in feet above Mean High Water, unless otherwise stated in the title of the chart.

Depth Contours and Soundings may be shown in meters on charts of foreign waters.

Visibility of a light is in nautical miles for an observer's eye 15 feet above water level.

Buoys and Beacons - On entering a channel from seaward, buoys on starboard side are red with even numbers, on port side black with odd numbers. Lights on buoys on starboard side of channel are red or white, on port side white or green. Mid-channel buoys have black-and-white vertical stripes. Junction or obstruction buoys, which may be passed on either side, have red-and-black horizontal bands. This system does not always apply to foreign waters. The dot of the buoy symbol, the small circle of the light vessel and mooring buoy symbols, and the center of the beacon symbol indicate their positions.

Improved channels are shown by limiting dashed lines, the depth, month, and the year of latest examination being placed adjacent to the channel, except when tabulated.

U. S. Coast Pilots, Sailing Directions, Light Lists, Radio Aids, and related publications furnish information required by the navigator that cannot be shown conveniently on the nautical chart.

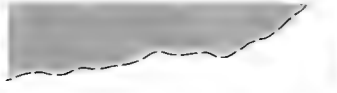
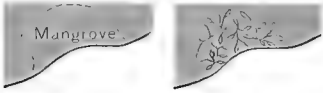
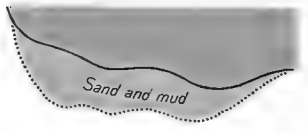
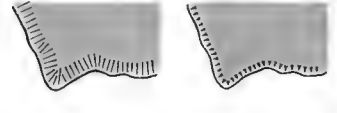

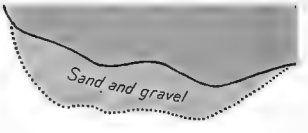
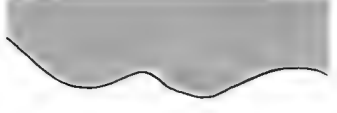


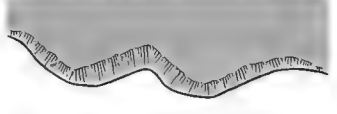

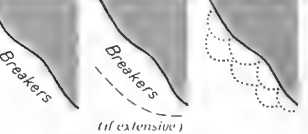

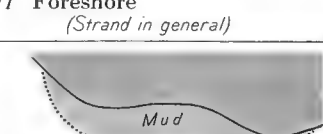
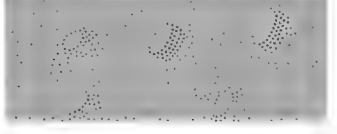

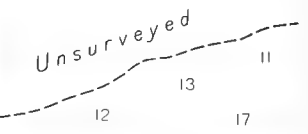
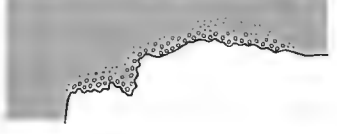
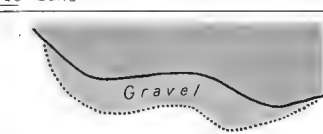
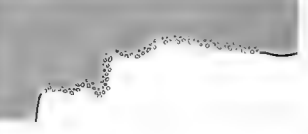
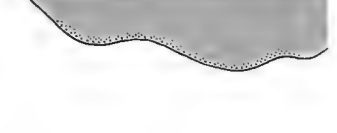



U. S. Nautical Chart Catalogs and Indexes list nautical charts, auxiliary maps, and related publications, and include general information (marginal notes, etc.) relative to the charts.

A glossary of foreign terms and abbreviations is generally given on the charts on which they are used, as well as in the Sailing Directions.

Charts already on issue will be brought into conformity as soon as opportunity affords.

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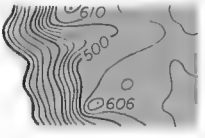


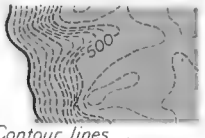




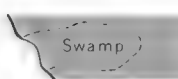




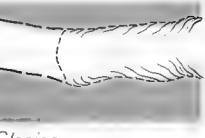

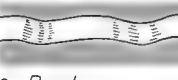
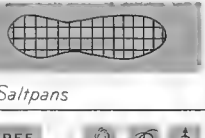


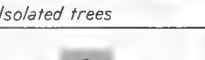

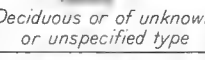

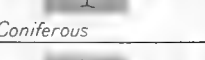

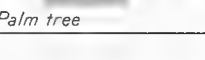







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A. The Coastline (Nature of the Coast)		
 1 Shoreline unsurveyed	 7 Mangrove	 11e Sand and mud
 2 Steep coast (Bluff)	 8 Surveyed coastline	 11f Sand and gravel
 2a Flat coast	 9 High water line	 11g Coral, uncovers at sounding datum (See O-10)
 3 Cliffy coast	 10 Low water line	 12 Breakers along a shore (See O-25)
 3a Rocky coast	 11 Foreshore (Strand in general)	
 4 Sandhills; Dunes	 11a Mud	 14 Limit of unsurveyed areas
 5 Stony or Shingly shore	 11b Sand	 (Aa) Rubble
 6 Sandy shore	 11c Stones; Shingle; or Gravel	
	 11d Rock, uncovers at sounding datum (See A-11g)	 (Ab) Shoreline from older surveys or small-scale charts

B. Coast Features

1	<i>G</i>	Gulf
2	<i>B</i>	Bay
(Ba)	<i>B</i>	Bayou
3	<i>Fd</i>	Fjord
		Loch; Lough;
4	<i>L</i>	Lake
5	<i>Cr</i>	Creek
5a	<i>C</i>	Cove
6	<i>In</i>	Inlet
7	<i>Str</i>	Strait
8	<i>Sd</i>	Sound
9	<i>Pass</i>	Passage; Pass
	<i>Thoro</i>	Thorofare
10	<i>Chan</i>	Channel
10a		Narrows
11	<i>Entr</i>	Entrance
12	<i>Est</i>	Estuary
12a		Delta
13	<i>Mth</i>	Mouth
14	<i>Rd</i>	Road; Roadstead
15	<i>Anch</i>	Anchorage
16	<i>Hbr</i>	Harbor
16a	<i>Hn</i>	Haveh
17	<i>P</i>	Port
(Bb)	<i>P</i>	Pond
18	<i>I</i>	Island
19	<i>It</i>	Islet
20	<i>Arch</i>	Archipelago
21	<i>Pen</i>	Peninsula
22	<i>C</i>	Cape
23	<i>Prom</i>	Promontory
24	<i>Hd</i>	Head; Headland
25	<i>Pt</i>	Point
26	<i>Mt</i>	Mountain; Mount
27	<i>Rge</i>	Range
27a		Valley
28		Summit
29	<i>Pk</i>	Peak
30	<i>Vol</i>	Volcano
31		Hill
32	<i>Bld</i>	Boulder
33	<i>Ldg</i>	Landing
34		Table-land (Plateau)
35	<i>Rk</i>	Rock
36		Isolated rock
(Bc)	<i>Str</i>	Stream
(Bd)	<i>R</i>	River
(Be)	<i>Slu</i>	Slough
(Bf)	<i>Lag</i>	Lagoon
(Bg)	<i>Apprs</i>	Approaches
(Bh)	<i>Rky</i>	Rocky

C. The Land (Natural Features)


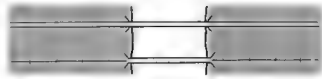

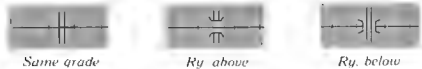

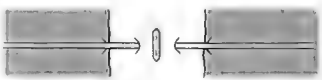


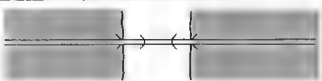

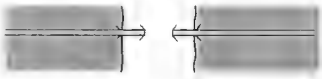


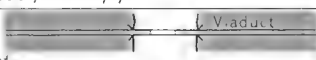
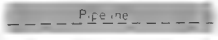



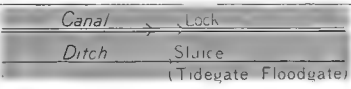
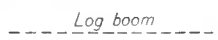
		
1 Contour lines (Contours)	5d Nipa palm	16 Lagoon (Lag)
		
1a Contour lines, approximate (Contours)	5e Filao	Symbol used in small areas
		
2 Hachures	5f Casuarina	17 Marsh; Swamp
		
2a Form lines, no definite interval	6 Cultivated fields	
		
2b Shading	6a Grass fields	18 Slough (Slu.)
		
3 Glacier	7 Paddy (rice) fields	19 Rapids
		
4 Saltpans	7a Park; Garden	20 Waterfalls
		
5 Isolated trees	8 Bushes	
		
5a Deciduous or of unknown or unspecified type	8a Tree plantation in general	21 Spring
		
5b Coniferous	9 Deciduous woodland	
		
5c Palm tree	10 Coniferous woodland	
		
	10a Woods in general	
		
	11 Tree top elevation (above height datum)	
		
	12 Lava flow	
		
	13 River; Stream	
		
	14 Intermittent stream	
		
	15 Lake; Pond	

D. Control Points		
1		Triangulation point (station)
2		Fixed point (landmark) (See L-63)
3		Summit of height (Peak) (when not a landmark)
(Da)		Peak, accentuated by contours
(Db)		Peak, accentuated by hachures
(Dc)		Peak, elevation not determined
(Dd)		Peak, when a landmark
4		Obs Spot Observation spot
5		BM Bench mark
6		See View View point
7		Datum point for grid of a plan
8		Graphical triangulation point
9	Astro	Astronomical
10	Tri	Triangulation
(De)	C of E	Corps of Engineers
12		Great trigonometrical survey station
13		Traverse station
14	Bdy. Mon	Boundary monument
(Df)		International boundary monument

E. Units			
1	hr	Hour	
2	m. min	Minute (of time)	
3	sec	Second (of time)	
4	m	Meter	
4a	dm	Decimeter	
4b	cm	Centimeter	
4c	mm	Millimeter	
4d	m ²	Square meter	
4e	m ³	Cubic meter	
5	km	Kilometer	
6	in	Inch	
7	ft	Foot	
8	yd	Yard	
9	fm	Fathom	
10	cbl	Cable length	
11	M	Nautical mile	
12	kn	Knot	
12a	t	Ton	
12b	cd	Candela (new candle)	
13	lat	Latitude	
14	long	Longitude	
15	pub	Publication	
16	Ed	Edition	
17	corr	Correction	
18	alt	Altitude	
19	ht. elev	Height; Elevation	
20	°	Degree	
21	'	Minute (of arc)	
22	"	Second (of arc)	
23	No	Number	
(Ea)	St. M	Statute mile	
(Eb)	Msec	Microsecond	









F. Adjectives, Adverbs and other abbreviations		
1	gt	Great
2	lit	Little
3	lrg	Large
4	sml	Small
5		Outer
6		Inner
7	mid	Middle
8		Old
9	anc	Ancient
10		New
11	St	Saint
12	conspic	Conspicuous
13		Remarkable
14	D., Destr	Destroyed
15		Projected
16	dist	Distant
17	abt	About
18		See chart
18a		See plan
19		Lighted; Luminous
20	sub	Submarine
21		Eventual
22	AERO	Aeronautical
23		Higher
24	exper	Experimental
25	discontd	Discontinued
26	prohib	Prohibited
27	explos	Explosive
28	estab	Established
29	elec	Electric
30	priv	Private, Privately
31	prom	Prominent
32	std	Standard
33	subm	Submerged
34	approx	Approximate
(Fa)	unverd	Unverified
(Fb)	auth	Authorized
(Fc)	cl	Clearance
(Fd)	maintd	Maintained
(Fe)	aband	Abandoned
(Ff)	cor	Corner
(Fg)	concr	Concrete
(Fh)	fl	Flood
(Fi)	extr	Extreme
(Fj)	mod	Moderate
(Fk)	bet	Between
(Fl)	1st	First
(Fm)	2nd	Second
(Fn)	3rd	Third
(Fo)	4th	Fourth


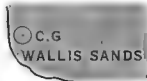



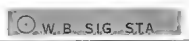




G.		Ports and Harbors	
1		Anch	Anchorage (large vessels)
2		Anch	Anchorage (small vessels)
3		Hbr	Harbor
4		Hn	Haven
5		P	Port
6		Bkw	Breakwater
6a			Dike
7			Mole
8			Jetty (partly below MHW)
8a			Submerged jetty
(Ga)			Jetty (small scale)
9		Pier	Pier
10			Spit
11			Groin (partly below MHW)
12		ANCH PROHIB	Anchorage prohibited (See P-25)
13			Spoil ground
(Gb)			Dumping ground
(Gc)			Disposal area
14		Fsh stks	Fisheries; Fishing stakes
14a			Fish trap; Fish weirs (actual shape charted)
14b			Duck blind
15			Tunny nets (See G-14a)
15a		Oys	Oyster bed
16		Ldg	Landing place
17			Watering place
18		Whf	Wharf
19			Quay
20			Berth
20a			Anchoring berth
20b			Berth number
21		Dol	Dolphin
22			Bollard
23			Mooring ring
24			Crane
25			Landing stage
25a			Landing stairs
26		Quar	Quarantine
27			Lazaret
28		Harbor Master	Harbor master's office
29		Cus Ho	Customhouse
30			Fishing harbor
31			Winter harbor
32			Refuge harbor
33		B. Hbr.	Boat harbor
34			Stranding harbor (uncovers at LW)
35			Dock
36			Dry dock (actual shape on large-scale charts)
37			Floating dock (actual shape on large-scale charts)
38			Gridiron; Careening grid
39			Patent slip; Slipway; Marine railway
39a		Ramp	Ramp
40			Lock (point upstream) (See H-13)
41			Wet dock
42			Shipyards
43			Lumber yard
44		Health Office	Health officer's office
45		Hk	Hulk (actual shape on large-scale charts) (See O-11)
46		PROHIB AREA	Prohibited area
47			Anchorage for seaplanes
48			Seaplane landing area
49			Work in progress
50			Under construction
(Gd)			Submerged ruins











H. Topography (Artificial Features)	
 <p>1 Road (Rd) or Highway (Hy)</p>	 <p>14 Bridge (BR) in general</p>
<p>2 Track, Footpath, or Trail</p>	<p>14a Stone, concrete bridge (Same as H-14)</p>
 <p>3 Railway (Ry) (single or double track); Railroad (RR)</p>	<p>14b Wooden bridge (Same as H-14)</p>
 <p>3a Tramway</p>	<p>14c Iron bridge (Same as H-14)</p>
<p>3b Railway station</p>	<p>14d Suspension bridge (Same as H-14)</p>
 <p>3c Tunnel (railroad or road)</p>	 <p>15 Drawbridge (in general)</p>
 <p>3d Embankment, Levee</p>	<p>16 Swing bridge (Same as H-15)</p>
 <p>3e Cutting</p>	 <p>16a Lift bridge</p>
 <p>4 Overhead power cable (OVHD PWR CAB)</p>	 <p>16b Weighbridge or Bascule bridge</p>
 <p>5 Power transmission line</p>	<p>17 Pontoon bridge</p>
<p>5a Power transmission mast</p>	<p>17a Footbridge</p>
 <p>6 Prominent telegraph or telephone line</p>	<p>18 Transporter bridge (Same as H-14)</p>
<p>7 Aqueduct; Water pipe</p>	<p>18a Bridge clearance, vertical</p>
 <p>8 Viaduct</p>	<p>18b Bridge clearance, horizontal</p>
 <p>8a Oil pipeline</p>	 <p>19 Ferry (Fy)</p> <p style="text-align: right;"><i>On small scale chart</i></p>
<p>9 Pile; Piling; Post (above MHW) (See L-59, O-30)</p>	<p>20 Ford</p>
 <p>9a Mast</p>	 <p>21 Dam</p>
<p>10 Highway (See H-1)</p>	<p>22 Fence</p>
<p>11 Sewer</p>	<p>23 Training wall</p>
<p>12 Culvert</p>	<p>(Ha) Log boom</p>
 <p>13 Canal; Ditch; Lock; Sluice (point upstream)</p>	

I. Buildings and Structures (see General Remarks)





































1		City or Town (large scale)	26a		Ave	Avenue
(1a)		City or Town (small scale)	(1e)		Blvd	Boulevard
2		Suburb	27		Tel	Telegraph
3		Vil Village	28		Tel. Off	Telegraph office
3a		Buildings in general	29		P.O	Post office
4		Cas Castle	30		Govt. Ho	Government house
5		House	31			Town hall
6		Villa	32		Hosp	Hospital
7		Farm	33			Slaughterhouse
8		Ch Church	34		Magz	Magazine
8a		Cath Cathedral	34a			Warehouse; Storehouse
8b		Spire Spire	35		Mon	Monument
8c		Christian Shrine	36		Cup	Cupola
9		Roman Catholic Church	37		Elev	Elevator; Lift
10		Temple	(If)		Elev	Elevation; Elevated
11		Chapel	38			Shed
12		Mosque; Minaret	39			Zinc roof
(1b)		Moslem Shrine	40		Ru	Ruins
13		Marabout	41		Tr	Tower
14		Pag Pagoda	42		WINDMILL	Windmill
15		Buddhist Temple; Joss-House	43			Watermill
15a		Shinto Shrine	43a		WINDMOTOR	Windmotor
16		Monastery; Convent	44		Chy	Chimney; Stack
17		Calvary; Cross	45		S pipe	Water tower; Standpipe
17a		Cemetery, Non-Christian	46			Oil tank
18		Cemetery, Christian	47		Facty	Factory
18a		Tomb	48			Saw mill
19		Fort (actual shape charted)	49			Brick kiln
20		Battery (Same as 1-19)	50			Mine; Quarry
21		Barracks	51		Well	Well
22		Powder magazine	52			Cistern
23		Airplane landing field	53		TANK	Tank
24		Airport, large scale (See P-13)	54			Noria
(1c)		Airport, military (small scale)	55			Fountain
(1d)		Airport, civil (small scale)				
25		Mooring mast				
26		King St St Street				

I.		Buildings and Structures (continued)	
61	Inst	Institute	
62		Establishment	
63		Bathing establishment	
64	Ct Ho	Courthouse	
65		Sch	School
(Ig)		H. S	High school
(Ih)		Univ	University
66		Bldg	Building
67		Pav	Pavilion
68		Hut	
69		Stadium	
70	T	Telephone	
71			Gas tank; Gasometer
72			Gable
73		Wall	
(Ii)		Ltd	Limited
(Ij)		Apt	Apartment
(Ik)		Cap	Capitol
(Il)		C ^o	Company
(Im)		Corp	Corporation
(In)			Landmark (conspicuous object)
(Io)			Landmark (position approx.)





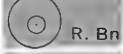
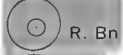











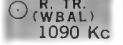




J.		Miscellaneous Stations	
1	Sta	Any kind of station	
2	Sta	Station	
3		C. G	Coast Guard station (Similar to LS. S.)
(Ja)		C. G WALLIS SANDS	Coast Guard station (when landmark)
4		LOOK. TR	Lookout station; Watch tower
5			Lifeboat station
6		LS. S	Lifesaving station (See J-3)
7	Rkt. Sta	Rocket station	
8		PIL. STA	Pilot station
9	Sig Sta	Signal station	
10	Sem	Semaphore	
11	S. Sig Sta	Storm signal station	
12		Weather signal station	
(Jb)		W. B. SIG. STA	Weather Bureau signal station
13		Tide signal station	
14		Stream signal station	
15		Ice signal station	
16		Time signal station	
17		Time ball	
18		Signal mast	
19			Flagstaff; Flagpole
(Jc)			Flag tower
20		Signal	
21	Obsy	Observatory	
22	Off	Office	
(Jd)		BELL	Bell (on land)
(Je)		HECP	Harbor entrance control post

K.		Lights			
1		Position of light	29	F F	Fixed and flashing light
2	Lt	Light	30	F Gt F	Fixed and group flashing light
(Ka)		Riprap surrounding light	31	Rot	Revolving or Rotating light
3	Lt Ho	Lighthouse	(Kbh)	Mo	Morse code
4		Aeronautical light (See F-22)	41		Period
4a		Marine and air navigation light	42		Every
5		Light beacon	43		With
6		Light vessel, Lightship	44		Visible (range)
8		Lantern	(Kc)	M	Nautical mile (See E-11)
9		Street lamp	(Kd)	m. min	Minutes (See E-2)
10	REF	Reflector	(Ke)	sec	Seconds (See E-3)
11		Leading light	45	Fl	Flash
12		Sector light	46	Occ	Occultation
13		Directional light	46a		Eclipse
14		Harbor light	47	Gt	Group
15		Fishing light	48	Occ	Intermittent light
16		Tidal light	49	SEC	Sector
17		Private light (maintained by private interests; to be used with caution)	50		Color of sector
21	F	Fixed light	51	Aux	Auxiliary light
22	Occ	Occulting light	52		Varied
23	F.	Flashing light	61	V.	Violet
24	Qk F	Quick flashing (scintillating) light	62		Purple
24a		Interrupted quick flashing light	63	B.	Blue
(Kb)	E Int	Equal interval (isophase) light	64	G	Green
25a	S Fl	Short flashing light	65	Or	Orange
26	Alt	Alternating light	66	R	Red
27	Gp Occ	Group occulting light	67	W	White
28	Gp Fl	Group flashing light	67a	Am	Amber
28a	S-L Fl	Short-long flashing light	68	OBSC	Obscured light
28b		Group short flashing light	(Kf)	Fog Det Lt	Fog detector light (See Nb)

K.		Lights (continued)		
69		<i>Unwatched light</i>	79	<i>Front light</i>
70	Occas	<i>Occasional light</i>	80	Vert <i>Vertical lights</i>
71	Irreg	<i>Irregular light</i>	81	Hor <i>Horizontal lights</i>
72	Prov	<i>Provisional light</i>	(Kh)	VB <i>Vertical beam</i>
73	Temp	<i>Temporary light</i>	(Ki)	RGE <i>Range</i>
(Kg)	D. Destr	<i>Destroyed</i>	(Kj)	Exper <i>Experimental light</i>
74	Exting	<i>Extinguished light</i>	(Kk)	TRLB <i>Temporarily replaced by lighted buoy showing the same characteristics</i>
75		<i>Faint light</i>	(Kl)	TRUB <i>Temporarily replaced by unlighted buoy</i>
76		<i>Upper light</i>	(Km)	TLB <i>Temporary lighted buoy</i>
77		<i>Lower light</i>	(Kn)	TUB <i>Temporary unlighted buoy</i>
78		<i>Rear light</i>		

L.		Buoys and Beacons (see General Remarks)		
<u>1</u>	•	<i>Position of buoy</i>	<u>16</u>	 <i>Port-hand buoy (entering from seaward)</i>
<u>2</u>		<i>Light buoy</i>	<u>17</u>	 <i>Bifurcation buoy (RBHB)</i>
<u>3</u>		<i>Bell buoy</i>	<u>18</u>	 <i>Junction buoy (RBHB)</i>
<u>3a</u>		<i>Gong buoy</i>	<u>19</u>	 <i>Isolated danger buoy (RBHB)</i>
<u>4</u>		<i>Whistle buoy</i>	<u>20</u>	 <i>Wreck buoy (RBHB or G)</i>
<u>5</u>		<i>Can or Cylindrical buoy</i>	<u>20a</u>	 <i>Obstruction buoy (RBHB or G)</i>
<u>6</u>		<i>Nun or Conical buoy</i>	<u>21</u>	 <i>Telegraph-cable buoy</i>
<u>7</u>		<i>Spherical buoy</i>	<u>22</u>	 <i>Mooring buoy (colors of mooring buoys never carried)</i>
<u>8</u>		<i>Spar buoy</i>	22a	<i>Mooring</i>
<u>8a</u>		<i>Pillar buoy</i>	<u>22b</u>	 <i>Mooring buoy with telegraphic communications</i>
<u>9</u>		<i>Buoy with topmark (ball) (See L-70)</i>	<u>22c</u>	 <i>Mooring buoy with telephonic communications</i>
<u>10</u>		<i>Barrel or Ton buoy</i>	<u>23</u>	 <i>Warping buoy</i>
(La)		<i>Color unknown</i>	<u>24</u>	 <i>Quarantine buoy</i>
(Lb)		<i>Float</i>	<u>25</u>	 <i>Explosive anchorage buoy</i>
<u>12</u>		<i>Lightfloat</i>	<u>25a</u>	 <i>Aeronautical anchorage buoy</i>
<u>13</u>		<i>Outer or Landfall buoy</i>	<u>26</u>	 <i>Compass adjustment buoy</i>
<u>14</u>		<i>Fairway buoy (BWVS)</i>	<u>27</u>	 <i>Fish trap buoy (BWHB)</i>
<u>14a</u>		<i>Mid-channel buoy (BWVS)</i>	<u>27a</u>	 <i>Spoil ground buoy</i>
<u>15</u>		<i>Starboard-hand buoy (entering from seaward)</i>	<u>28</u>	 <i>Anchorage buoy (marks limits)</i>
			<u>29</u>	 <i>Private buoy (maintained by private interests, use with caution)</i>

L.		Buoys and Beacons (continued)		
30		Temporary buoy (See Kk, l, m, n)	55	Cardinal marking system
30a		Winter buoy	56	Deviation Buoy Compass adjustment beacon
31		HB Horizontal stripes or bands	57	Topmarks (See L-9, 70)
32		VS Vertical stripes	58	Telegraph-cable (landing) beacon
33		Chec Checkered	59	Piles (See O-30, H-9) Stakes Stumps (See O-30) Perches
(Lc)		Diag Diagonal buoy		
41		W White		
42		B Black	61	CAIRN Cairn Cairn
43		R Red	62	Painted patches
44		Y Yellow	63	Landmark (conspicuous object) (See D-2)
45		G Green	(Lg)	Landmark (position approximate)
46		Br Brown	64	REF Reflector
47		Gy Gray	65	MARKER Range targets, markers
48		Bu Blue	(Lh)	W Or W Or Special-purpose buoys
(Ld)		Am Amber	70	Note: TOPMARKS on buoys and beacons may be shown on charts of foreign waters. The abbreviation for black is not shown adjacent to buoys or beacons.
(Le)		Or Orange		
51		Floating beacon		
52		Fixed beacon (unlighted or daybeacon)		
		Black beacon		
		Color unknown		
(Lf)	MARKER	Private aid to navigation		
53	Bn	Beacon, in general (See L-52)		
54		Tower beacon	(Li)	Ra Ref Radar reflector (See M-13)

M.		Radio and Radar Stations			
1	 R. Sta	Radio telegraph station	12	 Racon	Radar responder beacon
2	 R. T	Radio telephone station	13	 Ra Ref	Radar reflector (See Lj)
3	 R. Bn	Radiobeacon	14	Ra (conspic)	Radar conspicuous object
4	 R. Bn	Circular radiobeacon	14a		Ramark
5	 R. D	Directional radiobeacon; Radio range	15	D.F.S	Distance finding station (synchronized signals)
6		Rotating loop radiobeacon	(Mc)	 AERO R. Bn 302	Aeronautical radiobeacon
7	 R. D.F	Radio direction finding station	(Md)	 AERO R. Rge 342	Aeronautical radio range
(Ma)	 TELEM ANT	Telemetry antenna	(Me)	 Ra Ref Calibration Bn	Radar calibration beacon
9	 R. MAST	Radio mast	(Mf)	 CONSOL Bn 190 Kc MMF	Consol (Consolan) station
		 R. TR			
(Mb)	 TV TR	Television tower	(Mg)	 Loran Sta Venice	Loran station (name)
10	 R. TR. (WBAL) 1090 Kc	Radio broadcasting station (commercial)	(Mh)	 LORAN TR SPRING ISLAND	Loran tower (name)
10a	 R. Sta	Q.T.G. Radio station	(Mi)	 10	Radio calling-in point for traffic control
11	 Ra	Radar station			

N.		Fog Signals			
1	Fog Sig	Fog-signal station	12	HORN	Fog trumpet
2		Radio fog-signal station	13	HORN	Fog horn
3	GUN	Explosive fog signal	14	BELL	Fog bell
4		Submarine fog signal	15	WHIS	Fog whistle
5	SUB-BELL	Submarine fog bell (action of waves)	16	HORN	Reed horn
6	SUB-BELL	Submarine fog bell (mechanical)	17	GONG	Fog gong
7	SUB-OSC	Submarine oscillator	18		Submarine sound signal not connected to the shore (See N-5,6,7)
8	NAUTO	Nautophone	18a		Submarine sound signal connected to the shore (See N-5,6,7)
9	DIA	Diaphone	(Na)	HORN	Typhon
10	GUN	Fog gun	(Nb)	Fog Det Lt	Fog detector light (See Kf)
11	SIREN	Fog siren			

O. Dangers		
<p> (25)</p> <p>1 Rock which does not cover (elevation above MHW)</p>	<p>11 Wreck showing any portion of hull or superstructure above sounding datum</p>	<p> (5) <i>Obstr</i></p> <p>27 Obstruction</p>
<p>* <i>Uncov 2 ft</i> <i>Uncov 2 ft</i></p> <p>* (2) (2)</p> <p>2 Rock which covers and uncovers, with height in feet above chart (sounding) datum</p>	<p> <i>Masts</i></p> <p>12 Wreck with only masts visible above sounding datum</p>	<p>28 Wreck (See O-11 to 16)</p> <p>Wreckage Wks</p> <p>29 Wreckage</p> <p>29a Wreck remains (dangerous only for anchoring)</p>
<p> +</p> <p>3 Rock awash at the level of chart (sounding) datum</p> <p> * +</p> <p>When rock of O-2 or O-3 is considered a danger to navigation</p>	<p>13 Old symbols for wrecks</p> <p>13a Wreck always partially submerged </p>	<p> <i>Subm piles</i></p> <p>30 Submerged piling (See H-9, L-59)</p>
<p>4 Sunken rock with less than 6 feet of water over it (Same as O-26)</p>	<p>14 +++ Sunken wreck which may be dangerous to surface navigation (See O-6a)</p>	<p> <i>Snags</i> <i>Stumps</i></p> <p>30a <i>Snags, Submerged stumps</i> (See L-59)</p>
<p>5 Sunken rock with between 6 and 33 ft. of water over it (Same as O-26)</p>	<p>15 Wreck over which depth is known (5) <i>Wk</i></p>	<p>31 Lesser depth, possible</p>
<p>5a Shoal sounding on isolated rock (replaces symbol) <i>Rk</i></p>	<p>16 Sunken wreck, not dangerous to surface navigation +++</p>	<p>32 <i>Uncov Dries</i> (See A-10; O-2, 10)</p> <p>33 <i>Cov Covers</i> (See O-2, 10)</p> <p>34 <i>Uncov Uncovers</i> (See A-10; O-2, 10)</p>
<p>6 Sunken rock with more than 66 feet of water over it (Same as O-26)</p>	<p>17 Foul ground <i>Foul</i></p>	<p> (3) <i>Rep</i> (1958)</p> <p><i>Reported (with date)</i></p> <p> * <i>Eagle Rk</i> (rep 1958)</p>
<p>6a Sunken danger with depth cleared by wire drag (in feet or fathoms)</p> <p> <i>Rk</i> <i>Wk</i> <i>Obstr</i></p>	<p>18 <i>Tide Rips</i> <i>Overfalls or Tide rips</i> <i>Symbol used only in small areas</i></p>	<p>35 <i>Reported (with name and date)</i></p>
<p>7 Reef of unknown extent <i>Reef</i></p>	<p>19 <i>Eddies</i> <i>Symbol used only in small areas</i></p>	<p>36 <i>Discol Discolored</i> (See O-9)</p> <p>37 <i>Isolated danger</i></p>
<p>8 Submarine volcano <i>Sub Vol</i></p>	<p>20 <i>Kelp, Seaweed</i> <i>Symbol used only in small areas</i></p>	<p> <i>Limiting danger line</i></p>
<p>9 Discolored water <i>Discol Water</i></p>	<p>21 <i>Bk Bank</i></p> <p>22 <i>Shl Shoal</i></p> <p>23 <i>Rf Reef</i> (See A-11d, 11g; O-10)</p> <p>23a <i>Ridge</i></p> <p>24 <i>Le Ledge</i></p>	<p>38 <i>Limit of rocky area</i></p>
<p>10 Coral reef, detached (uncovers at sounding datum)</p> <p> <i>Co</i> <i>Co</i> <i>Co</i> <i>Co</i></p> <p> <i>Coral or Rocky reef, covered at sounding datum</i> (See A-11d, 11g)</p>	<p>25 <i>Breakers</i> (See A-12) </p> <p>26 <i>Sunken rock (depth unknown)</i> <i>When rock is considered a danger to navigation</i> +</p>	<p> <i>Subm Crib</i> <i>Crib (above water)</i></p> <p>(Oa) <i>Crib</i></p> <p> <i>Platform (lighted) HORN</i></p> <p>(Ob) <i>Offshore platform (unnamed)</i></p> <p> <i>Hazel (lighted) HORN</i></p> <p>(Oc) <i>Offshore platform (named)</i></p>







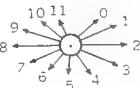
P. Various Limits, etc.	
1	Leading line, Range line
2	Transit
3	In line with
4	Limit of sector
5	Channel, Course, Track recommended (marked by buoys or beacons)(See P-21)
(Pa)	Alternate course
6	Leader cable
7	Submarine cable (power, telegraph, telephone, etc.)
7a	Cable Area Submarine cable area
8	Pipeline Submarine pipeline
8a	Pipeline Area Submarine pipeline area
9	Maritime limit in general
9a	RESTRICTED AREA Limit of restricted area
10	Limit of fishing zone (fish trap areas)
11	Limit of dumping ground, spoil ground (See P-9, G-13)
12	Anchorage limit
13	Limit of airport (See I-23, 24)
14	Limit of sovereignty (Territorial waters)
15	Customs boundary
16	International boundary (also State boundary)
17	Stream limit
18	Ice limit
19	Limit of tide
20	Limit of navigation
21	Course recommended (not marked by buoys or beacons)(See P-5)
22	District or province limit
23	Reservation line
24	Measured distance
25	Prohibited area (See G-12)

Q. Soundings	
1	SD Doubtful sounding
2	65 No bottom found
3	Out of position
4	Least depth in narrow channel
5	30 FEET APR 1958 Dredged channel (with controlling depth indicated)
6	24 FEET MAY 1958 Dredged area
7	Swept channel (See Q-9)
8	6 Drying or uncovering height in feet above chart (sounding) datum
9	Swept area, not adequately sounded (shown by green tint)
9a	Swept area adequately sounded (swept by wire drag to depth indicated)
10	Hair-line depths
10a	8 ₂ 19 Figures for ordinary soundings
11	8 ₂ 19 Soundings taken from foreign charts
12	8 ₂ 19 Soundings taken from older surveys or smaller scale charts
13	8 ₂ 19 Soundings taken by echo
14	8 ₂ 19 Sloping figures (See Q-12)
15	8 ₂ 19 Upright figures (See Q-10a)
16	Bracketed figures (See Q-1, 2)
17	Underlined sounding figures (See Q-8)
18	3 ₂ 6 ₁ Soundings expressed in fathoms and feet
(Qa)	Stream

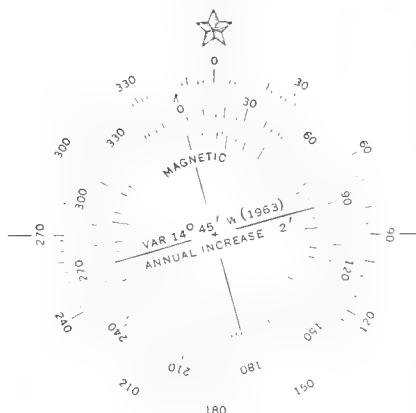
R. Depth Contours and Tints (see General Remarks)					
Feet	Fathoms		Feet	Fathoms	
0	0		300	50	
6	1		600	100	
12	2		1,200	200	
18	3		1,800	300	
24	4		2,400	400	
30	5		3,000	500	
36	6		6,000	1,000	
60	10		12,000	2,000	
120	20		18,000	3,000	
180	30		Or continuous lines, with values		5 (blue or black)
240	40				100

S. Quality of the Bottom								
<u>1</u>		Ground	25	Ms	Mussels	50	spk	Speckled
2	S	Sand	26	Spg	Sponge	51	gty	Gritty
3	M	Mud; Muddy	<u>27</u>		Kelp	<u>52</u>		Decayed
4	Oz	Ooze		Wd	Seaweed	53	fly	Flinty
5	MI	Marl	28	Grs	Grass	54	glac	Glacial
6	Cl	Clay	<u>29</u>		Seatangle	<u>55</u>		Tenacious
7	G	Gravel				56	wh	White
8	Sn	Shingle	<u>31</u>		Spicules	57	bk	Black
9	P	Pebbles	32	Fr	Foraminifera	58	vi	Violet
10	St	Stones	33	Gl	Globigerina	59	bu	Blue
11	Rk; rky	Rock; Rocky	34	Di	Diatoms	60	gn	Green
11a	Blds	Boulders	35	Rd	Radiolaria	61	yl	Yellow
12	Ck	Chalk	36	Pt	Pteropods	62	or	Orange
12a	Ca	Calcareous	37	Po	Polyzoa	63	rd	Red
13	Qz	Quartz	<u>38</u>		Cirripeda	64	br	Brown
<u>13a</u>		Schist	<u>38a</u>		Fucus	65	ch	Chocolate
14	Co	Coral	<u>38b</u>		Mattes	66	gy	Gray
(Sa)	Co Hd	Coral head	39	fne	Fine	67	lt	Light
15	Mds	Madrepores	40	crs	Coarse	68	dk	Dark
16	Vol	Volcanic	41	sft	Soft			
(Sb)	Vol Ash	Volcanic ash	42	hrd	Hard	<u>70</u>		Varied
17	La	Lava	43	stf	Stiff	<u>71</u>		Uneven
18	Pm	Pumice	44	sml	Small			
19	T	Tufa	45	lrg	Large			
20	Sc	Scoriae	46	stk	Sticky			
21	Cn	Cinders	47	brk	Broken			
22	Mn	Manganese	47a	grd	Ground	76		Fresh water springs in sea-bed
23	Sh	Shells	<u>48</u>		Rotten			
24	Oys	Oysters	<u>49</u>		Streaky			

T. Tides and Currents

1	HW	High water
1a	HHW	Higher high water
2	LW	Low water
(Ta)	LWD	Low water datum
2a	LLW	Lower low water
3	MTL	Mean tide level
4	MSL	Mean sea level
4a		Elevation of mean sea level above chart (sounding) datum
5		Chart datum (datum for sounding reduction)
6	Sp	Spring tide
7	Np	Neap tide
8	MHWS	Mean high water springs
8a	MHWN	Mean high water neaps
8b	MHHW	Mean higher high water
(Tb)	MHW	Mean high water
9	MLWS	Mean low water springs
9a	MLWN	Mean low water neaps
9b	MLLW	Mean lower low water
(Tc)	MLW	Mean low water
10	ISLW	Indian spring low water
11		High water full and change (vulgar establishment of the port)
12		Low water full and change
13		Mean establishment of the port
13a		Establishment of the port
14		Unit of height
15		Equinoctial
16		Quarter; Quadrature
17	Str.	Stream
18		Current, general, with rate
19		Flood stream (current) with rate
20		Ebb stream (current) with rate
21		Tide gauge; Tidepole, Automatic tide gauge
23	vel.	Velocity, Rate
24	kn.	Knots
25	ht.	Height
26		Tide
27		New moon
28		Full moon
29		Ordinary
30		Syzygy
31	fl.	Flood
32		Ebb
33		Tidal stream diagram
34	 	Place for which tabulated tidal stream data are given
35		Range (of tide)
36		Phase lag
(Td)		Current diagram, with explanatory note

U. Compass



Compass Rose

The outer circle is in degrees with zero at true north. The inner circles are in points and degrees with the arrow indicating magnetic north.

1	N	North
2	E	East
3	S	South
4	W	West
5	NE	Northeast
6	SE	Southeast
7	SW	Southwest
8	NW	Northwest
9	N	Northern
10	E	Eastern
11	S	Southern
12	W	Western
21	brg	Bearing
22		True
23	mag	Magnetic
24	var	Variation
25		Annual change
25a		Annual change nil
26		Abnormal variation; Magnetic attraction
27	deg	Degrees (See E-20)
28	dev	Deviation

Index of Abbreviations

A					
aband.	Abandoned	Fe	Cath.	Cathedral	I 8a
abt.	About	F 17	ebl.	Cable length	E 10
AERO	Aeronautical	F 22; M 6	C. G.	Coast Guard	J 3, a
AERO R. Bn.	Aeronautical radiobeacon	Mc	ch	Chocolate	S 65
AERO R. Rge.	Aeronautical radio range	Md	Ch.	Church	I 8
alt.	Altitude	E 18	Chan	Channel	B 10
Alt	Alternating (light)	K 26	Chec	Checked (buoy)	L 33
Am	Amber	K 67a; Ld	CHY.	Chimney	I 44
anc.	Ancient	F 9	Ck	Chalk	S 12
Anch	Anchorage	B 15; G 1,2	Cl	Clay	S 6
Anch prohib	Anchorage prohibited	G 12	CL.	Clearance	Fc
approx.	Approximate	F 34	cm.	Centimeter	E 4b
Apprs.	Approaches	Bg	Cn	Cinders	S 21
Apt.	Apartment	Ij	Co.	Company	Il
Arch.	Archipelago	B 20	Co	Coral	S 14
Astro.	Astronomical	D 9	Co Hd	Coral head	Sa
AUTH.	Authorized	Fb	concr.	Concrete	Fg
Aux	Auxiliary (light)	K 51	conspic.	Conspicuous	F 12
Ave.	Avenue	I 26a	C. of E.	Corps of Engineers	De
			cor.	Corner	Ff
			Corp.	Corporation	Im
			Cov	Covers	O 33
			corr.	Correction	E 17
			Cr.	Creek	B 5
			crs	Coarse	S 40
			Cswy.	Causeway	
			Ct. Ho.	Courthouse	I 64
			CUP.	Cupola	I 36
			Cus. Ho.	Customhouse	G 29
B			D		
B	Bay	B 2	D.; Destr.	Destroyed	F 14; Kg
B	Bayou	Ba	Diag	Diagonal (buoy)	Lc
B	Black	L 42	deg.	Degrees	U 27
Bdy. Mon.	Boundary monument	D 14	dev.	Deviation	U 28
BELL	Fog Bell	N 14	D. F. S.	Distance finding station	M 15
bet.	Between	Fk	Di	Diatoms	S 34
B Hbr	Boat harbor	G 33	DIA	Diaphone	N 9
Bk	Bank	O 21	Discol	Discolored	O 36
bk	Black	S 57	discontd.	Discontinued	F 25
Bkw.	Breakwater	G 6	dist.	Distant	F 16
Bld	Boulder	B 32	dk	Dark	S 68
Bldg.	Building	I 66	dm.	Decimeter	E 4a
Blds	Boulders	S 11a	Dol	Dolphin	G 21
Blvd.	Boulevard	Ie			
B.M.	Bench mark	D 5	E		
Bn	Beacon (in general)	L 52,53	E.	East, Eastern	U 2, 10
BR.	Bridge	H 14	Ed.	Edition	E 16
Br	Brown	L 46	E.D.	Existence doubtful	O 43
br	Brown	S 64	elec.	Electric	F 29
brg.	Bearing	U 21	elev.	Elevation	E 19
brk	Broken	S 47	ELEV.	Elevator, Lift	I 37
Bu	Blue	K 63; L 48	Elev.	Elevation, Elevated	If
bu	Blue	S 59	Entr	Entrance	B 11
BWHB	Black and white horizontal bands	L 27	E Int	Equal Interval light	Kb
BWVS	Black and white vertical stripes	L 14,14a	Est	Estuary	B 12
			estab.	Established	F 28
C			Exper	Experimental (light)	Kj
C	Can; Cylindrical (buoy)	L 5	exper.	Experimental	F 24
C	Cape	B 22	explos.	Explosive	F 27
C	Cove	B 5a			
Ca	Calcareous	S 12a			
Cap.	Capitol	Ik			
Cas.	Castle	I 4			

Abbreviations

Explos Anch	Explosive Anchorage (buoy)	L 25	HOR. CL.	Horizontal clearance	H 18b
Exting.	Extinguished (light)	K 74	HORN	Fog trumpet; Fog horn; Reed horn; Typhon	N 12, 13, 16, a
extr.	Extreme	Fi	Hosp.	Hospital	I 32
F					
F	Fixed (light)	K 21	hr.	Hour	E 1
Facty.	Factory	I 47	hrd	Hard	S 42
Fd	Fjord	B 3	H. S.	High School	I g
F Fl	Fixed and flashing (light)	K 29	ht.	Height	E 19; T 25
F Gp Fl	Fixed and group flashing (light)	K 30	HW	High water	T 1
Fl	Flash, Flashing (light)	K 23, 45	Hy.	Highway	H 1
fl.	Flood	Fh; T 31	I		
fly.	Flinty	S 53	I.	Island	B 18
fm	Fathom	E 9	I Qk; Int Qk	Interrupted quick	K 24a
fne	Fine	S 39	in.	Inch	E 6
Fog Det Lt	Fog detector light	Kf; Nb	In	Inlet	B 6
Fog Sig.	Fog signal station	N 1	Inst.	Institute	I 61
FP.	Flagpole	J 19	Irreg	Irregular	K 71
Fr	Foraminifera	S 32	ISLW	Indian spring low water	T 10
FS.	Flagstaff	J 19	It.	Islet	B 19
Fsh stks	Fishing stakes	Gb	K		
ft.	Foot	E 7	km.	Kilometer	E 5
Ft.	Fort	I 19	kn	Knots	E 12; T 24
F. TR.	Flag tower	Jc	L		
Fy.	Ferry	H 19	L.	Loch, Lough, Lake	B 4
G					
G	Gulf	B 1	La	Lava	S 17
G	Gravel	S 7	Lag	Lagoon	Bf; C 16
G	Green	K 64	lat.	Latitude	E 13
G	Green	L 20, 20a, 45	Ldg.	Landing; Landing place	B 33; G 16
GAB.	Gable	I 72	Ldg. Lt.	Leading light	K 11
Gl	Globigerina	S 33	Le	Ledge	O 24
glac	Glacial	S 54	LLW	Lower low water	T 2a
gn	Green	S 60	long.	Longitude	E 14
GONG.	Fog gong	N 17	LOOK. TR.	Lookout station; Watch tower	J 4
Govt. Ho.	Government House	I 30	lrg	Large	F 3; S 45
Gp	Group	K 47	LS. S.	Lifesaving station	J 6
Gp Fl	Group flashing	K 28	Lt.	Light	K 2
Gp Occ	Group occulting	K 27	lt.	Light	S 67
Grd	Ground	S 47a	Ltd.	Limited	Ii
Grs	Grass	S 28	Lt. Ho.	Lighthouse	K 3
gt.	Great	F 1	LW	Low water	T 2
gty	Gritty	S 51	LWD	Low water datum	Ta
GUN	Explosive fog signal	N 3	M		
GUN	Fog gun	N 10	M	Nautical mile	E 11; Kc
Gy	Gray	L 47	M	Mud, Muddy	S 3
gy	Gray	S 66	m.	Meter	E 4
H					
HB.	Horizontal bands or stripes	L 31	m. ; min.	Minute (of time)	E 2; Kd
Hbr	Harbor	B 16; G 3	mag.	Magnetic	U 23
Hd.	Head, Headland	B 24	Magz.	Magazine	I 34
HECP	Harbor entrance control post	Je	maintd.	Maintained	Fd
Hk	Hulk	G 45	Mds	Madrepores	S 15
HHW	Higher high water	T 1a	MHHW	Mean higher high water	T 8b
Hn	Haven	B 16a; G 4	MHW	Mean high water	Tb
Hor	Horizontal lights	K 81	MHWN	Mean high water neaps	T 8a

Abbreviations

MHWS	Mean high water springs	T 8	Pm	Pumice	S 18
mid.	Middle	F 7	Po	Polyzoa	S 37
MI	Marl	S 5	P. O.	Post Office	I 29
MLLW	Mean lower low water	T 9b	P.; Pos.	Position	O 44
MLW	Mean low water	Tc	priv.	Private, Privately	F 30
MLWN	Mean low water neaps	T 9a	Priv. maintd.	Privately maintained	K 17; L 29
MLWS	Mean low water springs	T 9	Prohib.	Prohibited	F 26
mm.	Millimeter	E 4c	prom.	Prominent	F 31
Mn	Manganese	S 22	Prom.	Promontory	B 23
Mo.	Morse code	Kbb	Prov	Provisional (light)	K 72
mod.	Moderate	Fj	Pt.	Point	B 25
MON.	Monument	I 35	Pt	Pteropods	S 36
Ms	Mussels	S 25	pub.	Publication	E 15
M. Sec.	Microsecond	Eb	PWI	Potable water intake	Oa
MSL	Mean sea level	T 4			
Mt.	Mountain, Mount	B 26			
Mth	Mouth	B 13			
MTL	Mean tide level	T 3			
N			Q		
N.	North; Northern	U 1, 9	Quar.	Quarantine	G 26
N	Nun; Conical (buoy)	L 6	Qk Fl	Quick flashing (light)	K 24
NAUTO	Nautophone	N 8	Qz	Quartz	S 13
NE.	Northeast	U 5			
No.	Number	E 23			
Np	Neap tide	T 7			
NW.	Northwest	U 8			
O			R		
OBSC	Obscured (light)	K 68	R	Red	K 66; L 15, 43
Obs. Spot	Observation spot	D 4	R.	River	Bd
Obstr.	Obstruction	O 27	Ra	Radar station	M 11
Obsy.	Observatory	J 21	Racon	Radar responder beacon	M 12
Occ	Occulting (light); Occultation	K 22, 46	Ra (conspic)	Radar conspicuous object	M 14
Occ	Intermittent (light)	K 48	Ra Ref	Radar reflector	Li; M 13
Occas	Occasional (light)	K 70	RBHB	Red and black horizontal bands	L 17, 18, 19, 20, 20a
Off.	Office	J 22	R	Red beacon	L 52
or	Orange	S 62	Rn	Radiobeacon	M 3, 4, 6
Or	Orange	K 65; Lf	R. Bn.	Radiolaria	S 35
OVHD.			Rd	Red	S 63
PWR. CAB.	Overhead power cable	H 4	Rd.	Road	H 1
Oys	Oysters; Oyster bed	G 15a; S 24	Rd	Road, Roadstead	B 14
Oz	Ooze	S 4	R.D.	Directional Radiobeacon; Radio range	M 5
			R. D. F.	Radio direction finding station	M 7
P			REF	Reflector	K 10; L 64
P	Pebbles	S 9	Rep.	Reported	O 35
P	Pillar (buoy)	L 8a	Rf	Reef	O 23
P	Pond	Bb	Rge.	Range	B 27
P.	Port	B 17; G 5	RGE	Range	Ki
P. A.	Position approximate	O 41	Rk.	Rock	B 35
Pag.	Pagoda	I 14	Rk, rky	Rock, Rocky	S 11
Pass	Passage, Pass	B 9	Rky.	Rocky	Bh
Pav.	Pavilion	I 67	R. MAST	Radio mast	M 9
P. D.	Position doubtful	O 42	Rot	Revolving; Rotating (light)	K 31
Pen.	Peninsula	B 21	RR.	Railroad	H 3
PIL. STA.	Pilot station	J 8	R. Sta.	Radio telegraph station; Q.T.G. Radio station	M 1, 10a
Pk.	Peak	B 29	R. T.	Radio telephone station	M 2
			R. TR.	Radio tower	M 9
			Ru.	Ruins	I 40
			RW	Red and white beacon	L 52
			Rn		
			Ry.	Railway	H 3

Abbreviations

S






















S	Sand.....	S 2	TRLB, TRUB, TLB, TUB	Kk, l, m, n	
S	South; Southern	U 3, 11	Tri.	Triangulation	D 10
S	Spar (buoy)	L 8	TV TR.	Television tower	Mb
Sc	Scoriae	S 20			
Sch.	School	I 65			
Sd	Sound	B 8	U		
SD	Sounding doubtful	Q 1	Uncov	Uncovers	O 2
SE.	Southeast	U 6	Uncov.	Uncovers; Dries	O 32, 34
sec.	Second (of time).....	E 3	Univ.	University	Ih
sec	Seconds	Ke	unverd.	Unverified	Fa
SEC	Sector	K 49			
See View	View point	D 6			
Sem.	Semaphore	J 10	V		
S Fl	Short flashing (light)	K 25a	var.	...Variation.	U 24
sft	Soft	S 41	VB	Vertical beam	Kh
Sh	Shells.....	S 23	vel.	Velocity	T 23
Shl	Shoal	O 22	Vert	Vertical (lights)	K 80
Sig. Sta.	Signal station	J 9	VERT. CL.	Vertical clearance	H 18a
SIREN	Fog siren	N 11	Vi	Violet	K 61
S-L Fl	Short-long flashing (light)	K 28a	vi	Violet	S 58
Slu	Slough	Be; C 18	Vil.	Village	I 3
sml	Small	F 4; S 44	Vol.	Volcano	B 30
Sn.	Shingle.....	S 8	Vol	Volcanic	S 16
Sp	Spring tide	T 6	Vol Ash	Volcanic ash	Sb
SP	Spherical (buoy)	L 7	VS	Vertical stripes	L 32
Spg	Sponge	S 26			
S'PIPE	Standpipe	I 45	W		
spk	Speckled	S 50	W.	West; Western	U 4, 12
S. Sig. Sta.	Storm signal station	J 11	W	White	K 67; L 41
St.	Saint.....	F 11	wh	White	S 56
St.	Street	I 26	W	White beacon	L 52
St	Stones	S 10	Bn		
Sta.	Station	J 1, 2	W.B. SIG. STA.	Weather Bureau signal station	Jb
std.	Standard	F 32			
stf	Stiff	S 43	Wd	Seaweed	S 28
stk	Sticky	S 46	Whf.	Wharf	G 18
St. M.	Statute mile.....	Ea	WHIS	Fog whistle	N 15
Str	Strait	B 7	Wk	Wreck	O 15, 28
Str	Stream	Be; T 17	Wks	Wreckage	O 29
sub	Submarine	F 20	W Or	White and orange	Lh
SUB-BELL	Submarine fog bell	N 5, 6			
subm	Submerged	F 33			
Subm	Submerged	Oa, 30	Y		
Subm Ruins	Submerged ruins	Gd	Y	Yellow	L 24, 44
SUB-OSC	Submarine oscillator.....	N 7	yl	Yellow	S 61
Sub Vol	Submarine volcano	O 8	yd.	Yard	E 8
SW.	Southwest	U 7			

T














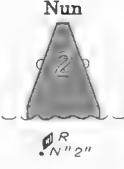



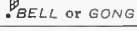
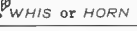


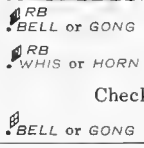
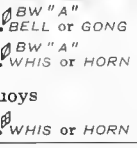
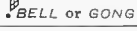
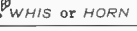

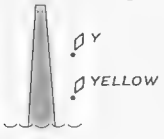
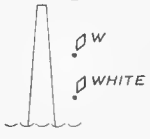


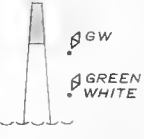
T.	Telephone.....	I 70; L 22c	1st	First..	F1
T	True	U 22	2nd	Second	Fm
T	Tufa	S 19	3rd	Third	Fn
TB	Temporary buoy	L 30	4th	Fourth	Fo
Tel.	Telegraph	I 27; L 22b			
Telem Ant	Telem antenna	Ma	°	Degree	E 20
Tel. Off.	Telegraph office	I 28	'	Minute (of arc)	E 21
Temp	Temporary (light)	K 73	"	Second (of arc)	E 22
Thoro	Thorofare.....	B 9			
Tk.	Tank	I 53			
TR.	Tower	I 41			

NAVIGATIONAL AIDS
IN
UNITED STATES WATERS

Light Characteristics and Typical Lighted Buoys

<p style="text-align: center;">PORT SIDE ENTERING FROM SEAWARD</p> <p>Marks port side of channels and obstructions. To be left to port when passed.</p> <p>Color: BLACK Numbers: ODD</p> <p style="text-align: center;">COLOR OF LIGHTS Green or White</p> <p style="text-align: center;">FLASHING</p>  <p style="text-align: center;">OCCULTING</p>  <p style="text-align: center;">QUICK FLASHING</p>  <p>Marking important turns, wrecks, etc., where particular caution is required.</p> <p style="text-align: center;">Lighted</p>  <p> "5" FI G 4sec "5" FI 4sec "5" Occ G 3sec "5" Occ 3sec "5" Qk FI G "5" Qk FI </p> <p style="text-align: center;">Lighted Bell or Gong</p>  <p> "5" FI G 4sec BELL "5" FI 4sec BELL "5" Occ G 3sec BELL "5" Occ 3sec BELL "5" Qk FI G BELL "5" Qk FI BELL </p> <p style="text-align: center;">Lighted Whistle or Horn</p>  <p> "5" FI G 4sec WHIS "5" FI 4sec WHIS "5" Occ G 3sec WHIS "5" Occ 3sec WHIS "5" Qk FI G WHIS "5" Qk FI WHIS </p>	<p>For JUNCTIONS or OBSTRUCTIONS</p> <p style="text-align: center;">COLOR OF LIGHTS White, Red or Green</p> <p style="text-align: center;">INTERRUPTED QUICK FLASHING</p>  <p>For MID-CHANNEL or FAIRWAY</p> <p style="text-align: center;">COLOR OF LIGHTS White only</p> <p style="text-align: center;">SHORT-LONG FLASHING</p>  <p style="text-align: center;">No special shapes. Buoy colors same as for unlighted buoys</p> <p style="text-align: center;">Lighted</p>   <p> "RB" Qk FI "RB" Qk FI R "RB" Qk FI G "BW"CH" S-L FI </p> <p style="text-align: center;">Lighted Bell or Gong</p>   <p> "RB" Qk FI BELL "RB" Qk FI R BELL "RB" Qk FI G BELL "BW"CH" S-L FI BELL </p> <p style="text-align: center;">Lighted Whistle or Horn</p>   <p> "RB" Qk FI WHIS "RB" Qk FI R WHIS "RB" Qk FI G WHIS "BW"CH" S-L FI WHIS </p>	<p style="text-align: center;">STARBOARD SIDE ENTERING FROM SEAWARD</p> <p>Marks starboard side of channels and obstructions. To be left to starboard when passed.</p> <p>Color: RED Numbers: EVEN</p> <p style="text-align: center;">COLOR OF LIGHTS Red or White</p> <p style="text-align: center;">FLASHING</p>  <p style="text-align: center;">OCCULTING</p>  <p style="text-align: center;">QUICK FLASHING</p>  <p>Marking important turns, wrecks, etc., where particular caution is required.</p> <p style="text-align: center;">Lighted</p>  <p> "R"6" FI R 4sec "R"6" FI 4sec "R"6" Occ R 3sec "R"6" Occ 3sec "R"6" Qk FI R "R"6" Qk FI </p> <p style="text-align: center;">Lighted Bell or Gong</p>  <p> "R"6" FI R 4sec BELL "R"6" FI 4sec BELL "R"6" Occ R 3sec BELL "R"6" Occ 3sec BELL "R"6" Qk FI R BELL "R"6" Qk FI BELL </p> <p style="text-align: center;">Lighted Whistle or Horn</p>  <p> "R"6" FI R 4sec WHIS "R"6" FI 4sec WHIS "R"6" Occ R 3sec WHIS "R"6" Occ 3sec WHIS "R"6" Qk FI R WHIS "R"6" Qk FI WHIS </p>			
<p>Combination lighted buoys may contain both light and BELL, GONG, WHIS or HORN. Lights on buoys are white unless otherwise indicated.</p> <p style="text-align: center;">Lighted Mooring Buoy</p>  <p style="text-align: center;">Lightship</p> <p style="text-align: center;">* BRENTON REEF Occ 4sec 13M DIA</p>		<table style="width:100%; border: none;"> <tr> <td style="border: none;"> <p>F FI Gp FI Qk FI Occ Gp Occ</p> </td> <td style="border: none; padding-left: 10px;"> <p>May be used as prefix to any color light</p> </td> <td style="border: none; padding-left: 10px;"> <p>"5" FI G 3sec "R"2" FI R 4sec "W"2G" FI 2sec</p> </td> </tr> </table>	<p>F FI Gp FI Qk FI Occ Gp Occ</p>	<p>May be used as prefix to any color light</p>	<p>"5" FI G 3sec "R"2" FI R 4sec "W"2G" FI 2sec</p>
<p>F FI Gp FI Qk FI Occ Gp Occ</p>	<p>May be used as prefix to any color light</p>	<p>"5" FI G 3sec "R"2" FI R 4sec "W"2G" FI 2sec</p>			

Lighted buoyage of the United States with explanation of their standard chart symbols and abbreviations. Light characteristics do not apply to Mississippi River System.

Unlighted Spar, Nun, and Can Buoys				
<p>PORT SIDE Entering from seaward (read up) Color: BLACK Numbers: ODD</p> <p>Spar</p>  <p><i>S</i>"5"</p> <p>Can</p>  <p><i>C</i>"5"</p>	<p>For JUNCTIONS or OBSTRUCTIONS Red and Black Horizontal Bands Numbers: NONE</p> <p>Where preferred channel is to STARBOARD the topmost band is BLACK</p> <p>Where preferred channel is to PORT the topmost band is RED</p> <p>Can Spar Spar Nun</p>     <p>For MID-CHANNEL or FAIRWAY Black and White Vertical Stripes Numbers: NONE</p> <p>Can Spar Nun</p>    <p>Checked Buoy</p>   		<p>STARBOARD SIDE Entering from seaward (read up) Color: RED Numbers: EVEN</p> <p>Spar</p>  <p><i>R</i> <i>S</i>"2"</p> <p>Nun</p>  <p><i>R</i> <i>N</i>"2"</p>	
Typical Sound Buoys				
<p>Bell or Gong</p>  <p><i>"5"</i> <i>BELL</i> or <i>GONG</i></p>	<p>No special shapes Numbers: NONE Buoy colors same as for unlighted buoys, as shown above.</p> <p>JUNCTIONS, MIDDLE GROUNDS and OBSTR.</p> <p>Bell or Gong Whistle or Horn</p>   <p>Checked Buoy</p>  		<p>Bell or Gong</p>  <p><i>R</i>"4" <i>BELL</i> or <i>GONG</i></p>	
<p>Whistle or Horn</p>  <p><i>"3"</i> <i>WHIS</i> or <i>HORN</i></p>	<p>Whistle or Horn</p>   <p>Checked Buoy</p>  		<p>Whistle or Horn</p>  <p><i>R</i>"2" <i>WHIS</i> or <i>HORN</i></p>	
Buoys Marking Special Areas				
<p>Quarantine Anchorage</p>  <p><i>Y</i> <i>YELLOW</i></p>	<p>Anchorage</p>  <p><i>W</i> <i>WHITE</i></p>	<p>Fish Net</p>  <p><i>BW</i> <i>S</i></p>	<p>Special Purpose</p>  <p><i>W Or</i></p>	<p>Dredging</p>  <p><i>GW</i> <i>GREEN WHITE</i></p>
<p><i>SP</i> <i>SP</i>^R Spherical Buoy</p> <p><i>"A"</i> Mooring Buoy</p>				

Unlighted buoyage of the United States with explanation of their standard chart symbols and abbreviations.

TYPES OF AIDS TO NAVIGATION INTRACOASTAL WATERWAY

GREEN REFLECTOR		WHITE OR GREEN LIGHTS, FIXED OR FLASHING					
REAR							
FRONT							
SPECIAL (S) CAN BUOY	RANGES ROUND, OVAL OR DIAMOND	SPAR BUOY 2nd.-4th. Class	DAYBEACONS Pointer Daymark	DOLPHIN	SLATTED, PILE STRUCTURES		SKELETON STRUCTURES <small>Note:- Daymark (shown dotted) added where needed. Border and number on Daymark where used.</small>
! C "3"	▲ "7" - ▲ "7"	! S "7"	▲ "17"	▲ "5"	● Fl 2sec "45"	● Fl G 5sec "17" ● F "9"	● FG "15"

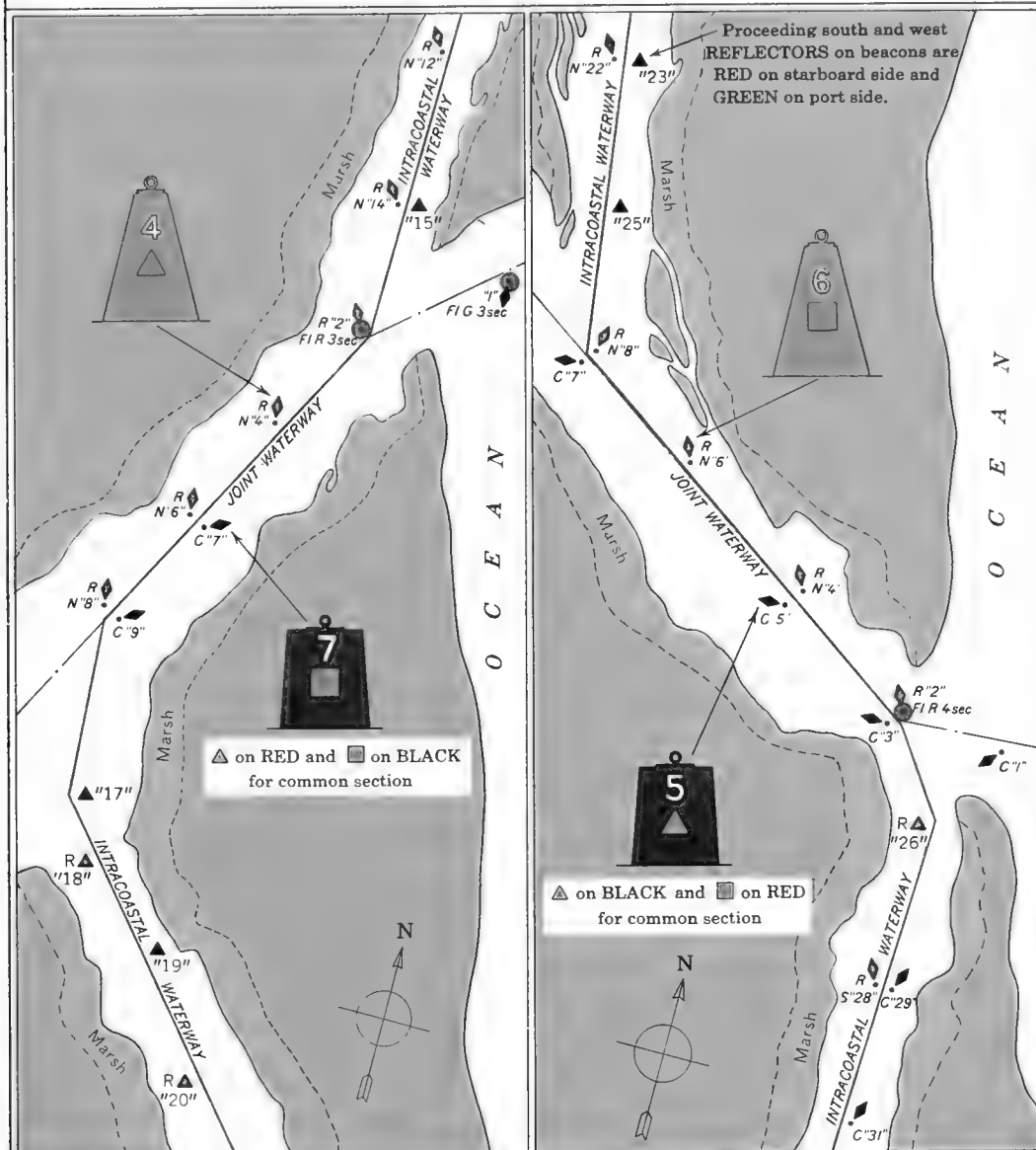
PORT Side of channel (Black with Odd Numbers) entering from north and east and traversed to south and west respectively.

RED REFLECTOR		WHITE OR RED LIGHTS, FIXED OR FLASHING					
REAR							
FRONT							
SPECIAL (S) NUN BUOY	RANGES ROUND, OVAL OR DIAMOND	SPAR BUOY 2nd.-4th. Class	DAYBEACONS Pointer Daymark	DOLPHIN	SLATTED, PILE STRUCTURES		SKELETON STRUCTURES <small>Note:- Daymark (shown dotted) added where needed. Border and number on Daymark where used.</small>
! R "2"	▲ R "4" ▲ R "4"	! S "4"	▲ R "14 A"	▲ R "6"	● Fl 2sec "14"	● Fl R 5sec "12" ● F "6"	● FR "12"

STARBOARD Side of channel (Red with Even Numbers) entering from north and east and traversed to south and west respectively.

		THE ICW AIDS ARE CHARACTERIZED BY THE YELLOW BORDER		
--	--	--	--	--

ILLUSTRATING THE SYSTEM OF DUAL-PURPOSE MARKING WHERE THE ICW AND OTHER WATERWAYS COINCIDE

**SKETCH A:**

ICW joins another waterway, which is numbered from seaward, at buoy No. 2 and is common with it to buoy No. 9. ICW numbers and yellow borders are omitted in this section but the ▲ or ■ is used on the regular aids to designate the ICW.

SKETCH B:

ICW joins another waterway at buoy No. 8 and is common with it to buoy No. 3. This section is numbered in the opposite direction to that of the ICW. The ICW numbers and yellow borders are omitted from the regular aids but a ▲ or ■ is shown to designate the ICW.



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