

SECTION VII - NAUTICAL CHARTS and CHART NO. 1

INTRODUCTION:

In conjunction with the ATON/CU Program, it is necessary for Auxiliary members to understand the general composition and purposes of NAUTICAL CHARTS and CHART NO. 1. A nautical chart is a representation, in a significantly reduced form, illustrated on a plane surface in a two-dimensional presentation, of a portion of the earth's surface, primarily water, emphasizing natural and man-made features. Through its ATON/CU Program activities, the Auxiliary plays an important role in providing information that affects corrections or changes to NAUTICAL CHARTS. This Auxiliary provided information assist NOS/NOAA in maintaining the quality and reliability of nautical charts for general navigation usage.

OBJECTIVE:

1. To acquire a general knowledge of NAUTICAL CHARTS, CHART NO. 1, the entitlement and procurement procedures for charts, and the responsibilities of the Auxiliary regarding nautical charts.
2. To become familiar with the various projections and scales employed on nautical charts.
3. To become familiar with the colors, symbols and abbreviations presentations on nautical charts.

INFORMATION:

The primary purpose of a nautical chart is to provide navigation related data to assist mariners in course plotting, danger avoidance and information interchange. Nautical charts are prepared by various Government agencies. They provide the pilot or navigator with a high level of accuracy, as charted, of navigable bodies of water showing depths, aids to navigation, shorelines, physical features and other useful and essential information. However, nautical charts are no more accurate than the competency of the survey upon which they are based. It is important to know that, a nautical chart and the data provided, does not absolve the pilot or navigator of the responsibility of safe passage. A need for periodic updating of nautical charts is required to keep current with physical or data input changes.

Nautical charts exhibit a grid of intersecting lines to aid in the description of a position on the chart. These grid lines are the charted representations of a system of GEOGRAPHIC COORDINATES (lines of vertical and horizontal parallels) which are depicted, representatively as if, on the earth's surface. GEOGRAPHIC COORDINATES are defined by two sets circles on the earth's surface. One set, referred to as MERIDIANS of LONGITUDE, consists of GREAT CIRCLES (a circle on the earth's surface described by a plane passing through the earth's center) each of which pass through the north and south geographic poles (refer to Figure

7-1). The other set, referred to as PARALLELS of LATITUDE, consist of parallel planes cutting through the earth perpendicular to the polar axis. The EQUATOR is the largest of these parallel planes, it is located midway between the poles and thus also passes through the center of the earth, it is the only one of these parallel planes which is a GREAT CIRCLE. The other PARALLELS of LATITUDE form SMALL CIRCLES (refer to Figure 7-2).

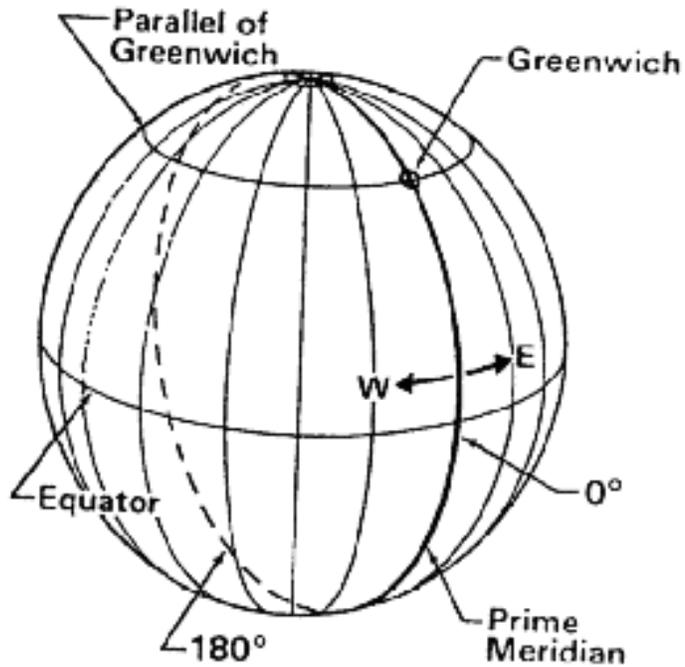


FIGURE 7-1 MERIDIANS OF LONGITUDE

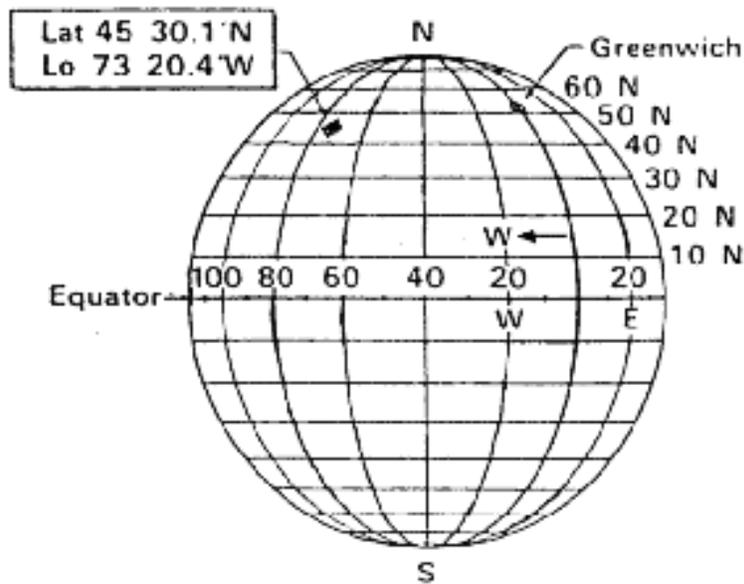


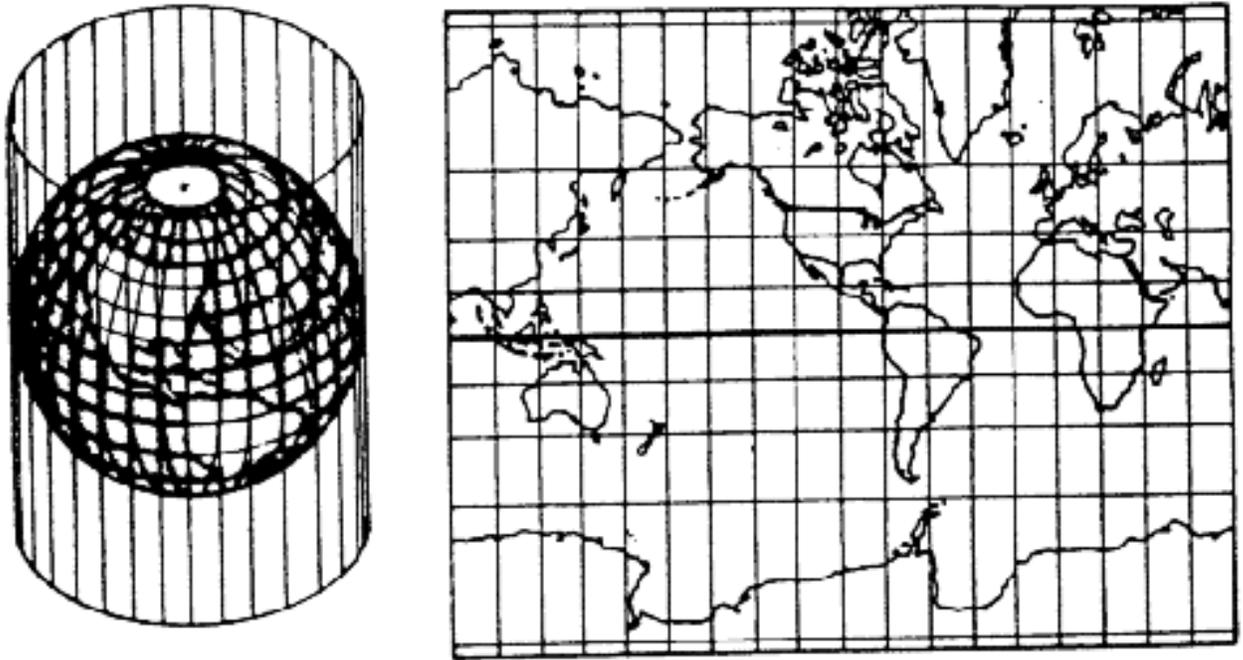
FIGURE 7-2 PARALLELS OF LATITUDE

The earth is essentially a sphere. The surface of a sphere is considered non-developable, i.e., its surface or portions thereof cannot be spread flat without some distortion. Again, a nautical chart is a reduced form/two-dimensional/flat surface representation of a portion of the earth's surface. As such, the construction of a chart depicting a segment of the earth's surface immediately produces problems of accurate representation. Since a certain ratio of distortion is inevitable, various methods for transferring details on a sphere to a flat surface have been developed. An approach, such as a cone or cylinder, which can be unrolled to form a flat surface, is considered to be developable. This method of transfer of details from a sphere onto a plane is called PROJECTION. In all PROJECTIONS, as the segment of the earth's surface illustrated on the chart decreases the ratio of distortion decreases and the accuracy of the PROJECTION increases (viz., as the segment of the earth's surface illustrated on the chart is closer to the point of tangency between the sphere and the plane, the ratio of distortion decreases and the accuracy of the PROJECTION increases).

- The optimum characteristics for PROJECTION include:
 - a. True shape of physical features. (Considered as, "CONFORMAL PROJECTION.")
 - b. Correct angular relationships. (Considered as, "CONFORMAL PROJECTION.")
 - c. Equal area, i.e., representation of areas in relative proportions.
 - d. True scale, i.e., permits accurate measurement of distance.
 - e. RHUMB LINES presented as straight lines. (A Rhumb Line is a line on the earth's surface that crosses all MERIDIANS at the same angle.)
 - f. GREAT CIRCLES represented as straight lines. (A Great Circle is a circle on the earth's surface described by a plane passing through the earth's center.)

NOTE: It is not possible to prepare a chart which includes all of the listed optimum characteristics, e.g., it is not possible to prepare a chart on which both Great Circles and Rhumb Lines are represented by straight lines.

There are many different types of PROJECTIONS. The two which are of primary interest to the mariner are the MERCATOR projection, most commonly used for ocean and coastal navigation, and POLYCONIC projection which is utilized on the Great Lakes and Inland Rivers. The Auxiliary is involved in updating MERCATOR and POLYCONIC projection charts. Refer to Figure 7-3 and Figure 7-4.



- Angles are correctly represented
- Great circle appears curved
- Rhumb line appears as straight line
- Distortion in BOTH directions

FIGURE 7-3 MERCATOR PROJECTION

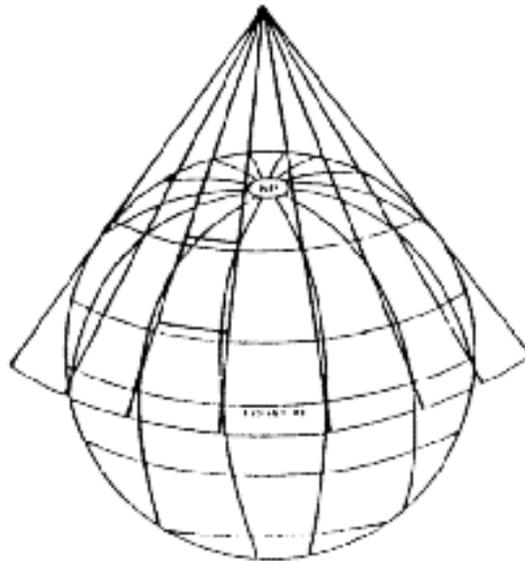


FIGURE 7-4 POLYCONIC PROJECTION

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As a nautical chart is a representation in reduced form on a flat surface of an area of navigable water on the surface of the earth, actual distances must be presented relative to the available space on the chart. This distance dimension reduction is termed the SCALE of the chart. The scale of a chart is its so-called "natural scale," an expression of the relationship between a given distance on the chart to the actual distance it represents on the earth's surface. The chart scale may be expressed in the form of a ratio, say 1:80,000, where one unit on the chart represents 80,000 units on the earth's surface. It may also be expressed in the form of a fraction, say 1/80,000, a priori. Charts are published in a wide range of scales.

- For general convenience of reference, the issuing agencies have classified charts into the following series:
 - a. **SAILING CHARTS** 1:600,000 scale and smaller
 - b. **GENERAL CHARTS** Scales range from 1:150,000 to 1:600,000
 - c. **COASTAL CHARTS** Scales range from 1:50,000 to 1:150,000
 - d. **HARBOR CHARTS** Scales range from 1:50,000 and larger
- Charts of the Great Lakes are also grouped into series:
 - a. **GENERAL** Showing all of the lakes plus one for each lake
 - b. **COAST** Scaled 1:80,000 or 1:120,000
 - c. **HARBOR** Having larger scales than NOS charts

When chart scales are expressed in the form of fraction, confusion sometimes results from the use of terms LARGE SCALE (where the denominator of the fraction gets smaller), and SMALL SCALE (where the denominator of the fraction gets larger). For example, 1/80,000 is a smaller fraction than 1/40,000, thus a chart of 1/80,000 scale is termed a SMALL SCALE CHART (refer to Figure 7-5).

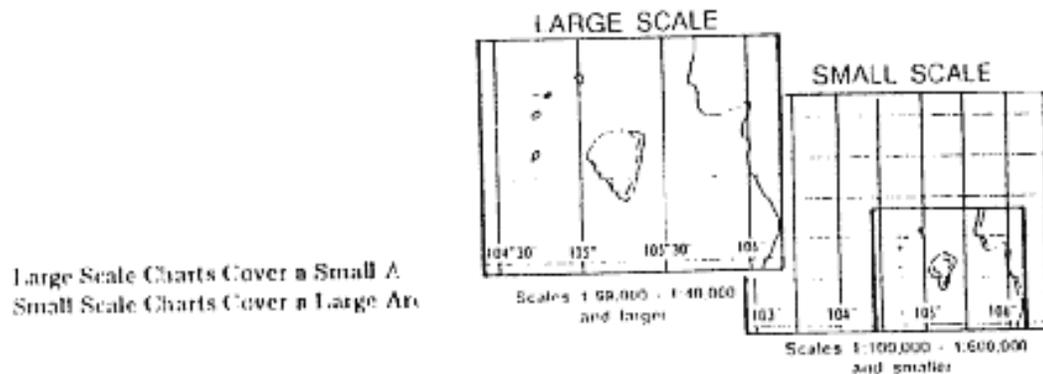


FIGURE 7-5 LARGE SCALE/SMALL SCALE CHARTS

When using MERCATOR projection charts, for distance measuring purposes, one minute of latitude equals one nautical mile, i.e., for distances measured parallel to MERIDIANS of LONGITUDE (north-south grid lines). On charts of a scale smaller than 1:80,000, the latitude scale will be the only means of measuring distance. Auxiliary members should primarily use large scale charts in conducting ATON/CU Program activities.

A general information block is located at a convenient place on charts. In this block are the chart title, description of the area covered, type of projection, scale, unit of depth measurement and datum plane for each sounding. It is important to know that, nautical charts are being converted to the METRIC SYSTEM with the **base unit** expressed in **meters**. Refer to Figure 7-6.

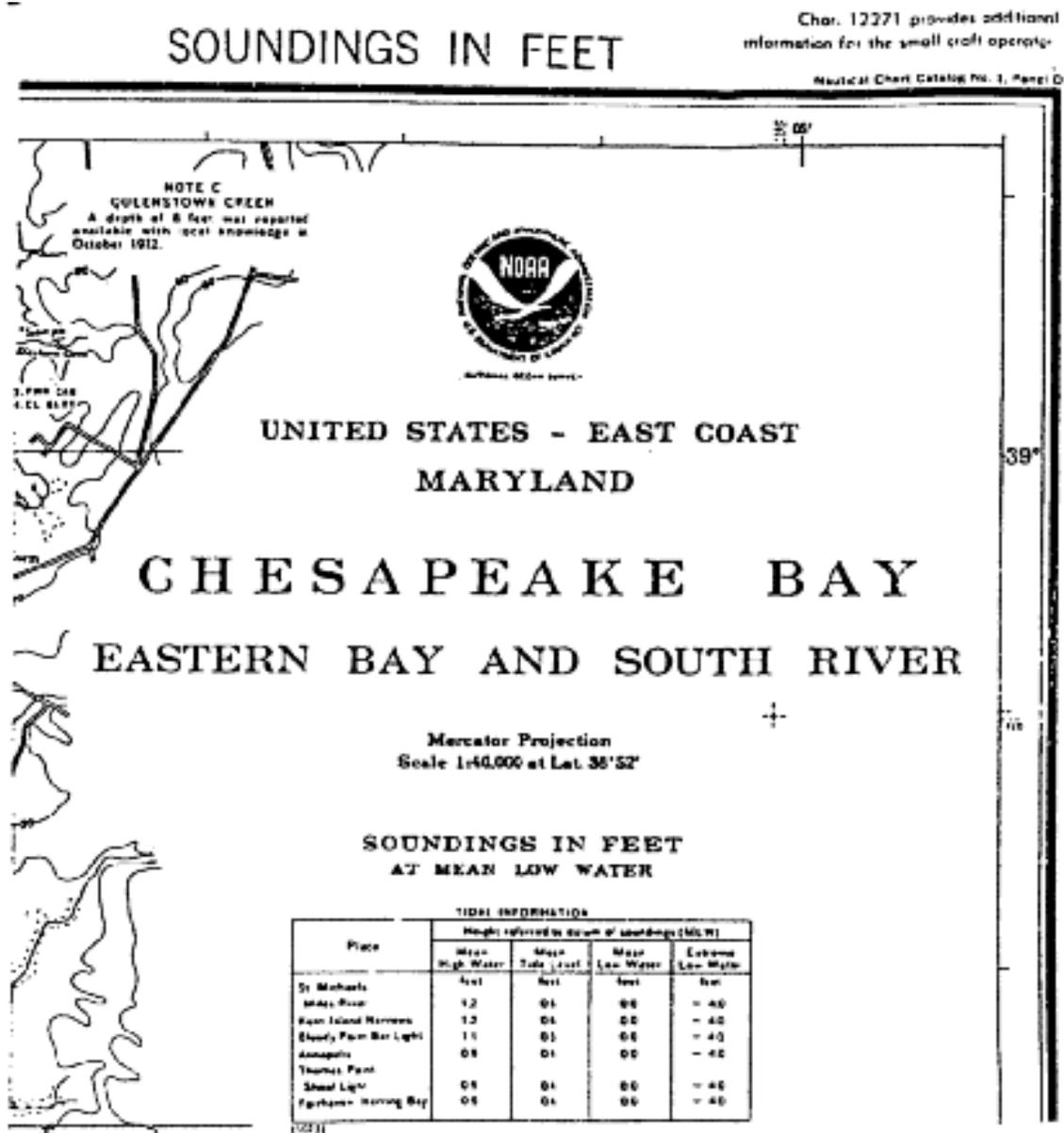


FIGURE 7-6 CHART - GENERAL INFORMATION BLOCK

Other useful and essential information may be found on the chart, such as the meaning of symbols and abbreviations, special notes of caution, units of measurements of heights and the reference plane from which measured, tidal information, anchorage information and physical features data.

The chart edition number and publication date appear at the lower left hand corner. Immediately following this data will be the date of the chart revision (refer to Figure 7-7).

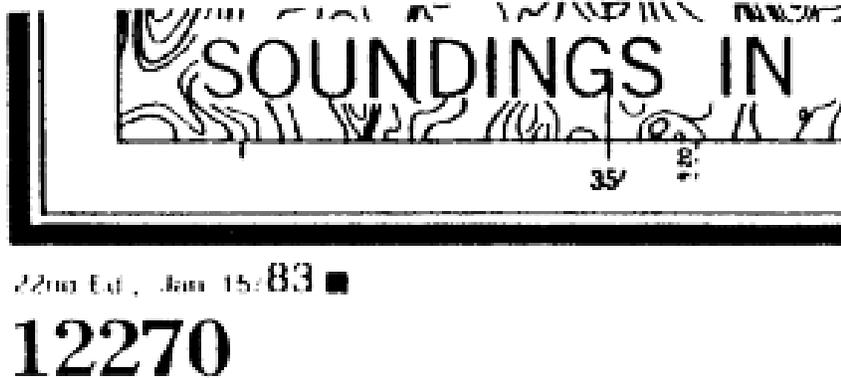


FIGURE 7-7 CHART EDITION NUMBER

New Editions charts are published when major changes in hydrography occur, as indicated by chart updating reports from the Auxiliary and other sources. A New Edition chart is a revision which cancels previous issues. It is important to note that, a Revised Print chart is a revision that does not supersede a current edition. Auxiliary members **SHOULD ONLY USE THE LATEST EDITION CHART** in support of ATON/CU activities. Moreover, such latest edition charts **SHOULD BE CURRENT**, i.e., annotated with chart updating input data from various sources not yet incorporated on the latest edition chart.

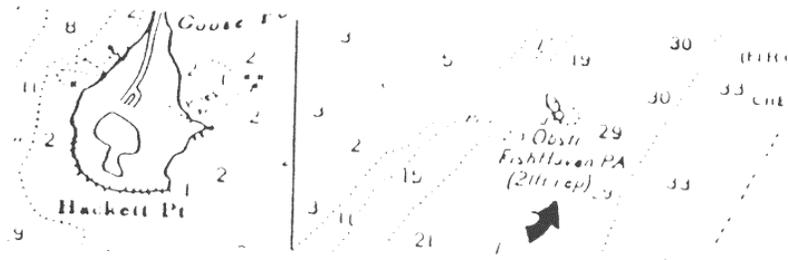
Conventional type nautical charts have the geographical north direction towards the top of the sheet, **LATITUDE** scale on the side borders and **LONGITUDE** scale on the top and bottom borders. The **PARALLELS** of Latitude and **MERIDIANS** of Longitude are drawn across the chart in fine black lines at intervals of two, five or 10 minutes of Latitude and Longitude as determined by the scale of the particular chart.

NOS charts which have a scale larger than 1:40,000, such as a 1:100,000 harbor chart, have border subdivisions scales in terms of minutes and tenths of minutes of Latitude and Longitude. On smaller scale charts, such as a 1:80,000 chart, the border subdivisions are in minutes and fractions of minutes.

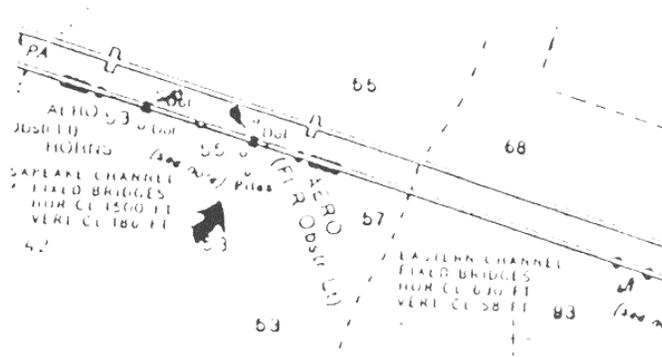
Most chart employ color to emphasize various features and to facilitate chart reading and interpretation. The NOS uses various shades of five colors on their regular charts: land areas are shown in buff or yellowish color; water areas are shown in white except in shallow regions which are shown in blue; submerged areas which at times uncover at some tidal stages are shown in green. Purple is used for many purposes on charts and shows well under red light,

for preservation of night vision. Buoys and other aids are appropriately colored, red, green, red and green, red and white, or yellow, while lighted buoys of any color have a purple disc over a dot or small portion of a symbol to assist in identification. Black is used for most symbols and printed information.

Certain classes of information are printed in one style of lettering and other classes in another style. Vertical lettering is used for features which are dry at high water and are not affected by movement of water, while leaning or slanted letters are used for water, underwater and floating features except depth features (refer to Figure 7-8).



Slanted Letters Indicate That an Obstruction Is Covered Part of the Time

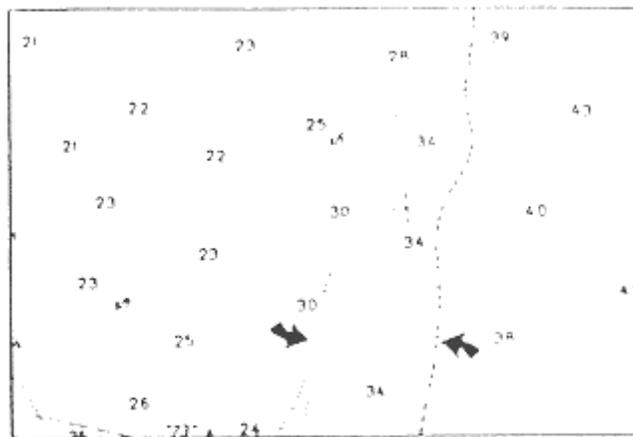


Straight Letters Indicate That an Obstruction Is Always Above Water

FIGURE 7-8 CHART – CLASSES OF INFORMATION

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For a system of depth information there must be a reference plane or datum, particularly in coastal areas where depths may change hourly as the result of tidal action. Each chart contains a statement of datum from which all depths are measured near to normal low-water levels. Depth information is shown on the chart by a number designation. These numbers indicate the depth at, that indicated position measured in feet (or fathoms) or meters. The tidal datum system for all marine waters of the U.S. and its territories have been implemented to Mean Lower Low Water. Lake and river charts will usually use a datum based on past records of variations in level over many years. Most charts contain contour lines, sometimes called Fathom Curves connecting points of equal depth. Such lines will appear at certain depths as determined by the chart scale and relative range of the depths. Continuous solid lines or various combinations of dots and dashes are used to code the depth along each line (refer to Figure 7-9).



Soundings with Five and Six Fathom Curves

FIGURE 7-9 FATHOM CURVES/RANGE OF DEPTHS

The NOS publishes six Nautical Chart Catalogs. These catalogs are available to the general public and the Auxiliary through regular chart distribution sources. The catalogs indicate areas covered by each chart, the scale used and the price. Catalogs 1 through 4 cover contiguous waters as follows: #1 - Atlantic & Gulf Coasts including Puerto Rico and Virgin Islands; #2 - Pacific Coast, including Hawaii and Pacific Islands, Guam & Samoa; #3 - Alaska including the Aleutian Islands; and #4 - Great Lakes, including connecting and adjacent waterways. Catalog #5 list Bathymetric and Fishing Maps. Catalog #6 is a Guide to NOAA Nautical Products and Services (refer to Figure 7-10).

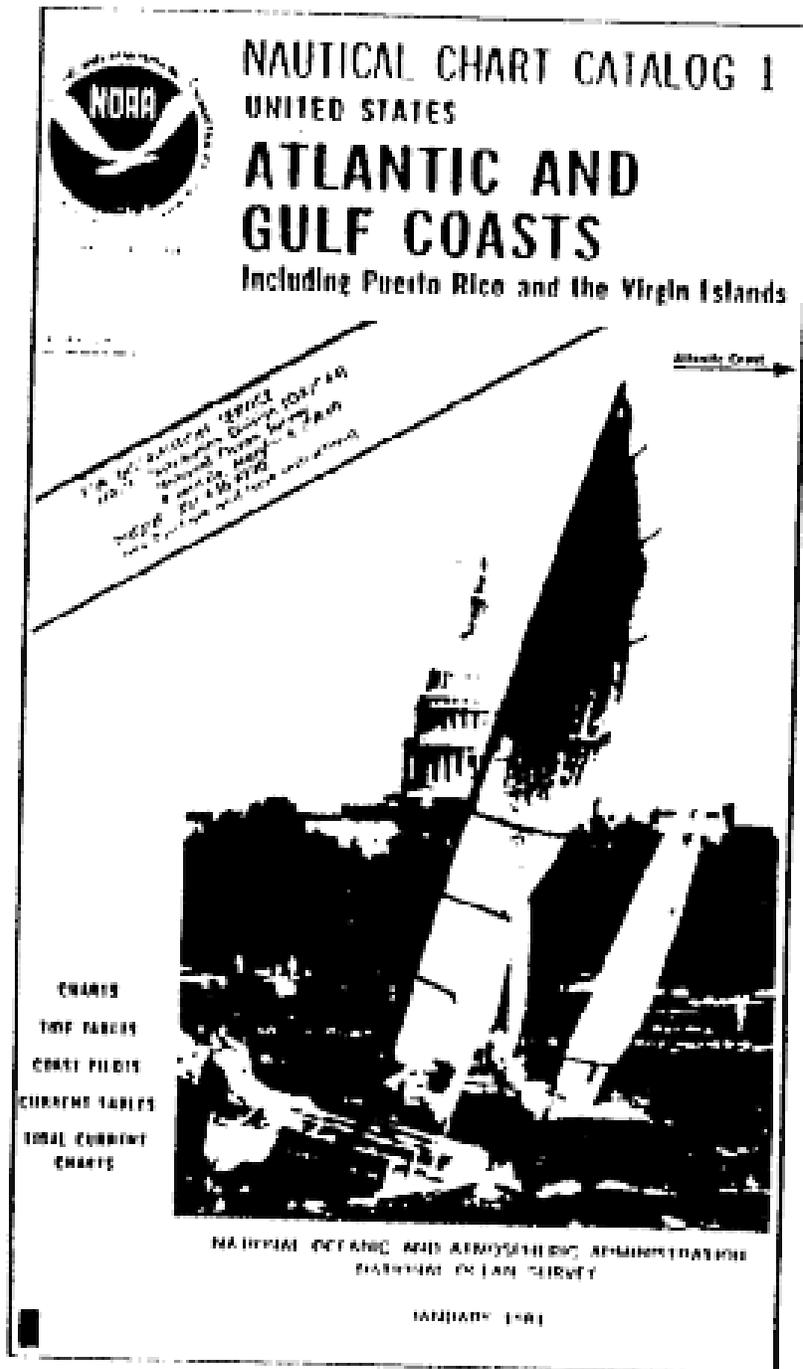


FIGURE 7-10 NAUTICAL CHART CATALOG #1

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The vast amount of information to be shown on a chart and the proximity in which many physical features appear necessitates the extensive use of charting symbols and abbreviations. Symbols and abbreviations used on charts have been standardized and published in a small pamphlet designated as Chart No. 1. Chart No. 1 is a joint publication of NOS/NOAA and DMAHTC. Generally, similar information is printed on the reverse of TRAINING CHART-1210Tr. Auxiliary members participating in the ATON/CU Program should be familiar with the contents of Chart No. 1, particularly with regard to some specific symbols and abbreviations. For example, it is important to know that the symbol for an APPROXIMATE position is a small circle with small lettering, whereas for an ACCURATE position the symbol is a larger circle with a dot in the center with capital letters. When available, accurate positions should always be used in taking bearings or determining position.

Other than purchases by over the counter sales, each Flotilla that agrees to and actively participates in CU activities of the ATON/CU Program is entitled annually to receive four Large Scale Nautical Charts (1:40,000 or larger) for their assigned geographical operating area. The purpose of this chart distribution is the replacement of charts that the Auxiliary (Flotilla) has sectioned/clipped for attachments to NOAA 77-5 reports. The Flotilla requests for charts are forwarded by the FSO-ANs to the SO-AN for consolidation into a single Division request. The SO-ANs forwards the Flotilla/Division consolidated request to the DSO-AN for review and forwarding to the BC-ONC. The period for such chart requests is from January 1 through May 1 or at other times for specific "special" projects. The turn-around time for Flotilla receipt of charts is approximately eight weeks. Refer to Section VI.